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CONTENTS.

INDEX.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 976

Contribution from the Bureau of Plant Industry
WM. A. TAYLOR, Chief

Washington, D. C. PROFESSIONAL PAPER January 20, 1922

CULTURAL EXPERIMENTS WITH GRAIN SORGHUMS IN THE TEXAS PANHANDLE.

By Benton E. Rothgeb, formerly *Assistant Agronomist in Charge of Grain-Sorghum and Broom-Corn Investigations, Office of Cereal Investigations.*

CONTENTS.

HISTORY OF THE EXPERIMENTS.

THE OFFICE OF CEREAL INVESTIGATIONS began experiments with grain sorghums in the Panhandle of Texas in 1904. These experiments were conducted for three years at Channing, Tex., on the the X I T Ranch. In 1906 the work was transferred to Amarillo, Tex., where it was continued until the close of the season of 1919. Early results indicated that these crops were well adapted to Panhandle conditions, and the demand for information concerning them resulted in the expansion of the work, beginning in 1908.

The data obtained are the basis of many statements made in numerous popular and scientific publications.[1] The detailed data obtained from the varietal experiments in the 9-year period from 1908 to 1916, inclusive, are published in Department Bulletin No. 698. The detailed results from the date-of-seeding, rate-of-seeding, and environmental experiments during the 6-year period from 1914 to 1919, inclusive, are presented herein.

[1] A list of these publications is printed at the end of this bulletin.

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DESCRIPTION OF THE AMARILLO CEREAL FIELD STATION.

LOCATION.

The results obtained at the Amarillo Cereal Field Station are applicable to a large part of the Panhandle of Texas (fig. 1) and to

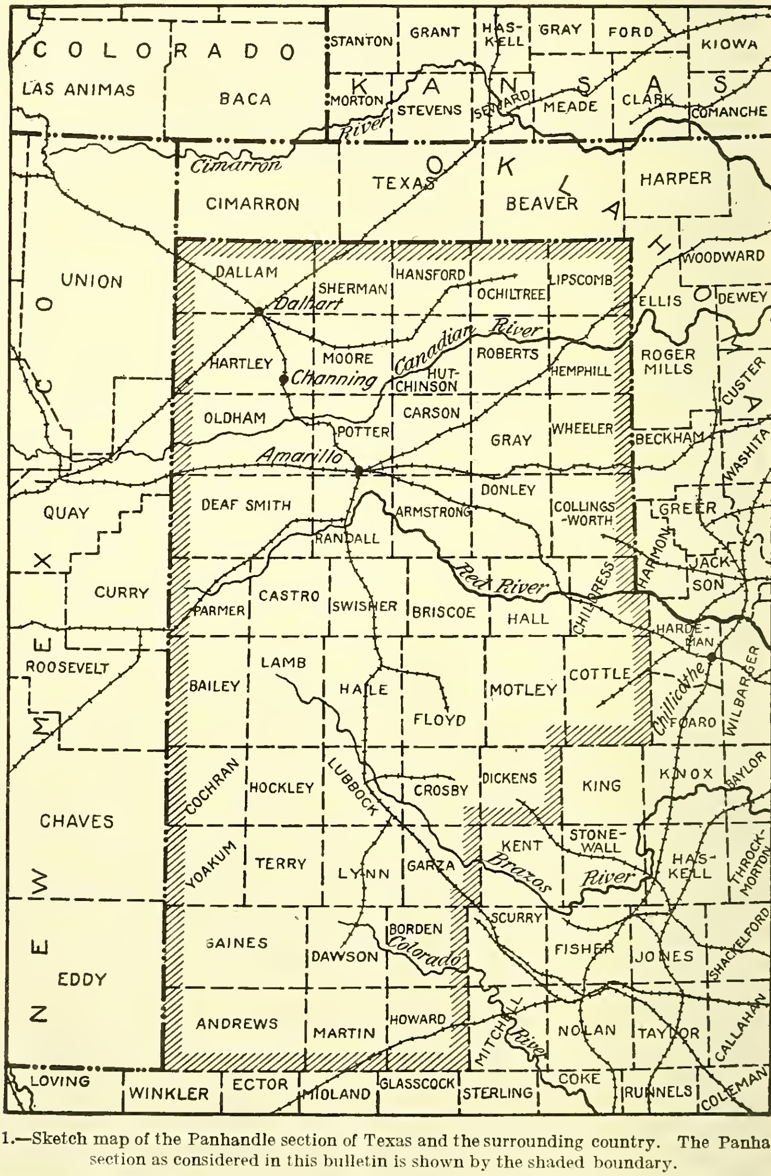

FIG. 1.—Sketch map of the Panhandle section of Texas and the surrounding country. The Panhandle section as considered in this bulletin is shown by the shaded boundary.

adjacent portions of New Mexico and Oklahoma having similar climatic conditions. To help determine just how far these results are applicable to other localities, it is desirable to know the physical factors obtaining at the Amarillo Cereal Field Station which influence crop growth. These factors are described in detail, in order that such comparisons may be made.

The Amarillo Cereal Field Station (fig. 2) is located about $2\frac{1}{2}$ miles northeast of the city of Amarillo, the county seat of Potter County,

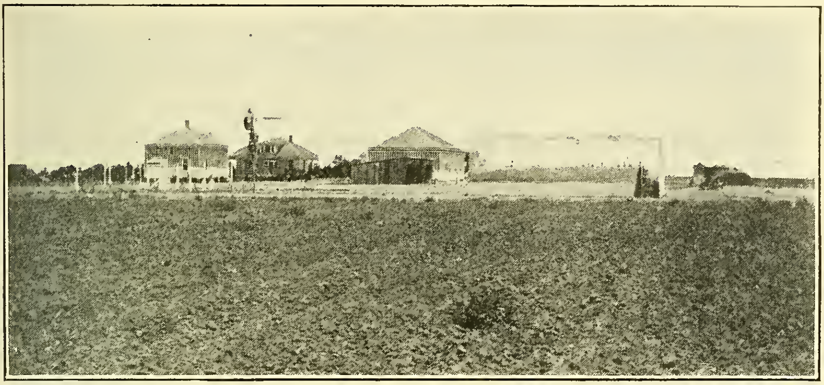

FIG. 2.—Amarillo Cereal Field Station, rear view, showing weather instruments, farm buildings, and screened inclosure for cooperative transpiration studies, 1913.

Tex. It contains 120 acres of level prairie land at an altitude of approximately 3,600 feet above sea level. This portion of the State was used almost entirely for grazing cattle until recently. During

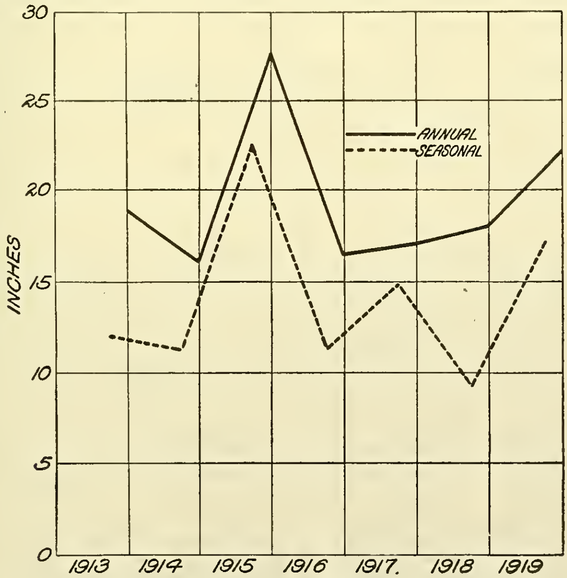

FIG. 3.—Annual and seasonal (April to September) precipitation, in inches, at the Amarillo Cereal Field Station during the 7-year period from 1913 to 1919, inclusive.

the past 20 years most of the large ranches have been divided and fenced into smaller farms. Large fields of grain sorghums, wheat, and oats may now be seen, breaking the monotony of the great expanse of level prairie.

PHYSICAL FACTORS.

The more important physical factors which usually influence crop production are (1) the soil, (2) the annual and seasonal rainfall and its distribution, and (3) the seasonal evaporation and temperature.

SOIL.

The soil at the Amarillo Cereal Field Station is a dark clay loam, which is known on the Plains as "tight" land. It bears a close turf of buffalo and grama grasses. The soil is productive, which results in high yields when the moisture is distributed so that crops can make proper use of it.

RAINFALL.

Precipitation and its distribution probably are the prime factors in crop production in the section of the Plains in which the Amarillo Cereal Field Station is located. There is usually moisture enough to grow a crop, but it is not always so distributed that the crop can make the best use of it. When it is not, crop yields are low, and in extreme cases total failures result.

MONTHLY AND ANNUAL PRECIPITATION.

Table I shows the monthly, annual, and mean annual precipitation, in inches, at Amarillo, Tex., during the 28-year period from 1892 to 1919, inclusive. The mean annual precipitation at Amarillo for these 28 years was 20⅘ inches, of which 15⅖ inches fell during the growing season, or from April to September, inclusive.

TABLE I.—*Monthly and annual precipitation at Amarillo, Tex., during the 28-year period from 1892 to 1919, inclusive.*

[Data (in inches) furnished by the observer of the United States Weather Bureau at Amarillo, Tex. T.=trace.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.	Mean annual.
1892	0.42	0.57	2.10	0.21	2.70	1.49	1.85	1.93	0.24	2.85	0.16	1.08	15.60	......
1893	.09	2.03	T.	.16	2.19	2.03	2.05	2.67	5.27	.03	.28	.43	17.23	16.42
1894	.02	1.15	.05	.85	1.30	3.59	1.82	3.41	2.41	.59	0	.82	15.81	16.21
1895	1.60	1.92	.16	1.31	1.78	6.84	2.08	3.87	.57	2.26	.81	.79	24.79	18.36
1896	.76	.41	.21	1.95	2.20	2.31	7.04	.63	2.45	3.09	.35	2.68	24.28	19.54
1897	2 26	.65	.47	1.08	4.44	2.32	2.16	2.71	.73	1.63	.08	.63	19.16	19.48
1898	.86	.82	.36	.98	3.52	4.81	3.88	4.03	.48	.41	.34	2.06	22.54	19.91
1899	.29	.07	.17	.23	3.12	4.45	6.96	.51	6.09	1.15	3.24	1.11	27.39	20.85
1900	.59	.47	.48	5.47	4.53	1.84	3.21	.83	5.25	1.58	.98	.07	24.40	21.24
1901	.03	.48	.02	4.90	5.99	.92	1.66	3.03	2.19	3.26	2.00	.04	24.42	21.56
1902	.04	T.	.74	1.83	9.14	2.01	1.45	2.42	.95	1.74	2.24	.55	23.11	21.70
1903	.12	2.93	.26	.90	1.79	2.83	3.38	4.67	.82	2.58	0	T.	20.28	21.58
1904	.16	.08	T.	.63	2.88	5.53	2.48	4.69	3.55	.44	.20	.69	21.33	21.56
1905	1.00	1.52	2.62	4.52	6.16	2.19	3.76	.63	3.08	.30	5.09	1.45	32.32	22.33
1906	.41	.51	.64	3.23	1.18	2.07	2.90	6.76	1.96	2.49	2.58	.19	24.92	22.50
1907	1.11	.24	.02	1.25	.99	1.97	1.49	6.20	.91	1.79	.66	1.46	18.09	22.22
1908	.26	.72	T.	1.90	3.55	1.75	5.40	2.75	1.83	.40	.51	0	19.05	22.04
1909	.07	.22	1.20	.50	1.08	4.72	3.63	.87	2.19	1.18	3.25	.54	19.59	21.90
1910	.05	.17	.34	.59	2.99	.66	3.57	2.19	.05	.26	.28	T.	11.15	21.34
1911	.13	2.88	.50	2.76	5.88	.20	3.85	2.97	.85	.84	.94	.95	22.73	21.41
1912	T.	1.94	.82	.72	1.67	1.90	1.88	2.28	2.28	.39	.02	1.18	15.08	21.10
1913	.11	55	.59	1.76	1.41	2.32	1.80	.61	4.19	.61	1.98	2.84	18.97	21.01
1914	.06	.10	.15	.95	4.43	.84	3.07	2.97	1.07	4.46	T.	1.17	19.27	20.93
1915	.72	1.60	1.00	5.05	1.70	1.04	4.14	5.85	4.69	1.55	.18	.13	27.64	21.21
1916	.36	.02	.57	1.71	.89	2.18	.94	3.82	1.76	2.90	.40	.88	16.43	21.02
1917	.69	.22	.25	.71	2.49	.83	2.68	6.17	2.05	.34	.59	.04	17.06	20.89
1918	1.01	.26	1.06	.48	2.23	1.43	2.23	2.36	.64	2.47	1.16	2.78	18.11	20.74
1919	T.	.73	1.73	2.56	2.08	2.94	1.75	3.21	4.58	.67	1.26	.50	22.01	20.81
Average.	.47	.83	.59	1.72	3.01	2.43	2.96	3.04	2.25	1.47	1.05	.89	20.81	......

Both the monthly and the annual precipitation fluctuate widely, as is shown in Table I. The rainfall in April amounted to less than three-tenths inch in several different years and to more than 5 inches in several other years, which is a difference of almost 5 inches between the extremes. June, July, August, and September each has about the same range of fluctuation as April. May has a wider range, amounting to about 8 inches. In the annual precipitation the extreme range is from 11 inches in 1910 to 32 inches in 1905.

Table II.—*Daily and monthly precipitation at Amarillo, Tex., during the 6-year period from 1914 to 1919, inclusive.*

[Data (in inches) furnished by the observer of the United States Weather Bureau at Amarillo, Tex. T.=trace.]

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1914:													
1					0.96		0.57						
2				0.04		0.06	.04	0.62					
3	T.			.17	T.								
4							.22	.67					
5		T.						.11					
6				.43			.63		0.30				
7				.17		.10	.07						
8													
9								.58					
10				.10				.41	.31				
11			T.	.01					.29	0.09			
12								T.	.15				
13													
14					.05	.05				T.			
15					.48	.01			.01				
16					.81								
17					.09		.21						
18				.11	.47								
19					.07		.11						
20			0.01		T.	.43						0.43	
21					T.				T.	.15			
22				.01					.04	2.28			
23										1.46			
24												.44	
25							.02						
26				.06	T.								
27		0.01			.22		.03						
28				T.	.47								
29			.01	.03	.02			.13					
30				.19	T.	T.							
31					.20								
Total	T.	.01	.02	1.27	3.83	.65	1.90	2.52	1.10	3.98	0	.87	16.15
1915:													
1						.22	.02	.02					
2			.20	T.		.03	.01						
3		T.	.10				.06						
4			.25			.23	.33						
5					T.	T.	T.		T.				
6			T.	.25	.08	T.			T.			.05	
7				.40		.01		T.					
8			.04	.25			T.	.73					
9			.17	.01			.01	.32					
10											T.		
11								T.		.21			
12							.01			.12			
13							.79						
14				.05				2.89		1.13			
15	T.			.65			.61	.36	.11	.09			
16	0.29		T.	.30	.39		1.33	.20	.02				
17				1.34	.44			T.	.34		0.18		
18		T.		T.	.01		T.		.04				
19			T.	.01	T.		.21		.11				
20		.83			.19		.54		T.				
21		T.	T.	.09				.27					
22	.03	T.		.07					.14				
23	.01							.31	.03				
24				.73			.12	.20	.22			T.	
25	T.			.28		.40	.02		3.05		T.		

TABLE II.—*Daily and monthly precipitation at Amarillo, Tex., during the 6-year period from 1914 to 1919, inclusive*—Continued.

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1915:													
26	T.	0.58	T.		0.23				0.01				
27		.19			.21	0.06		T.				0.02	
28						.09		0.55					
29	0.01			0.55	.11	T.	0.08		.05				
30	.12			.07	.04	T.	T.		.57				
31	.26		0.24									.06	
Total	.72	1.60	1.00	5.05	1.70	1.04	4.14	5.85	4.69	1.55	0.18	.13	27.65
1916:													
1		.02		T.						T.			
2													
3													
4	T.			.22		1.38							
5						.15							
6				.06		.04			T.				
7				T.				T.				.21	
8								.03	.06		.03	.05	
9					T.								
10	T.		T.						.51	.70		.04	
11	.07				T.		T.		.01	.02	T.		
12		T.		.04		T.	.01		.01	.82	T.		
13				.16		T.		.28		.02	.03		
14			T.	.97		.03		.01		1.07		T.	
15					.01	.35							
16	.05					.12		.04		T.			
17	.12				.88			.14				T.	
18							.02		.17				
19					T.		.19	.27	.01				
20	.11			.12			T.	.99				.16	
21								1.49			.34	.11	
22						.11		.41					
23			9.17					T.	.70				
24									.29	.04			
25	T.			.02									
26	T.			.12									
27	T.						T.						
28	T.	T.					T.			.23			
29	.01						.72						
30	T.			T.			T.	.16				.20	
31			.40					T.				.11	
Total	.36	.02	.57	1.71	.89	2.18	.94	3.82	1.76	2.90	.40	.88	16.43
1917:													
1			T.	T.		T.		1.11	.22				
2							.06		.08				
3			.25				.03						
4					T.		.60	T.					
5					.35			T.					
6					.71								
7								.42				.04	
8									.22	.29			
9					.37		T.					T.	
10				.29	.55			.14	.14				
11				.22			T.	.50					
12	T.			.01				T.	T.				
13	.09		T.	.01	.41			1.02					
14	.36	.22		.05	.02		.06	.06	.80				
15	.13					T.		.50	.38				
16	.04						1.20	.26	.04	T.	.09		
17							.28	.61			.08		
18		T.		.13	.04	T.				T.	.36		
19				T.	T.	.54		1.08					
20	.01					.01		.01					
21					.03	T.		.68					
22	.06					.28		.10					
23						T.			.02				
24					T.				T.				
25													
26			T.			T.			.15				
27					.01			.12			.05		
28				T.				.01					
29										.05			
30													
31							.45						
Total	.69	.22	.25	.71	2.49	.83	2.68	6.17	2.05	.34	.59	.04	17.06

TABLE II.—*Daily and monthly precipitation at Amarillo, Tex., during the 6-year period from 1914 to 1919, inclusive*—Continued.

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1918:													
1							T.						
2			0.07			0.01	T.		0.07				
3			.02		0.14	T.			.06				
4					T.	T.			.01				
5					.17	.01			.31				
6						.11		0.11					
7						1.20		1.28			0.04		
8				0.31			0.01	.42					
9						T.	T.	.28		0.04			
10	0.48						T.			T.			
11		0.26			.17		T.			.01			
12							.34					0.06	
13				.13									
14	.03										.01		
15	.17						.33	.05	.04				
16				T.			.44	T.	.13		.03	.20	
17												.57	
18				.01			.07	.20		.06			
19	.26			.03				T.		.17		.77	
20	.03			T.						.01		.04	
21			T.				.01			1.43			
22							.27			.01	.06	.47	
23								.01		.03	.05	.39	
24					.09			.01			.46		
25					.22		T.			.27	.46		
26	T.					T.			02	.43	.05		
27	.03	T.			.15	.03				.01			
28		T.	.44		.43								
29			.52		.05	T.	.02	T.		T.			
30	.01		.01		.81	.07	.74					.05	
31												.23	
Total	1.01	.26	1.06	.48	2.23	1.43	2.23	2.36	.64	2.47	1.16	2.78	18.11
1919:													
1		.09		.01	.01	T.	T.					.02	
2				.61		T.						.01	
3				.13		.05		.08				.01	
4						.01				T.			
5					T.			T.		.25	T.	T.	
6			T.	T.	.64					.04			
7			.12					1.42		.07	T.		
8		T.	T.	.19	T.		T.	.15		.09	.60	.05	
9				.61		1.34		.91			.17		
10			.06		.43	.16			T.	.11			
11					.07	.70			T.				
12		.04				T.	.05			.04			
13	T.	T.			.02		.05						
14	T.					.39	T.						
15			T.			.09	.06		1.33				
16							.02		1.89				
17							1.29	.07	1.36				
18						.01	.27	.28				.34	
19		.24				.08	.01	.30			T.	.07	
20							T.				T.		
21		.32	T.										
22			.22		T.								
23			.78		.11								
24			.55	.07	.35	.11							
25		.03		.60	.32						.20		
26	T.			.31	.03					T.	.08		
27				.03	.08					T.	.08		
28		.01									.13		
29			T.	T.			T.			.03			
30					.02				T.	.04			
31								T.					
Total	T.	.73	1.73	2.56	2.08	2.94	1.75	3.21	4.58	.67	1.26	.50	22.01

DISTRIBUTION OF MONTHLY RAINFALL.

The total annual and seasonal rainfall in the 7-year period from 1913 to 1919, inclusive, which is shown graphically in figure 3, easily may be misleading. Because of the irregular distribution of the seasonal rainfall, the varying quantities deposited by different showers and the manner in which it falls are not shown. These will be better understood by a careful study of the data in Table II, which contains a record of the daily rainfall, with monthly totals, throughout the 6-year period from 1914 to 1919, inclusive.

The annual and seasonal rainfall was sufficient to produce fair to good yields of the grain-sorghum crops in all the years during which these experiments were conducted; but in several seasons the low yields obtained were due largely to the unfavorable distribution of the moisture. This may occur in several ways: (1) Much of the

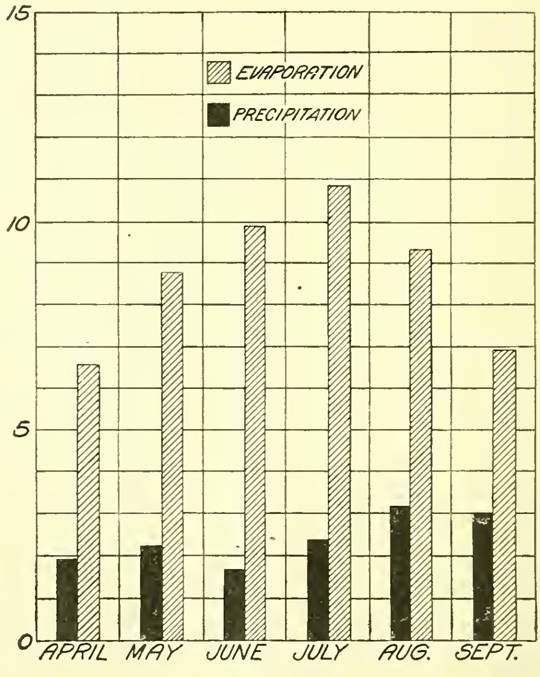

FIG. 4.—Average monthly precipitation and evaporation, in inches, at the Amarillo Cereal Field Station during the growing season (April to September) in the 7-year period from 1913 to 1919, inclusive.

annual rainfall may come within a short period, either near the beginning, in the middle, or at the end of the year; (2) the seasonal rainfall may be sufficient in quantity but poorly distributed; or (3) the rainfall may be fairly evenly distributed and about sufficient in quantity and yet be unsuitable for crop production, as when it occurs in light showers which do not penetrate the soil and are soon evaporated. The seasons of 1916 and 1918 are good examples of the last-mentioned condition. Showers amounting to less than half an inch may add little or no moisture if followed by high winds and bright sunshine, which cause rapid evaporation.

TEMPERATURE.

The data on mean, maximum, and minimum temperatures, by months, for the growing season (April to September) in the 6-year period from 1914 to 1919, inclusive, are given in Table III. The summer days usually are warm to hot, followed by cool nights, which gives a wide range of temperature during the 24 hours. The maximum temperature frequently goes near the 100° F. mark, but seldom exceeds it. June 29, 1918, was the hottest day recorded in this 6-year period. On that date the temperature registered 106° F.

Table III.—*Monthly data on temperature and wind movement recorded at Amarillo, Tex., in the six months from April to September, inclusive, each year, during the 6-year period from 1914 to 1919, inclusive.*

Year and month.	Temperature.					Wind.		
	Mean.	Maximum.		Minimum.		Prevailing direction.	Monthly movement.	Highest hourly movement.
		Reading.	Date.	Reading.	Date.			
Season of 1914:	°*F.*	°*F.*		°*F.*			*Miles.*	*Miles.*
April	56	88	21	20	8	SW.	9,827	40
May	63	95	10	42	12	S.	8,416	37
June	76	99	26	57	17	SW.	10,429	40
July	78	97	31	60	2	S.	6,023	40
August	76	94	31	57	28	S.	6,559	31
September	73	98	6	49	28	S.	7,938	40
Season of 1915:								
April	57	88	28	29	1	S.	7,997	46
May	62	92	25	30	7	S.	9,263	44
June	72	103	20	42	7	S.	8,841	37
July	75	102	11	52	5	S.	8,893	44
August	71	95	4	48	30	S.	6,232	27
September	69	94	10	47	30	S.	7,860	33
Season of 1916:								
April	53	87	11	26	8	NE.	9,123	42
May	67	98	31	35	1	SW.	9,585	37
June	75	100	21	50	7	S.	8,988	35
July	79	100	3	61	7	S.	6,856	25
August	77	97	13	55	28	S.	7,652	39
September	68	91	10	40	29	S.	8,174	35
Season of 1917:								
April	55	90	23	26	8	S.	10,157	42
May	58	98	17	30	7	SE.	9,032	25
June	74	100	12	38	2	SE.	8,972	40
July	79	100	14	58	4	S.	8,393	32
August	74	95	7	49	29	S.	7,147	39
September	69	94	7	40	27	SE.	6,4	35
Season of 1918:								
April	53	87	26	31	21	SW.	8,176	37
May	68	93	24	35	10	S.	8,943	32
June	77	106	29	54	1	S.	6,727	26
July	78	99	10	58	1	S.	7,823	32
August	78	98	2	55	31	S.	7,898	38
September	65	99	14	37	20	S.	8,176	26
Season of 1919:								
April	55	88	21	26	10	SW.	8,417	44
May	62	87	3	45	20	NE.	7,060	39
June	69	90	7	38	2	SE.	6,561	42
July	76	95	11	61	22	S.	8,341	35
August	78	101	6	60	8	S.	6,760	38
September	71	99	2	47	23	S.	7,730	31

In winter the temperature sometimes reaches zero, and occasionally lower temperatures occur for short periods only. The average date of the last spring frost is about April 19 and that of the first fall frost October 30, leaving an average frost-free period of 194 days.

WIND.

Data on wind movement are shown in Table III; also data on temperature. The total wind movement is high for each month during the season in this 6-year period. The lowest total movement recorded in any month was 6,023 miles for July, 1914, and the highest, 10,429 miles, or an average of 14.3 miles per hour, for June of the same year. Some days are calm and others are partly so. On other days the wind reaches a very high velocity. A maximum velocity of 35 to 45 miles per hour is not uncommon. Such high winds are often injurious to the grain-sorghum crops. They may cause damage by covering the young plants, by cutting them off with moving particles of soil, by whipping the half-grown plants into shreds, or by blowing down the crop when it is approaching maturity.

EVAPORATION.

A great quantity of moisture is lost by evaporation at the Amarillo Cereal Field Station. The prime factors influencing evaporation are precipitation, wind, temperature, and sunshine. The highest evaporation naturally occurs in periods of low precipitation, high temperatures, strong winds, and bright sunshine.

Table IV shows the monthly precipitation and evaporation at the station during the six months from April to September in each year of the 7-year period from 1913 to 1919, inclusive. The evaporation measured is from the free water surface of a tank 8 feet in diameter. These data also are shown graphically in figure 4, where the enormous difference between the precipitation and evaporation may be noted at a glance. On the average during this period the evaporation was 3.75 times as great as the precipitation. July has a higher rate of evaporation than any other month, averaging 10.8 inches in this 6-year period; August has an average of 9.3 inches.

TABLE IV.—*Monthly, seasonal, and 7-year monthly average precipitation and evaporation at the Amarillo Cereal Field Station during the six months from April to September, inclusive, in the 7-year period from 1913 to 1919, inclusive.*

[Data (in inches) obtained at the Amarillo Cereal Field Station in cooperation with the Office of Biophysical Investigations and the Office of Dry-Land Agriculture of the Bureau of Plant Industry, United States Department of Agriculture.]

Year.	April.		May.		June.		July.		August.		September.		Seasonal total.	
	Prec.	Evap.	Prec.	Evap.	Prec.	Evap.	Prec.	Evap.	Prec.	Evap.	Prec.	Evap.	Prec.	Evap.
1913	1.7	7.7	1.7	9.8	2.3	7.0	1.4	12.7	0.5	10.3	5.6	5.9	13.2	53.4
1914	1.3	6.7	3.8	6.7	.7	10.1	1.9	8.7	2.5	8.9	1.1	8.0	11.3	49.1
1915	4.8	4.6	2.0	6.9	1.2	8.8	3.7	9.3	4.6	7.3	4.9	6.0	21.2	42.9
1916	1.8	6.0	.9	10.3	2.7	10.7	1.2	11.7	3.4	10.2	2.2	7.7	12.2	56.6
1917	.6	7.7	2.8	7.6	.7	12.5	2.6	12.4	5.5	8.6	2.1	6.0	14.3	64.7
1918	.5	7.0	2.4	11.0	1.2	10.1	2.7	10.7	2.2	10.3	.7	7.4	9.7	56.6
1919	2.5	6.8	2.0	8.7	3.5	9.9	2.4	10.3	3.4	9.2	4.7	7.2	18.4	52.9
Average	1.9	6.6	2.2	8.7	1.6	9.9	2.3	10.8	3.2	9.3	3.0	6.9	14.3	53.7

EXPERIMENTAL METHODS.

The prime objects in conducting the experiments reported herein were to determine the best time to sow the crop and the rate of seeding from which the best yield can be obtained and to compare yield and composition of crops from home-grown seed with those from imported seed. These experiments were conducted in plats under conditions which conform as closely as possible to good farm practices.

PLAT EXPERIMENTS.

The plats used in these experiments were 8 rods long by 1 or 2 rods wide, containing either a twentieth or a tenth of an acre each. The rows were 132 feet long and 42 inches apart, each row representing approximately 0.01 of an acre. In some cases 10 rows constituted a plat, and in others 5 rows. In sowing the seed the rows were made longer than 132 feet, and when the plants were about 1 foot high the ends of the rows were trimmed to the proper length. Each plat was bordered on either end by a road, but the sides of the plats adjacent to the roads at the ends of the series were protected by guard rows from undue influence from that source.

CROP ROTATION.

The crop rotation practiced on the experimental area for at least the past six years has been cowpeas, small grains, and grain sorghums, in the order named.

METHOD OF SEEDING.

A 2-row corn drill fitted with special sorghum plates was used for sowing the crop in all these experiments. Seeding was done at a rate heavy enough to insure a thick stand under normal conditions, with the idea of obtaining a stand sufficient for these experiments if the conditions were unfavorable. Occasionally, the desired stand was not obtained. When the plants were from 6 to 10 inches high the plats were thinned by hand, wherever possible, to the stands desired.

METHODS OF OBTAINING DATA.

The data on plant and stalk spacing and on the occurrence of suckers and heads were obtained by actual counts of the plants, stalks, and heads in all the rows of each plat for which such data are presented. The percentage of suckers is determined by dividing the difference between the number of stalks and the number of plants by the number of stalks. The percentage of erect heads in Dwarf milo is determined by dividing the number of erect heads by the total number of heads produced, and the percentage of headed stalks is the number of stalks that bore heads divided by the total number of stalks in the plat. The growing period as given here is the total time elapsing from seeding until the crop is ripe. The vegetative period is the time from seeding until the heads appear. The fruiting period is the time from the appearance of the heads until the kernels are ripe. The height of the plants is the average of several measurements made at different places in the plat.

Harvesting is done with a corn binder, leaving a stubble about 6 inches high. The bundles are shocked in the field and left from four to six weeks to cure before thrashing is done. They are then hauled to the scales and weighed. The heads usually are cut from the bundles before thrashing is done, but occasionally very dwarf varieties are thrashed without heading the bundles. Thrashing is done with a Keystone No. 1 separator. The thrashed grain is weighed as it comes from the thrasher and the acre yield computed therefrom. The yields are based on 60 pounds to the bushel for kafir and 58 pounds for all other varieties.

ENVIRONING CONDITIONS.

A brief summary of the environing conditions during the 6-year period from 1914 to 1919, inclusive, is given to aid in the interpretation of the results obtained from these experiments.

The season of 1914 was not favorable to high yields. The first three months of the year were without precipitation. April had a number of light showers, but none of them penetrated the soil to any depth. May was unusually wet and cold, which caused poor germination in most plats of the early seedings. June was remarkably dry, and the light rains in July furnished only temporary relief to the crop. The rains in early August stimulated growth, and were followed by about an inch of rainfall in the first 12 days of September, which resulted in only fair yields.

The season of 1915 was exceptionally favorable, resulting in the highest yields in the history of the Amarillo Cereal Field Station. The seasonal rainfall was sufficient and so distributed that the crop at no time suffered for moisture.

Dry and unfavorable conditions obtained during the season of 1916. May was dry. A good rain fell on June 4, followed by a number of light showers during the remainder of the month. July had a few light showers, but the next rain of value did not come until August 20 and 21. This was followed by dry, hot weather during the remainder of the month and the first 10 days of September. The light rains of September furnished only temporary relief, so that very low yields of all grain-sorghum crops resulted.

During the season of 1917 enough moisture fell to grow good crops, but the distribution was poor. The moisture for April was less than half the normal, May was slightly below, and June was almost bone dry, only a few light showers falling. July was normal in rainfall, and August was abnormally wet. Had the distribution been such that the crop could have made better use of the moisture much higher yields would have resulted.

The season of 1918 was very poor for crops, resulting in low yields. Each month from April to September was below normal in rainfall. The moisture received was reasonably well distributed, but in many small showers which made no impression on a dry soil.

In 1919 the seasonal rainfall was about normal in each month except July, which was $1\frac{1}{2}$ inches less than the normal. At seeding time the temperatures were rather low, and much of the seed rotted in the ground or failed to germinate from other causes, which resulted in thin stands in many plats. Otherwise the season was favorable to

FIG. 5.—Early-sown and late-sown plats of Dwarf milo in the date-of-seeding experiment at the Amarillo Cereal Field Station, Amarillo, Tex., on July 2, 1913.

crop growth, and fair to good yields were obtained, considering the thin stands in many plats.

DATE-OF-SEEDING EXPERIMENTS.

The plan followed in the date-of-seeding experiments was to sow on three dates each year. The first or early seeding was made as early as conditions were at all favorable, which usually is about May 10. The normal time for seeding grain sorghums at the Amarillo Cereal Field Station is about May 25, and the latest these crops can be sown in that locality with any assurance that they will ripen before cool weather or frost is about June 10. The early seeding was made on May 10 in 1915, 1916, and 1919, and on May 11 in 1914 and 1918, but in 1917 seeding was delayed by rains until May 16. The normal seeding was made on May 25 in 1914 and 1917, on May 26 in 1915, on May 27 in 1916, and on May 29 in 1919, but was delayed by rains until

June 3 in 1918. The late seeding was made on June 7 in 1917, on June 9 in 1916, on June 10 in 1914 and 1915, on June 12 in 1918, and on June 20 in 1919.

Four varieties, Dwarf milo (C. I. No. 332), Feterita (C. I. No. 182), Dawn kafir (C. I. No. 340), and Manchu kaoliang (C. I. No. 171), were included in these experiments. One plat of each variety was seeded at an early date, one at a normal date, and one at a late date each year. In the early and late dates the varieties each occupied tenth-acre plats, and in the normal date they occupied twentieth-acre plats for each year during this 6-year period.

The results obtained from the date-of-seeding experiments are shown in Tables V to IX, inclusive. The results for each variety are shown separately first, and the averages of the four varieties are then included in one table to facilitate comparison.

TABLE V.—*Yields and other agronomic data in date-of-seeding experiments with Dwarf milo at the Amarillo Cereal Field Station, each year, during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 58 pounds.]

Year and time of seeding.	Row space.		Length of growing period.			Suckers.	Erect heads.	Height of plants.	Grain in crop.	Yields per acre.		
	Plants.	Stalks.	Vegetative.	Fruiting.	Total.					Total crop.	Grain.	
	Inches.	*Inches.*	*Days.*	*Days.*	*Days.*	*P. ct.*	*P. ct.*	*Feet.*	*P. ct.*	*Lbs.*	*Lbs.*	*Bush.*
1914:												
Early	10.3	3.6	73	28	101	64.7	99.6	3.3	31.9	5,260	1,680	29.0
Normal	7.1	3.8	65	26	91	47.2	99.8	3.0	32.4	5,440	1,760	30.3
Late	15.8	3.8	70	26	96	76.1	91.1	3.3	38.3	4,100	1,570	27.1
1915:												
Early	27.4	6.6	84	41	125	75.9	73.0	3.8	40.9	8,320	3,410	58.8
Normal	12.1	4.5	74	45	119	63.0	91.6	4.5	39.3	10,380	4,080	70.3
Late	8.2	3.5	62	36	98	57.7	71.1	3.8	36.9	9,680	3,580	61.7
1916:												
Early	6.9	4.0	80	32	112	42.4	99.3	2.0	18.0	1,000	180	3.1
Normal	7.7	3.7	78	36	114	52.6	100	2.3	27.2	2,060	560	9.7
Late	8.3	4.9	69	26	95	41.4	80.2	2.0	20.3	2,300	470	8.1
1917:												
Early	6.1	3.6	90	15	105	41.3	89.6	3.3	29.5	7,360	2,170	37.4
Normal	6.1	3.4	70	35	105	45.1	78.8	3.3	20.8	4,800	1,000	17.2
Late	10.1	5.8	89	28	117	42.7	70.6	4.3	37.9	5,540	2,100	36.2
1918:												
Early	6.3	5.2	106	26	132	18.6	93.8	2.3	14.9	1,140	170	2.9
Normal	4.7	3.7	83	33	116	21.5	92.1	2.3	15.6	1,800	280	4.8
Late	4.2	3.7	80	27	107	13.2	96.0	2.5	14.7	1,460	215	3.7
1919:												
Early	10.5	4.4	87	36	123	58.1	....	3.3	25.4	4,600	1,170	20.2
Normal	17.0	5.7	76	27	103	66.4	....	3.3	48.3	5,840	2,820	48.6
Late	5.7	3.1	63	19	82	46.1	....	4.0	28.8	4,540	1,310	22.6

DWARF MILO.

Table V shows the agronomic data for Dwarf milo in the date-of-seeding experiments. (Fig. 5.) This table shows that the stands obtained from the different dates of seeding are not comparable in all cases in the same year or in the different years. The row space to the plant ranged from about 5 to 8 inches in 11 of the 18 plats used in the experiment. In 6 of the 7 plats remaining, the row space ranged from 10 to 17 inches, and in the other plat it was 27 inches. The thin stands resulted from unfavorable conditions at seeding time, which affected germination. In some cases poor germination was due to wet, cold soil, and in others to dry soil. The plants have a tendency to adjust themselves to environing conditions, and where the stands were thin a larger number of suckers were produced than in the thicker stands. This condition reduced materially the differences in row space per stalk between the thick and the thin stands.

In most of the years the early date required longer vegetative and total growing periods than either the normal or late dates. This was

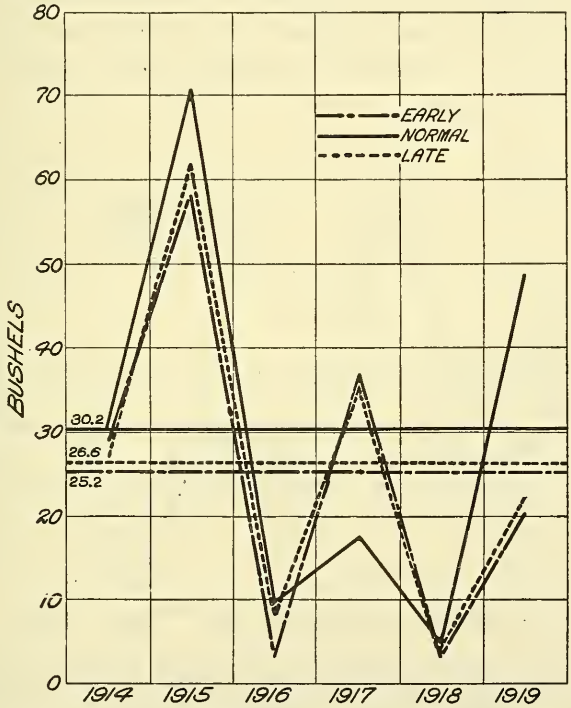

FIG. 6.—Annual and average yields per acre, in bushels, of Dwarf milo (C. I. No. 332) in the date-of-seeding experiments at the Amarillo Cereal Field Station, in the 6-year period from 1914 to 1919, inclusive. Horizontal lines show averages for the period.

due largely to the cold condition of the soil, which prevented normal growth the first few weeks after seeding. The longest time required for the crop to mature was 132 days by the early date in 1918, and the shortest was 82 days by the late date in 1919.

The suckers produced vary with the stands, date of seeding, and seasonal conditions. The thin stands have a higher percentage of suckers than the thick ones in the same season, but the percentage varies with the season. In 1918 but few suckers were produced in any date of seeding. They ranged from 13.2 per cent in the late date to 21.5 per cent in the normal, the early date having 18.6 per cent.

The crop of 1915 has the highest percentage of suckers. That year thin stands were obtained and the season was favorable for luxuriant growth.

The data on erect heads include only the results for five years, from 1914 to 1918, inclusive. During this period the proportion of erect heads ranged from 89.6 to 100 per cent in 10 of the 15 plats for which such data are recorded. In the remaining five plats it is much lower, ranging from 70.6 to 80.2 per cent. No one date of seeding produced the highest percentage of erect heads in all these years, this depending to some extent upon conditions at heading time. It has been observed that more pendent heads occur when the crop is making very rapid growth at heading time than where normal growth only

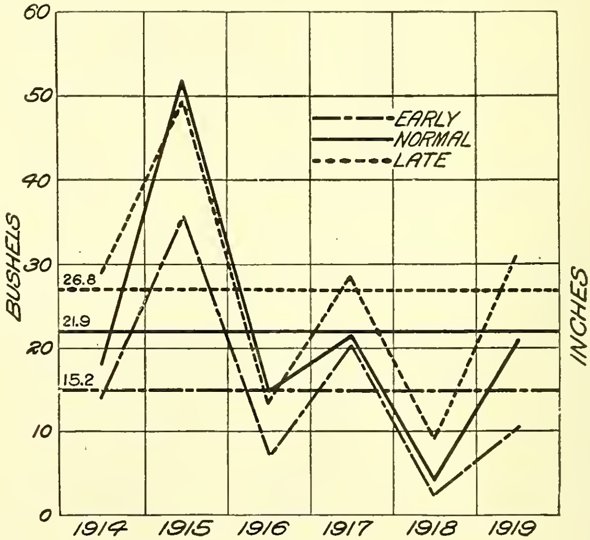

FIG. 7.—Annual and average yields per acre, in bushels, of feterita (C. I. No. 182) in the date-of-seeding experiments at the Amarillo Cereal Field Station in the 6-year period from 1914 to 1919, inclusive. Horizontal lines show averages for the period.

is being made. This may be explained in part by the fact that under conditions which promote rapid growth the sheath unfolds from around the peduncle before it is strong enough to support the head without bending. The degree of curvature of the head depends largely on the strength of the peduncle at the time it is released by the sheath.

The height of the plants ranges from 2 to 4½ feet. The time of seeding apparently has little to do with the height of the plants.

The yield is recorded in three ways: First, the total crop; second, the grain yield in pounds; and, third, the grain yield in bushels of 58 pounds each. The yields are influenced by seasonal conditions to such an extent that no one date of seeding is best for all years and under all conditions. This can be studied best from Table IX, which shows the averages for all dates in all years. The yields also are graphically shown in figure 6.

FETERITA.

The agronomic data recorded for feterita in the date-of-seeding experiments are shown in Table VI, and the yields are shown also in Table IX, for comparison with other varieties.

TABLE VI.—*Yields and other agronomic data in date-of-seeding experiments with feterita at the Amarillo Cereal Field Station, each year, during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 58 pounds.]

Year and time of seeding.	Row space.		Length of growing period.			Suckers.	Headed.	Height of plants.	Grain in crop.	Yields per acre.		
	Plants.	Stalks.	Vegetative.	Fruiting.	Total.					Total crop.	Grain.	
	Inches.	*Inches.*	*Days.*	*Days.*	*Days.*	*Per ct.*	*Per ct.*	*Feet.*	*Per ct.*	*Lbs.*	*Lbs.*	*Bush.*
1914:												
Early	52.8	13.0	73	28	101	75.4	99.0	5.0	25.6	3,160	810	14.0
Normal	11.8	4.9	60	29	89	58.3	63.6	4.5	23.4	4,600	1,075	18.3
Late	17.9	6.1	57	39	96	65.9	88.0	4.3	35.1	4,780	1,680	29.0
1915:												
Early	26.0	5.9	83	40	123	77.1	100	5.5	27.4	7,640	2,100	36.2
Normal	25.0	7.3	68	51	119	70.6	100	5.3	35.1	8,600	3,020	52.1
Late	9.2	4.0	62	36	98	57.0	85.6	5.0	31.1	9,220	2,870	49.5
1916:												
Early	5.4	3.7	80	51	131	32.3	31.8	2.3	21.9	1,960	430	7.4
Normal	8.2	4.2	67	46	113	48.6	48.8	3.0	31.8	2,640	840	14.5
Late	8.3	7.8	64	33	107	6.3	100	3.3	34.5	2,260	780	13.4
1917:												
Early	6.1	3.4	83	24	107	44.5	....	4.0	20.5	5,800	1,190	20.5
Normal	7.7	3.7	80	25	105	51.3	....	4.5	20.9	5,920	1,240	21.4
Late	10.7	5.6	74	33	107	47.8	....	5.0	33.8	4,867	1,645	28.4
1918:												
Early	12.3	8.7	89	50	139	29.3	69.5	3.0	14.6	960	140	2.4
Normal	7.0	5.3	73	43	116	24.6	62.8	3.0	20.0	1,200	240	4.1
Late	5.3	3.8	66	41	107	28.1	62.7	3.3	35.4	1,440	510	8.8
1919:												
Early	35.2	9.1	83	39	122	74.2	100	5.0	14.4	4,240	610	10.5
Normal	63.4	16.1	67	31	98	74.6	100	4.8	41.1	3,920	1,200	20.7
Late	11.7	4.6	52	30	82	60.4	100	4.5	37.5	4,900	1,840	31.7

The stands of feterita in general were not as good as those of Dwarf milo. In 1914 the stand in the early-sown plat was only one plant to approximately 53 inches of row space, and in 1919 the plants in the plats sown on early and normal dates averaged 35.2 inches and 63.4 inches of row space, respectively. These stands produced suckers to the extent of 75 per cent, which reduced the stalk space to distances ranging from 9 to 16 inches. Even then, however, these plats were not directly comparable with the others in the same years. When there is a large number of suckers, usually some of them are late and do not form heads. These tend to increase the total crop yield, but add nothing to the grain yield.

There is a wide range in yield from the different dates in the same year and in the different years. The early date made the low yield each year. The normal date made the high yield in two of the six years, while the late-sown plat led in four years. These yields are compared in Table IX and may be seen at a glance in figure 7.

DAWN KAFIR.

Table VII shows the agronomic data for Dawn kafir in the date-of-seeding experiments. The yields are shown also in Table IX and graphically in figure 8.

Good to fair stands were obtained in most plats in all years during which the experiments were conducted. In most of the plats the row space to the plant ranged from about 5 to 11 inches. A few plats had thinner stands, in one the row space being 26 inches to the plant. On the average the early seeding gave the thinnest stand and the normal seeding the thickest, making a difference of about 3

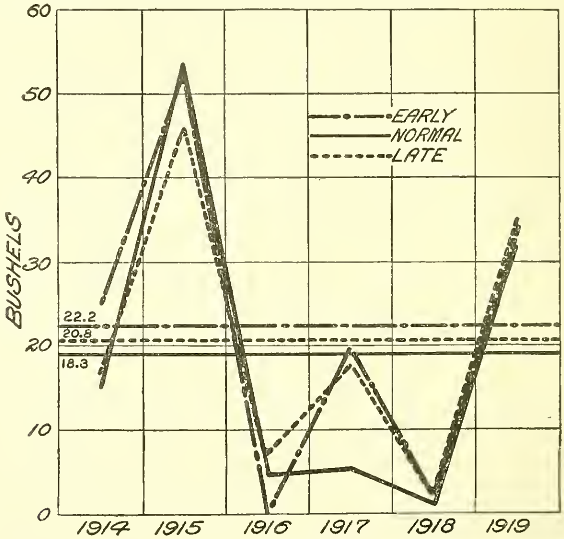

FIG. 8.—Annual and average yields per acre, in bushels, of Dawn (dwarf) kafir (C. I. No. 340) in the date-of-seeding experiments at the Amarillo Cereal Field Station in the 6-year period from 1914 to 1919, inclusive. Horizontal lines show averages for the period.

inches of row space to the plant. These stands are similar to those of Dwarf milo.

The vegetative period ranged from 71 days for the late date in 1914 to 118 days for the normal date in 1916. The total growing period ranged from 93 days for the normal date in 1917 to 156 days for the early date in 1918. The early date usually required a longer total growing period than either of the other seedings. This was due in part to the slow growth made in the early part of the season while the soil temperatures were low and in part to the large number of suckers, which are usually later than the main stalk.

The production of suckers varied greatly in the different seedings in the same year and in the same seeding in the different years. In 1914 the early seeding produced 49.3 per cent of suckers, and the late seeding produced only 12.6 per cent. In 1915 a large number of suckers was produced on each plat, amounting to over 66 per cent in the early and to more than 45 per cent in each of the other seedings. In the unfavorable season of 1918 few suckers were produced. These amounted to about 14.5 per cent in the early and late seedings and 13 per cent in the normal seeding.

The percentage of stalks bearing heads runs high in the favorable seasons and low in the unfavorable ones. In the season of 1915 the early seeding produced 97 per cent of headed stalks, the normal seeding 94.8 per cent, and the late seeding 91.4 per cent. The maximum of 100 per cent was made by each seeding in 1919. In the poor seasons of 1916 and 1918 the percentage of headed stalks was quite small.

TABLE VII.—*Yields and other agronomic data in date-of-seeding experiments with Dawn kafir at the Amarillo Cereal Field Station, each year, during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 60 pounds.]

Year and time of seeding.	Row space.		Length of growing period.			Suckers.	Headed.	Height of plants.	Grain in crop.	Yields per acre.		
	Plants.	Stalks.	Vegetative.	Fruiting.	Total.					Total crop.	Grain.	
	Inches.	*Inches.*	*Days.*	*Days.*	*Days.*	*P. ct.*	*P. ct.*	*Feet.*	*P. ct.*	*Lbs.*	*Lbs.*	*Bush.*
1914:												
Early	17.4	8.8	81	32	113	49.3	83.5	3.8	27.4	5,480	1,500	25.0
Normal	5.7	4.8	73	29	102	15.7	61.8	3.0	16.1	5,440	880	14.7
Late	5.9	5.0	71	39	110	12.6	88.5	4.0	21.1	4,750	1,000	16.7
1915:												
Early	19.9	6.6	89	52	141	66.8	97.0	4.5	32.7	9,610	3,150	52.5
Normal	10.2	6.0	81	50	131	45.3	94.8	4.3	36.1	8,860	3,200	53.3
Late	14.5	7.9	80	57	137	45.5	91.4	4.8	27.1	10,220	2,770	46.3
1916:												
Early	7.2	3.8	113	20	133	47.3	11.9	2.5	....	1,660	No grain.	
Normal	9.1	4.5	118	26	144	50.9	45.2	3.3	4.2	5,200	220	3.7
Late	5.1	3.7	97	18	115	26.1	32.6	3.3	20.0	2,100	420	7.0
1917:												
Early	10.6	4.5	104	23	127	57.3	77.6	4.0	15.5	7,660	1,190	19.8
Normal	10.0	4.3	72	21	93	56.8	52.2	3.8	5.4	5,560	300	5.0
Late	26.0	11.1	89	29	118	57.4	79.3	4.5	21.0	5,040	1,060	17.7
1918:												
Early	7.4	6.3	98	58	156	14.5	17.0	2.3	4.4	2,750	120	2.0
Normal	8.4	7.3	79	57	136	13.2	12.3	2.5	4.7	1,500	70	1.2
Late	5.0	4.2	75	49	124	14.9	11.1	2.3	4.3	2,080	90	1.5
1919:												
Early	10.4	5.2	96	27	123	49.7	100	3.5	29.1	6,980	2,030	33.8
Normal	11.6	5.8	77	30	107	50.1	100	4.0	33.3	5,760	1,920	32.0
Late	5.8	3.8	77	38	115	33.9	100	4.0	32.3	6,560	2,120	35.3

The average height of the plants ranged from 2.3 feet in 1918 to 4.8 feet in the late seeding in 1915. Growing conditions in the vegetative period largely govern the height of the plants. With favorable conditions during this period the height will be greater than with unfavorable conditions when followed by favorable conditions during the fruiting period. Dawn kafir usually attains a height of about 4 feet under average conditions.

The yields vary with seasonal conditions. The highest total yield, 10,220 pounds, was made by the late seeding in the favorable season of 1915, and the lowest, 1,500 pounds, by the normal seeding in the poor season of 1918. Low yields were obtained in 1916. That year the early seeding produced 1,660 pounds of crop; but only 11.9 per cent of the stalks formed heads, and these did not mature, which made that seeding a failure in grain production.

There is a wide range between the grain yields for the different dates of seeding in the same year and also for the same dates in the different years. Therefore, it is necessary to study the averages to determine the best date to sow. This can be seen in Table IX and at a glance in figure 8.

MANCHU KAOLIANG.

The agronomic data recorded in the date-of-seeding experiments with Manchu kaoliang are shown in Table VIII, and the yields are shown for comparison in Table IX and graphically in figure 9.

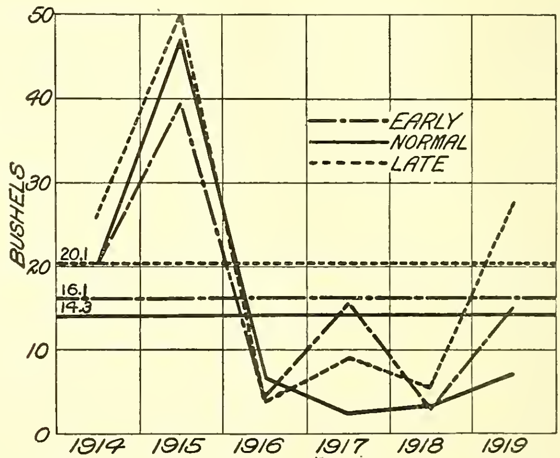

FIG. 9—Annual and average yields per acre, in bushels, of Manchu kaoliang (C I. No. 171) in the date-of-seeding experiments at the Amarillo Cereal Field Station in the 6-year period from 1914 to 1919, inclusive. Horizontal lines show averages for the period.

The stands obtained in most cases were good. In 1916 the normal seeding had a thin stand, averaging one plant to 25½ inches of row space. The late seeding had a very poor stand in 1917, and in 1919 both the early and normal seedings had poor stands. The normal seeding that year was almost a failure, averaging only about 11 plants to the row of 132 feet.

Manchu kaoliang is earlier than any other variety included in these experiments. The vegetative period ranged from 56 days in the late seeding in 1919 to 91 days in the early seeding in 1918. The early seeding usually required the longest and the late seeding the shortest vegetative period. The total growing period ranged from 80 days in the normal seeding in 1914 to 123 days in the early seeding in 1918. Under average conditions from 95 to 100 days are required for this crop to mature.

TABLE VIII.—*Yields and other agronomic data in date-of-seeding experiments with Manchu kaoliang at the Amarillo Cereal Field Station, each year, during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 58 pounds.]

Year and time of seeding.	Row space.		Length of growing period.			Suckers.	Headed.	Height of plants.	Grain in crop.	Yields per acre.		
	Plants.	Stalks.	Vegetative.	Fruiting.	Total.					Total crop.	Grain.	
	Inches.	*Inches.*	*Days.*	*Days.*	*Days.*	*P. ct.*	*P. ct.*	*Feet.*	*P. ct.*	*Lbs.*	*Lbs.*	*Bush.*
1914:												
Early	7.6	7.3	68	21	89	4.8	95.2	5.8	37.5	3,150	1,180	20.3
Normal	6.5	5.1	60	20	80	21.9	97.5	5.3	35.1	3,300	1,160	20.0
Late	6.8	6.6	57	30	87	3.4	97.8	5.0	35.6	4,300	1,530	26.4
1915:												
Early	5.1	4.4	71	42	113	14.0	96.3	6.0	27.9	8,090	2,260	38.9
Normal	4.0	3.8	67	36	103	4.3	92.9	6.5	......	......	2,700	46.6
Late	4.2	3.9	58	48	106	7.1	95.6	5.8	36.7	7,810	2,870	49.5
1916:												
Early	5.8	5.2	76	20	96	9.8	43.3	3.8	37.1	700	260	4.5
Normal	25.5	17.7	70	27	97	30.8	86.2	4.0	35.1	1,080	380	6.6
Late	9.9	7.6	64	39	103	23.4	80.7	3.5	20.6	970	200	3.4
1917:												
Early	20.8	9.6	83	16	99	54.0	81.8	5.3	15.5	3,140	890	15.3
Normal	12.6	9.2	83	21	104	27.4	84.5	4.8	5.4	2,080	140	2.4
Late	44.1	20.8	74	26	104	52.8	89.2	5.3	21.0	1,580	500	8.6
1918:												
Early	18.0	15.6	91	32	123	13.3	78.5	4.0	21.4	700	150	2.6
Normal	5.8	5.4	74	20	94	6.7	68.2	3.8	25.0	720	180	3.1
Late	10.7	9.7	68	23	91	8.8	78.7	4.5	25.0	1,240	310	5.3
1919:												
Early	32.6	13.6	73	31	104	58.3	100	5.3	29.8	2,920	870	15.0
Normal	127.7	48.9	69	28	97	61.7	100	5.5	37.0	1,080	400	6.9
Late	13.2	9.1	56	26	82	31.8	100	5.5	43.5	3,860	1,600	27.6

The average number of suckers produced by Manchu kaoliang is not as large as in Dwarf milo, feterita, or Dawn kafir. On the half of the plats used in this experiment on which good stands were obtained, the suckers did not exceed 14 per cent in any one plat. In other plats with thin stands larger percentages of suckers were produced.

In the favorable seasons of 1914, 1915, and 1919 more than 92 per cent of the stalks in each plat produced heads. A much lower percentage was produced in the less favorable seasons, reaching a minimum of 43.3 per cent in the early seeding in 1916.

The height of the plants ranged from 3½ feet in the late seeding in 1916 to 6½ feet in the normal seeding in 1915. The normal seeding produced the tallest and the late seeding the shortest plants during the 6-year period.

The heaviest total crop yield, 8,090 pounds, was made by the early seeding in 1915, and the lightest, 700 pounds, was made by the same seeding in both 1916 and 1918. A study of the averages is necessary to determine the best date of seeding. These are presented in figure 9 and Table IX.

COMPARATIVE YIELDS IN DATE-OF-SEEDING EXPERIMENTS.

Table IX and figures 6 to 9 show the annual and average acre-yields from the early, normal, and late seedings of the four varieties of grain sorghums used in the date-of-seeding experiments.

The annual yields of each variety for each date of seeding are given first, followed in each case by the 6-year average. Dwarf milo made its highest yield, 70.3 bushels, from the normal seeding in 1915, and the lowest yield, 2.9 bushels, from the early seeding in 1918. The normal seeding in this variety yielded highest in five years, and was exceeded by the early seeding in one year. The late seeding made better yields than the early seeding in four of the six years. In average yield during this 6-year period the normal seeding ranks first, with 30.2 bushels, the late seeding takes second place, with an average of 26.6 bushels, and the early seeding is third, with an average of 25.2 bushels. This tends to show that the normal date, from about May 20 to 25, is the best time to sow Dwarf milo in that locality, and that it is safer to delay seeding a little than to sow much earlier than the dates mentioned.

TABLE IX.—*Annual and average yields of four varieties of grain sorghum grown in the date-of-seeding experiments at the Amarillo Cereal Field Station during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 60 pounds for kafir and at 58 pounds for other sorghums.]

Variety and time of seeding.	Annual yields per acre.						
	1914	1915	1916	1917	1918	1919	Average.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dwarf milo:							
Early	29.0	58.8	3.1	37.4	2.9	20.2	25.2
Normal	30.3	70.3	9.7	17.2	4.8	48.6	30.2
Late	27.1	61.7	8.1	36.2	3.7	22.6	26.6
Feterita:							
Early	14.0	36.2	7.4	20.5	2.4	10.5	15.2
Normal	18.3	52.1	14.5	21.4	4.1	20.7	21.9
Late	29.0	49.5	13.4	28.4	8.8	31.7	26.8
Dawn kafir:							
Early	25.0	52.5	0	19.8	2.0	33.8	22.2
Normal	14.7	53.3	3.7	5.0	1.2	32.0	18.3
Late	16.7	46.3	7.0	17.7	1.5	35.3	20.8
Manchu kaoliang:							
Early	20.3	38.9	4.5	15.3	2.6	15.0	16.1
Normal	20.0	46.6	6.6	2.4	3.1	6.9	14.3
Late	26.4	49.5	3.4	8.6	5.3	27.6	20.1

The lowest yield of feterita was produced from the early seeding in all six years. The normal seeding made the best yields in two years and the late seeding in four years. On the average the late seeding takes first place with 26.8 bushels, the normal is second with 21.9 bushels, and the early comes last with only 15.2 bushels. The yield from the late seeding on the average is more than 5 bushels larger than that of the normal and over 11 bushels more than from the early seeding. This shows clearly that early seeding should not be practiced with feterita in the Amarillo section.

Dawn kafir made the highest yields from the early seeding in three years and a failure in one year. The normal seeding ranked first in one year and the late seeding ranked first in two years. In the 6-year average the early seeding ranks first with 22.2 bushels, the late seeding comes second with 20.8 bushels, and the normal seeding takes last place with 18.3 bushels. The averages show that early seeding for Dawn kafir is best and that late seeding is better than the normal date.

Manchu kaoliang produced the best yield in one year from the early seeding, in one year from the normal, and in four years from the late seeding. The late seeding ranks first with an average of 20.1 bushels, the early seeding is second with 16.1 bushels, and the normal seeding is third with an average of only 14.3 bushels. This indicates that Manchu kaoliang should be seeded late if grown at all in this locality, which is true also of feterita.

SPACING EXPERIMENTS.

The spacing experiments were conducted with Dwarf milo (C. I. No. 332) and Dawn kafir (C. I. No. 340). The object of these experiments was to determine the reaction of these crops to the different environing conditions and to determine the distances between plants and rows that would give the best yields. These experiments were divided into two sections. The first section consisted of six plats each year during the 6-year period from 1914 to 1919, inclusive. The rows in these plats were 3½ feet apart (fig. 10), the plants being spaced at different distances, representing six rates of seeding each year. The second section also contained six plats each year. It differs from the first section in the spacing of the rows, which are 7 feet apart (fig. 11), and of the plants, which are twice as thick in the row as in the first section, thus representing the same number of plants per acre.

DWARF MILO.

FIRST SECTION, ROWS 3½ FEET APART.

The agronomic data recorded on Dwarf milo in the first section of the spacing experiments are presented in Table X. This table shows that in 1914 the thickest stand was one plant to 3.7 inches of row space, and that the thinnest stand was one plant to 17.4 inches of row space, with the other four rates ranging from 4.3 to 11.7 inches of row space to the plant. In 1915 the row space to the plant ranged from 6 to 21.4 inches. In 1916 the thickest rate was one plant to 4.2 inches of row space and the thinnest rate was one plant to 20.8 inches. In 1917 the first five rates were practically identical with those of 1915, ranging from 6 inches of row space in the first or thick rate to 18 inches of row space to the plant in the fifth rate. The thin rate had a row space of 24 inches to the plant. In 1918 the row space ranged from 3 inches in the thick rate to 9.1 inches in the fourth rate and 12 and 12.8 inches in the fifth and sixth rates, respectively. In 1919 the germination was poor, making it impracticable to get the desired stands in all rates. The row space to the plant for the different rates is shown in Table X.

The average stalk space varies much less in the different rates than the plant space, because of the difference in the number of suckers produced per plant in the different rates. The percentage of suckers varies in the different rates in the same year and in the same rates in the different years. In general, however, the percentage of suckers increases as the stand decreases. The thick rate produced 5.8 per cent of suckers in 1918, which was the minimum in the 6-year period. The maximum, 74.4 per cent, was produced

FIG. 10.—Dawn (dwarf) kafir in rows spaced 42 inches apart, plants spaced 12 inches apart, Amarillo Cereal Field Station, Amarillo, Tex., August 17, 1915.

by the thin rate in 1914. It appears that from 65 to 75 per cent, or an average of about three suckers to the plant, is the limit for Dwarf milo and that such rates of suckering may be expected under favorable conditions from plants with 10 to 20 or more inches of row space.

The percentage of erect heads was high in most years, reaching almost 100 per cent in all rates. Thin stands have a greater tendency to produce pendent heads than thick ones, but growing conditions at the time the crop is heading probably are the determining factors in their production. Rapid growth at heading time is favorable to the production of pendent heads.

The yields of the total crop and those of grain in pounds and in bushels of 58 pounds each are recorded in Table X. The thicker stands usually produced the higher yields in the favorable seasons and the thinner ones in the less favorable years. The highest yield in the different years was not produced by the same stand each year. It is necessary to study the averages to determine the rate which will give the best results during a series of years.

TABLE X.—*Data recorded in the spacing experiments with Dwarf milo grown in rows spaced 3½ feet apart at the Amarillo Cereal Field Station during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 58 pounds.]

Year.	Row space.		Suckers.	Erect heads.	Yields per acre.		
	Plants.	Stalks.			Total crop.	Grain.	
	Inches.	*Inches.*	*Per cent.*	*Per cent.*	*Pounds.*	*Pounds.*	*Bushels.*
1914	3.7	2.8	24.6	99.8	5,155	1,255	21.6
	4.3	3.1	29.1	99.8	5,940	1,560	26.9
	6.4	2.9	54.6	99.8	5,480	1,520	26.2
	10.4	3.6	65.6	99.5	5,500	1,470	25.3
	11.7	3.9	66.7	99.6	4,000	860	14.8
	17.4	4.5	74.4	99.2	4,870	1,190	20.5
1915	6.0	3.2	46.3	98.0	9,980	3,900	67.2
	9.0	3.5	60.5	96.2	9,860	3,950	68.1
	12.0	3.8	65.2	96.1	10,430	4,220	72.8
	14.9	4.7	68.0	92.7	9,870	4,210	72.6
	17.7	5.6	68.4	64.7	9,090	3,570	61.5
	21.4	6.3	70.7	73.7	9,330	4,050	69.8
1916	4.2	3.6	14.2	100	2,680	710	12.3
	7.9	4.7	39.8	99.9	1,940	430	7.4
	10.0	5.5	45.4	100	1,700	440	7.6
	11.7	7.5	35.9	99.5	2,360	900	15.5
	15.1	6.6	56.3	99.3	2,980	1,060	18.3
	20.8	10.5	49.6	97.4	2,740	1,120	19.3
1917	6.0	4.0	34.0	81.3	5,720	1,600	27.6
	9.0	3.5	61.2	73.6	5,340	1,520	26.2
	12.0	4.1	66.2	65.8	5,160	1,580	27.3
	14.7	4.9	66.6	67.1	5,900	2,000	34.5
	18.0	4.9	72.6	68.0	5,060	1,480	25.5
	24.0	6.1	74.7	78.4	5,300	1,630	28.1
1918	3.0	2.8	5.8	96.4	1,100	60	1.0
	5.1	4.6	9.7	95.0	1,000	70	1.2
	6.0	5.1	15.1	91.3	960	100	1.7
	9.1	5.8	36.7	89.5	1,440	270	4.7
	12.0	7.8	35.2	87.6	1,240	190	3.3
	12.8	7.9	37.9	89.0	1,200	180	3.1
1919	4.1	3.4	17.8	99.2	6,000	2,880	49.7
	5.3	4.0	24.8	98.8	6,060	2,930	50.5
	13.2	5.0	61.9	95.0	5,900	2,970	51.2
	13.7	5.0	63.8	93.9	6,120	3,050	52.6
	21.0	6.7	68.3	91.9	5,500	2,900	50.6
	21.6	6.5	69.9	86.4	5,880	3,090	53.3

Table XI shows the annual and average acre yields of Dwarf milo in rows spaced 3½ feet apart in the spacing experiments during the 6-year period from 1914 to 1919, inclusive. In this table the plant spacings which were approximately the same are combined. The first or thickest rate represents a space per plant ranging from 6 to 8 inches; the second has a space of 9 to 10 inches to the plant, and the third has 12 inches of row space to the plant. In the fourth rate the row space ranges from 15 to 18 inches, and in the fifth, from 20 to 24 inches. All rates were not obtained throughout the entire

6-year period. For that reason averages are given for two 4-year periods, a 5-year period, and the 6-year period. In the first four years, from 1914 to 1917, inclusive, the highest average was made by the 15 to 18 inch spacing and the lowest by the 9 to 10 inch spacing. In the four years from 1915 to 1919, omitting 1918, the

Fig. 11.—Dawn (dwarf) kafir in rows spaced 84 inches apart, plants spaced 6 inches apart, Amarillo Cereal Field Station, Amarillo, Tex., August 17, 1915.

20 to 24 inch spacing ranks first, while the 6 to 8 inch spacing is lowest in yield. In the 5-year period from 1914 to 1918, inclusive, which includes only three rates for all years, the averages are approximately the same. In the 6-year period the averages are approximately the same for the two rates which are represented in all years.

Table XI.—*Annual and average yields of Dwarf milo in rows spaced 3½ feet apart in the spacing experiments at the Amarillo Cereal Field Station during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 58 pounds.]

Row space per plant.	Annual yields per acre.						Average yields per acre.			
	1914	1915	1916	1917	1918	1919	4 years, 1914 to 1917.	4 years, 1915, 1916, 1917, and 1919.	5 years, 1914 to 1918.	6 years, 1914 to 1919.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
6 to 8 inches	26.2	67.2	7.4	27.6	1.7	50.5	32.1	38.2	26.0	30.1
9 to 10 inches	25.3	68.1	7.6	26.2	4.7	....	31.8	....	26.4	....
12 inches	14.8	72.8	15.5	27.3	3.3	51.2	32.6	41.7	26.7	30.8
15 to 18 inches	20.5	61.5	18.3	34.5	....	52.6	33.7	41.7	....	....
20 to 24 inches	....	69.8	19.3	28.1	....	50.6	....	42.0	....	....

SECOND SECTION, ROWS 7 FEET APART.

The second section of these experiments differs from the first section in the spacing of the rows, which are 7 feet apart, and of the plants, which are twice as thick in the rows.

Table XII shows the data recorded for Dwarf milo grown in rows spaced 7 feet apart in the spacing experiments during the 6-year period from 1914 to 1919, inclusive. Six plats were grown each year, representing as many rates of seeding. However, the spacings are not in all cases the same in all years.

TABLE XII.—*Data recorded in the spacing experiments with Dwarf milo grown in rows spaced 7 feet apart at the Amarillo Cereal Field Station during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 58 pounds.]

Year.	Row space.		Suckers.	Erect heads.	Yields per acre.		
	Plants.	Stalks.			Total crop.	Grain.	
	Inches.	*Inches.*	*Per cent.*	*Per cent.*	*Pounds.*	*Pounds.*	*Bushels.*
1914	3.7	2.6	30.0	99.8	4,240	1,870	32.2
	3.9	2.8	29.3	99.9	3,820	1,250	21.6
	3.9	2.6	33.2	99.4	4,660	1,700	29.3
	4.3	2.8	34.6	99.6	5,020	1,820	31.4
	5.7	2.6	54.6	99.7	4,800	1,870	32.2
	8.6	3.0	65.0	99.7	5,140	2,060	35.5
1915	4.1	2.6	37.5	90.4	7,680	3,270	56.4
	4.5	2.6	43.3	92.4	7,730	3,520	60.7
	6.0	2.8	52.9	91.9	7,540	3,520	60.7
	9.0	3.7	58.4	84.3	7,260	3,130	54.0
	9.4	3.9	58.5	72.9	7,340	3,080	53.1
	11.2	4.4	60.3	66.0	7,370	2,980	51.4
1916	2.1	1.8	13.4	100.0	1,590	520	9.0
	3.9	3.2	18.0	99.9	1,230	400	6.9
	5.2	3.6	30.1	97.4	1,790	710	12.3
	5.9	3.5	40.0	99.4	2,500	900	15.5
	7.5	4.0	47.1	98.6	3,500	1,620	27.5
	26.4	15.3	42.1	87.1	1,420	730	12.6
1917	3.1	2.9	8.9	96.6	3,600	1,600	27.6
	4.5	3.4	23.6	95.3	4,500	1,850	31.9
	6.0	3.8	36.5	94.4	5,120	2,060	35.5
	7.4	3.5	53.2	92.2	4,920	1,870	32.2
	9.1	3.4	62.3	92.8	5,120	1,890	32.6
	12.2	3.9	68.1	92.7	4,800	1,780	30.7
1918	1.5	1.5	0	99.5	1,160	170	2.9
	2.5	2.4	4.7	97.9	1,060	230	4.0
	3.0	2.7	9.9	98.5	1,120	260	4.5
	4.5	3.7	16.9	97.2	1,860	700	12.1
	6.0	5.1	16.0	96.0	960	230	4.0
	12.7	7.8	38.7	87.8	900	270	4.7
1919	2.7	2.5	7.9	94.8	5,100	2,720	46.9
	2.7	2.6	6.3	96.4	5,000	2,680	46.2
	6.5	3.6	45.4	88.7	5,160	2,830	48.9
	10.3	4.6	55.5	86.0	4,900	2,660	45.9
	16.0	5.5	64.7	80.2	4,300	2,320	40.0
	22.6	7.1	68.8	72.3	3,400	1,780	30.7

In 1914 the thickest rate averaged one plant to 3.7 inches and the thinnest rate one plant to 8.6 inches of row space, with four intermediate rates ranging from 3.9 to 5.7 inches of row space to the plant. In 1915 the thick rate was one plant to 4.1 inches of row space and the thin rate had a row space of 11.2 inches to the plant. The four intermediate rates ranged from 4.5 to 9.4 inches to the plant. In 1916 the first five rates ranged from 2.1 to 7.5 inches of row space to the plant in the different rates. The sixth rate was abnormally thin, averaging 26.4 inches of row space to the plant. In 1917 the rates ranged from 3.1 to 12.2 inches of row space to the plant. In 1918 the thick rate had 1.5 inches of row space to the plant and the thin rate 12.7 inches, with the four intermediate rates ranging from 2.5 to 6 inches of row space to the plant. In 1919 there were only five rates, the first two plats having the same stand. The thick rate had a stand of one plant to 2.7 inches of row space, while the thin rate was abnormally thin, averaging one plant to 22.6 inches of row space. In the three intermediate rates the row space to the plant ranged from 6.5 to 16 inches.

The average stalk space in the different rates does not show the wide range that the plant space does. This is due to the difference in the number of suckers produced, the thin rates having the larger number. The percentage of suckers varies from year to year, but usually increases as the stand decreases.

The percentage of erect heads ran high in most plats in all the years. Thin stands have a tendency to produce pendent heads, though conditions during heading time influence their production.

The total crop yield ranges from 7,730 pounds from the rate with 4.5 inches of row space to the plant in the favorable season of 1915, to 900 pounds from the 12.7-inch rate in 1918. It varies greatly from the different rates in the same year, and from the same rates in different years. In the favorable seasons of 1915 and 1919, the thicker rates produced best, while in the less favorable seasons of 1914, 1916, and 1917 the thinner rates yielded highest. The high grain yields can not always be correlated with high total crop yields. This may be due in part to the development of suckers. A production of suckers which do not develop heads may increase the total crop yields, but the percentage of grain may then be less than in cases having fewer suckers and a higher percentage of stalks bearing heads. To determine the best rate of seeding it is necessary to study averages which cover a series of years. These are shown in Table XIII.

The annual and average acre yields of Dwarf milo in rows spaced 7 feet apart are shown in Table XIII. Four rates are here represented. In the first or thick rate, the space per plant ranges from 2 to 3 inches in the different years; in the second rate, from 4 to 4½ inches; in the third rate it is approximately 6 inches; and in the fourth it ranges from 8 to 12 inches.

Seasonal conditions play an important part in the grain yields. In the four years from 1914 to 1917, which include one fair, one good, and two poor seasons, the average is in favor of the thin rate. In the four years, 1915, 1916, 1917, and 1919, which include two good and two poor seasons, the average is slightly in favor of the 6-inch rate. The 5-year period, 1914 to 1918, which includes one fair, one good, and three poor seasons, shows the higher yields from the thin rates. The 6-year period adds another good season to the 5-year period, but does not materially change the results, which indicate that in rows spaced 7 feet apart, somewhere between 6 and 12 inches of row space per plant for Dwarf milo is the surest rate under Amarillo conditions.

TABLE XIII.—*Annual and average yields of Dwarf milo in rows spaced 7 feet apart in the spacing experiments at the Amarillo Cereal Field Station during the 6-year period, from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 58 pounds.]

Row space per plant.	Annual yields per acre.						Average yields per acre.			
	1914	1915	1916	1917	1918	1919	4 years, 1914 to 1917.	4 years, 1915, 1916, 1917, and 1919.	5 years, 1914 to 1918.	6 years, 1914 to 1919.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
2 to 3 inches	32.2	56.4	9.0	27.6	4.0	46.9	31.3	35.0	25.8	29.4
4 to 4½ inches	27.4	60.7	6.9	31.9	12.1	27.8	31.7	31.8	27.8	27.8
6 inches	32.2	60.7	15.5	35.5	4.0	48.9	36.0	40.2	29.6	32.8
8 to 12 inches	35.5	53.1	27.5	32.6	4.7	45.9	37.2	39.8	30.7	33.2

COMPARATIVE YIELDS FROM 3½-FOOT AND 7-FOOT ROWS.

Table XIV shows the annual and average acre yields of Dwarf milo in the spacing experiments, arranged so that comparisons may be made easily between the different methods. Four different rates are represented, and these are arranged in four groups, each containing the yields from rows spaced 3½ and 7 feet apart, but having the same number of plants to the acre. The data shown are the distance between the rows in feet, the row space between plants in inches, and the annual and average acre yields for each spacing.

Group A contains the data for the thick rate, with an average of approximately one plant to 6½ inches of row space in rows 3½ feet apart, and of one plant to each 3 inches where the rows were 7 feet apart, or about 24,000 plants to the acre. The highest yield, 67.2 bushels, from this rate was made in 1915, with the rows spaced 3½ feet apart. This method also made the lowest yield, 1.7 bushels, in 1918, but it has given the highest average in the 4-year, 5-year, and 6-year periods.

Group B represents an average stand of one plant to 9½ inches of row space where the rows are 3½ feet apart, and 4.3 inches where the rows are 7 feet apart, or approximately 16,000 plants to the acre. This rate occurs in only five years where the rows are spaced 3½ feet apart. A higher yield was produced from 3½-foot rows than from 7-foot rows during only two of these five years. The average yield from both methods in the 4-year period is the same, but in the 5-year period the average is in favor of the rows spaced 7 feet apart.

TABLE XIV.—*Annual and average yields of Dwarf milo in the spacing experiments at the Amarillo Cereal Field Station during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 58 pounds.

Approximate number of plants per acre.	Space between rows.	Row space per plant.	Annual yields per acre.						Average yields per acre.		
			1914	1915	1916	1917	1918	1919	4 years, 1914 to 1917.	5 years, 1914 to 1918.	6 years, 1914 to 1919.
	Feet.	*Inches.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Group A, 24,000 plants.	3½	6.5	26.2	67.2	7.4	27.6	1.7	50.5	32.1	26.0	30.1
	7	3.0	32.2	56.4	9.0	27.6	4.0	46.9	31.3	25.8	29.4
Group B, 16,000 plants.	3½	9.5	25,3	68.1	7.6	26.2	4.7	......	31.8	26.4	......
	7	4.3	27.4	60.7	6.9	31.9	12.1	27.8	31.7	27.8	27.8
Group C, 13,000 plants.	3½	12.0	14.8	72.8	15.5	27.3	3.3	51.2	32.6	26.7	30.8
	7	6.0	32.2	60.7	15.5	35.5	4.0	48.9	36.0	29.6	32.8
Group D, 9,000 plants.	3½	16.5	20.5	61.5	18.3	34.5	......	52.6	33.7	......	......
	7	9.6	35.5	53.1	27.5	32.6	4.7	45.9	37.2	......	33.2

Group C represents a stand of 12 inches of row space to the plant in the rows spaced 3½ feet apart and 6 inches in the rows 7 feet apart, or approximately 13,000 plants to the acre. At this rate the best yields were produced in two years from the rows spaced 3½ feet apart and in three years from the rows spaced 7 feet apart, while the methods tied in yield in the other year. The rows spaced 7 feet apart lead in average yields in all three periods.

Group D has an average of one plant to 16½ inches of row space in rows spaced 3½ feet apart and 9.6 inches where the rows are spaced 7 feet apart, or approximately 9,000 plants to the acre. This rate is not represented in 1918 by the method with the rows spaced 3½ feet apart, which leaves five years only for comparison between the two methods. In this period the 3½-foot rows produced the highest yield in three years, but in the 5-year period the rows spaced 7 feet apart produced a higher average yield by 3½ bushels. It is interesting to note that the method of spacing the rows 7 feet apart usually produced the highest yields in fair to poor seasons, which is an indication that it is the surest method of growing a grain crop in unfavorable seasons.

DAWN KAFIR.

The series of spacing experiments conducted with Dwarf milo were duplicated with Dawn kafir (figs. 10 and 11). As the nature of the experiment has already been described, only the results obtained need to be considered. These data are shown in Tables XV to XIX, inclusive.

FIRST SECTION, ROWS $3\frac{1}{2}$ FEET APART.

Table XV shows the results with Dawn kafir in the spacing experiment with the rows $3\frac{1}{2}$ feet apart. (Fig. 10.) Six plats were sown each year, representing six different rates. In a few cases practically the same stands were obtained in two plats in the same year. This condition occurred in the first two plats in 1914 and again in the last two plats in 1918. In general the thick rate ranged from 3 to 7 inches and the thin rate from 15 to 20 inches of row space to the plant in the different years. However, the last two plats in 1917 and in 1919 had much thinner stands.

TABLE XV.—*Data recorded in the spacing experiments with Dawn kafir grown in rows spaced $3\frac{1}{2}$ feet apart at the Amarillo Cereal Field Station during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 60 pounds.]

Year.	Row space—		Suckers.	Headed.	Yields per acre.		
	Plants.	Stalks.			Total crop.	Grain.	
	Inches.	*Inches.*	*Per cent.*	*Per cent.*	*Pounds.*	*Pounds.*	*Bushels.*
1914	7.0	5.3	24.8	40.7	4,222	522	8.7
	7.2	5.0	30.7	63.0	5,180	1,052	17.5
	8.0	5.2	35.3	67.1	5,360	1,110	18.5
	10.8	5.6	47.7	59.8	4,780	1,010	16.8
	11.0	5.9	46.7	60.4	4,860	1,120	18.7
	18.7	7.7	58.7	76.2	4,600	1,140	19.0
1915	6.0	4.1	32.7	93.6	11,710	3,610	60.2
	8.8	4.1	53.3	93.3	11,410	4,140	69.0
	11.8	4.9	58.6	95.3	11,130	4,100	68.3
	14.8	5.4	63.5	96.6	11,250	4,070	67.8
	18.8	6.5	65.3	96.0	9,870	3,760	62.7
	21.1	8.0	62.0	96.1	8,470	3,330	55.5
1916	4.0	3.4	16.0	8.9	1,160	0	....
	7.4	4.7	36.3	13.3	1,640	60	1.0
	11.8	6.2	47.7	59.6	3,800	350	5.80
	13.0	6.5	50.5	53 6	3,000	250	4.2
	17.1	7.4	56.6	51.3	2,780	230	3.8
	20.5	8.6	58.3	62.7	2,640	310	5.2
1917	6.1	4.0	34.4	67.2	6,880	890	14.8
	10.8	4.9	54.5	64.5	6,120	730	12.2
	15.9	5.5	64.9	68.2	6,260	1,110	18.5
	19.3	5.9	69.7	73.5	5,940	1,070	17.8
	26.2	7.8	70.1	90.5	5,940	1,610	26.8
	32.7	8.9	72.7	83.8	5,160	1,260	21.0
1918	3.0	2.3	25.1	2.1	1,660	20	.3
	6.0	5.2	14.2	6.0	1,540	40	.7
	9.0	7.7	14.1	18.9	1,580	110	1.8
	12.0	10.0	17.0	12.1	1,080	40	.7
	14.6	11.6	20.6	22.1	1,160	70	1.2
	14.9	10.8	27.1	23.0	1,400	200	3.3
1919	7.6	4.3	15.4	100	6,840	2,330	38.8
	13.0	6.7	48.3	100	5,860	1,940	32.3
	19.6	9.6	51.2	100	5,700	1,970	32.8
	21.9	10.9	50.0	100	5,160	1,780	29.7
	37.4	16.4	55.1	100	4,160	1,530	25.5
	38.7	15.2	60.7	100	4,300	1,560	26.0

The tendency to produce suckers changed with the stand and with the season, the percentages usually increasing as the stands decreased. In 1915 the proportion of suckers ranged from 32.7 per cent in the

6-inch spacing to 65.3 per cent in the 18-inch spacing. The maximum, 72.7 per cent, was produced in 1917 from a stand of 32.7 inches of row space to the plant. A low percentage of suckers was produced by all rates of seeding in 1918.

The number of stalks bearing heads varies widely between the spacings in some seasons. The number or percentage of headed stalks usually increases as the stands decrease. This is especially true for the poor seasons of 1916, 1917, and 1918.

The best total crop yields were produced in 1915, and the poorest in 1918. The highest yield, 11,710 pounds, was from the 6-inch spacing in 1915; and the lowest, 1,080 pounds, from the 12-inch spacing in 1918. The highest grain yield does not always accompany the highest total crop yield. Seasonal conditions at and following heading largely govern the grain yield. Favorable seasons are conducive to high grain yields from thick stands, while thin stands have the advantage in unfavorable seasons. In the favorable season of 1915 the highest grain yield was from a stand having 8.8 inches of row space to the plant. In the poor seasons of 1916, 1917, and 1918 the highest yields were produced by stands with 6 to 7 inches of row space to the plant. A study of the average yields for a series of years is essential to determine the rate which will give the best results under average conditions. These are presented in Table XVI.

TABLE XVI.—*Annual and average yields of Dawn kafir in rows spaced 3½ feet apart in the spacing experiments at the Amarilla Cereal Field Station during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 60 pounds.]

Row space per plant.	Yields per acre.						Average yields per acre.				
	1914	1915	1916	1917	1918	1919	3 years, 1915, 1917, and 1919.	4 years, 1915 to 1918.	5 years, 1914, 1915, and 1917 to 1919.	5 years, 1914 to 1916, 1918, 1919.	6 years, 1914 to 1919.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
6 to 7 inches	8.7	60.2	1.0	14.8	0.7	38.8	37.9	19.2	24.6	21.9	20.7
8 to 10 inches	18.5	69.0	......	12.2	1.8	25.4	35.5	....	25.4	....	....
11 to 13 inches	18.7	68.3	5.8	......	.7	32.3	....	....	....	25.2	....
15 to 19 inches	19.0	62.7	3.8	17.8	3.3	32.8	37.8	21.9	27.1	24.3	23.2
21 to 26 inches	......	55.5	......	26.8	......	29.7	37.3	....	....	....	....

The annual and average acre yields from the six spacings are shown in Table XVI. The first or thick rate has a stand in the different years with 6 to 7 inches of row space to the plant. The second rate has a stand with 8 to 10 inches of row space to the plant. This rate is omitted in 1916, and the 11 to 12 inch stand is missing in 1917. The 15 to 19 inch stand continued through the 6-year period, but the 21 to 26 inch stand obtains only in three years. In order to get comparisons of all rates it is necessary to strike averages for a 3-year, a 4-year, two 5-year, and a 6-year period. In the 3-year average, which includes two good seasons and one poor one, there is practically no difference in the average yields from the first, fourth, and fifth rates. In the 4-year period, which includes two rates only, the average yield is in favor of the 15 to 19 inch spacing. This same rate leads in the first 5-year period, but is exceeded by the 11 to 13 inch spacing in the second 5-year period. In the 6-year average, which includes only two rates, the 15 to 19 inch spacing again has first place. These results indicate that under such conditions a stand with about 15 inches of row space to the plant is probably the safest rate.

TABLE XVII.—*Data recorded in the spacing experiments with Dawn kafir grown in rows spaced 7 feet apart at the Amarillo Cereal Field Station during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 60 pounds.]

Year.	Row space.		Suckers.	Headed.	Yields per acre.		
	Plants.	Stalks.			Total crop.	Grain.	
	Inches.	*Inches.*	*Per cent.*	*Per cent.*	*Pounds.*	*Pounds.*	*Bushels.*
1914	5.8	4.6	21.0	96.8	4,300	1,500	25.0
	6.6	4.6	31.1	88.4	4,120	1,410	23.5
	6.7	4.9	26.5	86.5	3,480	1,140	10.0
	7.7	5.2	32.1	92.7	3,600	1,170	19.5
	8.5	5.8	31.3	92.7	3,320	1,090	18.2
	8.8	4.9	44.5	86.9	4,140	1,490	24.8
1915	3.0	2.6	11.5	96.6	8,500	2,860	47.7
	4.4	3.0	32.6	92.7	8,170	2,880	48.0
	5.9	3.4	43.0	93.3	8,290	2,980	49.7
	7.5	4.4	40.5	90.5	7,370	2,830	47.2
	9.5	4.9	48.2	93.9	6,770	2,630	43.8
	10.4	5.1	51.2	97.5	6,450	2,450	40.8
1916	2.0	1.9	9.2	19.7	1,660	100	1.7
	3.9	2.6	31.2	54.1	3,360	510	8.5
	6.0	4.0	33.4	79.5	3,120	640	10.7
	8.6	5.1	40.3	60.8	1,920	320	5.3
	13.0	6.6	50.0	72.6	1,940	370	6.2
	20.5	9.2	55.3	89.3	2,440	650	10.8
1917	3.3	2.8	14.7	86.4	4,640	1,060	17.7
	4.7	3.1	35.0	82.1	5,020	1,300	21.7
	7.8	3.8	51.2	85.5	5,700	2,030	33.8
	12.7	4.8	62.3	89.8	4,840	1,530	25.5
	15.8	5.4	65.7	90.8	4,420	1,400	23.3
	32.9	9.3	65.7	94.2	3,480	1,220	20.3
1918	1.5	1.5	0.0	15.4	1,440	120	2.0
	3.0	2.9	3.3	18.0	1,060	115	1.9
	4.5	4.2	7.5	36.6	940	180	3.0
	6.0	5.5	9.0	28.0	640	70	1.2
	7.6	6.4	15.5	50.4	900	180	3.0
	15.6	11.6	26.1	66.5	1,240	70	1.2
1919	4.3	3.0	29.5	100	6,400	2,225	37.1
	5.9	4.4	24.7	100	5,225	1,888	31.5
	9.5	6.3	33.8	100	4,600	1,640	27.3
	12.3	7.8	36.5	100	4,020	1,420	23.7
	21.0	9.9	52.6	100	3,340	1,200	20.0
	47.1	18.7	60.2	100	2,000	713	11.9

SECOND SECTION, ROWS 7 FEET APART.

Table XVII shows the data recorded with Dawn kafir in rows spaced 7 feet apart (fig. 11) in the spacing experiments. In this section, as in the first, six plats were seeded each year, representing as many different rates. The stands obtained from the same rate were not the same in all years. The stands in the thick rate range from about 2 to 5 inches of row space to the plant in the different years, while the thinner stands in some years have a much wider range.

The various spacings between plants in rows 7 feet apart have an influence on suckering similar to those in rows 3½ feet apart, the percentage increasing as the stand decreases. In 1918 the thick stand produced no suckers, but the percentage increased in the thinner rates up to 26 per cent in the 15-inch stand. The percentage of suckers was much higher in other years, but it usually showed the same general trend between the thin and thick rates.

The good seasons show a high percentage of stalks bearing heads, but in these seasons, as in the poor ones, the thinner plantings show a higher percentage than the thicker ones. The lowest percentage in all the rates was produced in 1918 and the highest in 1919.

The total crop yields in the 7-foot rows do not run as high as in the corresponding spacings with the rows spaced 3½ feet apart. The highest total crop yield, 8,500 pounds, in this 6-year period, was made by the 3-inch spacing in 1915, and the lowest by the 6-inch spacing in 1918. The high grain yields do not in all cases follow the high total crop yields. In 1915 the spacing that ranked second in total crop yield had first place in grain yield. In 1916 and 1918 the spacings given third place in total crop yield took first place in grain yields. The grain yields were higher from all rates in 1915 than in any other year.

TABLE XVIII.—*Annual and average yields of Dawn kafir in rows spaced 7 feet apart in the spacing experiments at the Amarillo Cereal Field Station during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 60 pounds.]

Row space per plant.	Annual yields per acre.						Average yields per acre.			
	1914	1915	1916	1917	1918	1919	4 years, 1915 to 1918.	5 years, 1914 to 1916, 1918, 1919.	5 years, 1915 to 1919.	6 years, 1914 to 1919.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
2 to 3 inches	....	47.7	1.7	17.7	1.9	....	17.3	....	....	....
4 to 5 inches	25.0	48.0	8.5	21.7	3.0	37.1	20.3	24.3	23.7	23.9
6 inches	23.5	49.7	10.7	....	1.2	31.5	....	23.3	....	....
8 to 9 inches	18.2	43.8	5.3	33.8	3.0	27.3	21.5	19.5	22.6	21.9
10 to 15 inches	....	40.8	6.2	25.5	1.2	23.7	18.4	....	19.5	....

Table XVIII shows the annual and average acre yields in bushels of 60 pounds each for five rates in part or all of the 6-year period from 1914 to 1919, inclusive. The thick rate had a stand ranging from 2 to 3 inches of row space to the plant in the four years for which data are shown. The second rate, with 4 to 5 inches of row space to the plant, was obtained each year. The 6-inch rate is missing in 1918, and the 10 to 15 inch rate was omitted in 1914. In the 4-year period, which includes four rates, the average is in favor of the 8 to 9 inch rate, but in the two 5-year periods and one 6-year period it favors the 6-inch rate. This indicates that 6 inches of row space to the plant in rows spaced 7 feet apart is probably the best rate.

COMPARATIVE YIELDS FROM 3½-FOOT AND 7-FOOT ROWS.

Table XIX shows the annual and average acre yields of Dawn kafir in 3½-foot and in 7-foot rows in the spacing experiments, so that comparisons between the spacings may be easily made.

TABLE XIX.—*Annual and average yields of Dawn kafir in the spacing experiments at the Amarillo Cereal Field Station during the 6-year period from 1914 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 60 pounds.]

Approximate number of plants per acre.	Space between rows.	Row space per plant.	Annual yields per acre.						Average yields per acre.					
			1914	1915	1916	1917	1918	1919	3 years, 1915, 1917, and 1919.	4 years, 1915 to 1918.	5 years, 1914 to 1916, 1918, 1919.	5 years, 1914, 1915, 1917 to 1919.	5 years, 1915 to 1919.	6 years, 1914 to 1919.
	Feet.	*Inches.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Group A, 24,000	3½	6–7	8.7	60.2	1.0	14.8	0.7	38.8	37.9	19.2	21.9	24.6	23.1	20.7
plants	7	2–3	.....	47.7	1.7	17.7	1.9	.....	.....	17.3	.....	.....	.....	.....
Group B, 18,000	3½	8–10	18.5	69.0	.....	12.2	1.8	25.4	35.5	.....	.....	25.4	.....	.....
plants	7	4–5	25.0	48.0	8.5	21.7	3.0	37.1	35.6	20.3	24.3	27.0	23.7	23.9
Group C, 12,500	3½	11–13	18.7	68.3	5.8	.....	.7	32.3	.....	.....	25.2	.....	.....	.....
plants	7	6	23.5	49.7	10.7	.....	1.2	31.5	.....	.....	23.3	.....	.....	.....
Group D, 9,000	3½	15–19	19.0	62.7	3.8	17.8	3.3	32.8	37.8	21.9	24.3	27.1	24 1	23.2
plants	7	8–9	18.2	43.8	5.3	33.8	3.0	27.3	37.7	21.5	19.5	25.2	22.6	21.9
Group E, 7,000	3½	21–26	.....	55.5	.....	26.8	.....	29.7	37.3	.....	.....	.....	.....	.....
plants	7	10–15	.....	40.8	6.2	25.5	1.2	23.7	30.0	18.4	.....	.....	19.5	.....

Group A represents a rate of 6 to 7 inches of row space to the plant in rows 3½ feet apart and 2 to 3 inches where the rows are 7 feet apart, or an average of approximately 24,000 plants to the acre. At this rate the methods are comparable in only four years, and in that period the average yield is in favor of the rows 3½ feet apart.

Group B has a stand of 8 to 10 inches in rows 3½ feet apart and its equivalent in rows 7 feet apart, or approximately 18,000 plants to the acre. This rate shows a small difference in the average yields in favor of rows spaced 7 feet apart in the 3-year and the 5-year periods for which averages are possible.

Group C has a plant space of 11 to 13 inches in rows spaced 3½ feet apart and of 6 inches in rows spaced 7 feet apart, or an average of approximately 12,500 plants to the acre. These rates were obtained in only five years and in that period the average yield is in favor of the rows spaced 3½ feet apart.

Group D represents a stand of 15 to 19 inches of row space to the plant where the rows are spaced 3½ feet apart, and 8 to 9 inches with the rows spaced 7 feet apart, or approximately 9,000 plants to the acre. This rate continued through the 6-year period from 1914 to 1919, inclusive. Averages are made for a 3-year period, a 4-year period, three 5-year periods, and a 6-year period. The average yields are approximately the same for both methods in the 3-year and 4-year periods. In the three 5-year periods and the 6-year period the average yields are in favor of rows 3½ feet apart.

Group E shows a stand of 21 to 26 inches of row space to the plant in rows spaced 3½ feet apart and 10 to 15 inches where the rows are spaced 7 feet apart, or an average of approximately 7,000 plants to the acre. This rate was obtained in three years in the 3½-foot rows and in five years in the 7-foot rows. The average yield for this rate in the three years 1915, 1917, and 1919 is decidedly in favor of the rows spaced 3½ feet apart.

These data show that in favorable seasons, such as 1915 and 1919, the rows spaced 3½ feet apart produced a higher yield in all rates with one exception than where the rows were 7 feet apart; but in the poor seasons of 1916, 1917, and 1918 the high yields are from the 7-foot rows in practically all cases. This tends to show that the method with rows spaced 7 feet apart is a surer way to grow a grain crop in localities which are likely to have unfavorable seasons. The 6-year average yields indicate that a row space of 8 to 9 inches to the plant is the best rate when the rows are spaced 7 feet apart.

ENVIRONMENTAL EXPERIMENTS.

Environmental experiments were conducted at the Cereal Field Station, Amarillo, Tex., at the Plant Introduction Field Station, Chico, Calif., and at Arlington Experimental Farm, Rosslyn, Va., the objects of which were to determine the effect of different climatic conditions on plant growth and on chemical composition and to determine the comparative productivity of home-grown and imported seed.

These experiments included three of the best commercial varieties, viz, Dwarf milo (C. I. No. 332), feterita (C. I. No. 182), and Dawn kafir (C. I. No. 340). In 1913 all varieties were grown at the Cereal Field Station, Amarillo, Tex. Seed from that crop was sent to the other points for sowing in 1914. Beginning with the 1914 crop seed was exchanged between all three points each year for sowing the following season. It was not practicable to get yield data on the crop at either the Plant Introduction Field Station or at the Arlington Experimental Farm, owing to the eating of a large percentage of the immature kernels by birds. The damage from that source at these points was so great that enough seed for chemical analysis and for sowing the next season could be obtained only by protecting a number of the heads with paper bags.

Table XX.—*Agronomic data recorded in the environmental experiments with grain sorghums grown at the Amarillo Cereal Field Station during the 5-year period from 1915 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 60 pounds for kafir and at 58 pounds for other sorghums.]

Year, variety, and source of seed.	Row space.		Suckers.	Erect heads.	Headed.	Yields per acre.		
	Plants.	Stalks.				Total crop.	Grain.	
1915.								
Dwarf milo:	*Inches.*	*Inches.*	*Per cent.*	*Per cent.*	*Per cent.*	*Pounds.*	*Pounds.*	*Bushels.*
Amarillo, Tex....	7.2	3.3	54.1	73.0	....	10,220	3,580	61.7
Arlington, Va....	7.2	3.3	54.1	80.8	....	9,180	3,780	65.2
Feterita:								
Amarillo, Tex....	10.6	3.8	64.2	....	97.4	7,680	2,720	46.9
Arlington, Va....	10.6	3.9	63.4	....	95.2	10,400	2,820	48.6
Dawn kafir:								
Amarillo, Tex....	8.0	4.6	42.5	....	100	11,380	3,220	53.7
Arlington, Va....	8.0	4.5	43.3	....	97.8	11,680	3,500	58.3
1916.								
Dwarf milo:								
Amarillo, Tex....	11.3	5.1	55.1	97.0	....	1,090	160	2.8
Arlington, Va....	11.3	5.6	50.5	98.9	....	800	170	2.9
Chico, Calif.......	11.3	5.1	55.1	100	....	760	130	2.3
Feterita:								
Amarillo, Tex....	14.8	6.3	57.3	....	13.6	1,050	270	4.7
Arlington, Va....	14.7	5.2	64.1	....	43.2	2,716	916	15.8
Chico, Calif.......	14.8	5.5	63.7	....	46.5	2,370	860	14.8
Dawn kafir:								
Amarillo, Tex....	10.8	4.7	55.9	....	47.1	3,740	340	5.7
Arlington, Va....	10.7	5.1	52.5	....	52.7	4,000	370	6.2
Chico, Calif.......	10.8	5.3	50.7	....	50.7	3,460	320	5.3
1917.								
Dwarf milo:								
Amarillo, Tex....	12.5	4.2	66.4	81.6	....	6,400	1,720	29.7
Arlington, Va....	12.5	4.2	66.4	76.9	....	5,400	1,560	26.9
Chico, Calif.......	12.5	4.0	68.8	96.1	....	4,840	1,320	22.8
Feterita:								
Amarillo, Tex....	19.4	5.0	74.1	....	....	5,750	1,080	18.6
Arlington, Va....	23.6	5.7	75.7	....	....	4,640	1,000	17.2
Chico, Calif.......	22.9	5.6	82.8	....	....	4,000	980	16.9
Dawn kafir:								
Amarillo, Tex....	26.4	7.2	72.8	....	91.4	7,640	1,400	26.7
Arlington, Va....	26.4	5.6	78.9	....	83.4	5,240	1,740	29.0
Chico, Calif.......	26.4	5.1	80.5	....	79.8	5,720	1,180	19.7
1918.								
Dwarf milo:								
Amarillo, Tex....	14.8	9.9	32.9	87.3	....	920	280	4.8
Arlington, Va....	15.0	10.7	29.0	91.5	....	1,400	380	6.6
Feterita:								
Amarillo, Tex....	10.7	7.1	33.5	....	71.2	1,240	180	3.1
Arlington, Va....	10.3	7.4	28.2	....	65.4	840	240	4.1
Dawn kafir:								
Amarillo, Tex....	16.1	12.5	22.1	....	27.0	1,400	80	1.3
Arlington, Va....	16.2	13.7	15.5	....	44.3	1,160	120	2.0
1919.								
Dwarf milo:								
Amarillo, Tex....	10.4	4.4	57.6	100	....	6,000	2,900	50.0
Arlington, Va....	12.9	4.8	62.1	100	....	5,200	2,700	46.6
Chico, Calif.......	8.5	3.9	53.4	100	....	5,520	2,600	44.3
Feterita:								
Amarillo, Tex....	44.8	10.8	75.3	....	100	3,760	1,580	27.2
Arlington, Va....	28.6	7.8	73.1	....	100	4,800	2,040	35.1
Chico, Calif.......	13.4	4.3	68.1	....	100	5,920	2,600	44.8
Dawn kafir:								
Amarillo, Tex....	33.1	11.6	65.2	....	100	4,400	1,560	26.0
Arlington, Va....	20.1	7.9	60.5	....	100	5,600	1,860	31.0
Chico, Calif.......	10.4	5.0	51.9	....	100	6,800	2,240	37.3

AGRONOMIC DATA.

Table XX shows the agronomic data recorded for the environmental experiments conducted at the Cereal Field Station, Amarillo, Tex., in the 5-year period from 1915 to 1919, inclusive. In 1915 and again in 1918 no crop from seed from Chico, Calif., was grown. For each variety the data recorded are from seed continuously grown at Amarillo in comparison with that from seed grown at the other points. The stands in all plats of the same variety were made comparable by hand thinning each year except in 1919, which eliminated whatever influence unequal stands might have had on the crop.

The data recorded for suckers and erect heads in Dwarf milo and headed stalks in the other varieties generally do not show any striking differences in the same year. However, in the 1916 crop, feterita from the Amarillo seed is somewhat lower in the percentage of suckers and considerably below the others in percentage of stalks bearing heads.

The yields of the same variety are fairly close in the same year. The seed from the same source did not make the highest yield in all years.

TABLE XXI.—*Annual and average yields of grain sorghums grown in the environmental experiments at the Amarillo Cereal Field Station during the 5-year period from 1915 to 1919, inclusive.*

[In the statement of yields per acre the bushel is rated at 60 pounds for kafir and at 58 pounds for other sorghums.]

Variety and source of seed.	Annual yields per acre.					Average yields per acre.	
	1915	1916	1917	1918	1919	3 years, 1916, 1917, and 1919.	6 years, 1915 to 1919.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dwarf milo:							
Amarillo, Tex	61.7	2.8	29.7	4.8	50.0	27.5	29.8
Arlington, Va	65.2	2.9	26.9	6.6	46.6	25.5	29.6
Chico, Calif	....	2.3	22.8	....	44.8	23.3	....
Feterita:							
Amarillo, Tex	46.9	4.7	18.6	3.1	27.2	16.8	20.1
Arlington, Va	48.6	15.8	17.2	4.1	35.1	22.7	24.2
Chico, Calif	....	14.8	16.9	....	44.8	25.5	....
Dawn kafir:							
Amarillo, Tex	53.7	5.7	26.7	1.3	26.0	19.5	22.7
Arlington, Va	58.3	6.2	29.0	2.0	31.0	22.1	25.3
Chico, Calif	....	5.3	19.7	....	37.3	20.8	....

The annual and average acre yields recorded in Table XXI show that Dwarf milo from Amarillo seed yielded highest in 1917 and 1919, and from the Arlington seed in 1915, 1916, and 1918. The 3-year average yield favors the home-grown seed, but the 5-year average yield shows no difference between that and the seed grown at the Arlington Experimental Farm.

Feterita made the high yield from home-grown seed in only one year; from seed grown at the Arlington Experimental Farm, Va., in three years; and from seed grown at Chico, Calif., in one year. In the 3-year average yield, plats from Chico seed take first place and from the home-grown seed third place. In the 5-year average yield the plat from home-grown seed is lowest.

Dawn kafir produced less favorable results from home-grown seed than either of the other varieties. It made the best yield each year from seed grown elsewhere. The crop grown from Arlington seed leads in both the 3-year and the 5-year periods.

These data tend to show that the source of the seed has little influence on the yield of the resulting crop when grown at the Amarillo Cereal Field Station.

CHEMICAL COMPOSITION.

Samples of the grain produced in the environmental experiments with Dwarf milo, feterita, and Dawn kafir were analyzed by the Plant Chemical Laboratory of the Bureau of Chemistry. The percentages of water, ash, protein, fat, and fiber were determined, as were the weight of 1,000 kernels and the weight per bushel. Seed grown at Chico, Calif., was not available for sowing at any of the three stations in 1915, while the crop at Chico in 1917 was a total failure, except that enough seed was produced for resowing there in 1918. Analyses are presented from seed grown at the Arlington Experimental Farm, Rosslyn, Va., and at the Cereal Field Station, Amarillo, Tex., from Arlington and Amarillo seed in each of the five years, and at these two stations from Chico seed in 1916, 1917, and 1919. The figures on crops grown at Chico from Arlington and Amarillo seed are for 1915, 1916, 1918, and 1919, and from Chico seed in 1916, 1918, and 1919 only. These data are shown in Table XXII.

In Table XXII the chemical data on environmental experiments are summarized, the data being combined in two ways. The average data shown are first combined by stations at which the crop was grown and then by sources from which the seed was obtained. Thus the average figures on Dwarf milo are given for all the crops grown at the Arlington Experimental Farm, Va., from all three sources, then those grown at Amarillo, Tex., and then those grown at Chico, Calif. Following these, averages are given for all the crops grown at the three stations from seed produced at Arlington, at Amarillo, and at Chico. Similar data are given for feterita and Dawn kafir.

TABLE XXII.—*Average composition and weight of sorghum grains grown in the environmental experiments at three stations in Virginia, Texas, and California, in three or more of the five years from 1915 to 1919, inclusive.*

Crop and place of growth.	Seed from—	Years.	Composition. Water.	Composition. Ash.	Composition. Protein (N. × 6.25).	Composition. Fat.	Composition. Fiber.	Weight. 1,000 kernels.	Weight. Bushel.
			Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Pounds.*
Dwarf milo:									
Arlington, Va.	Rosslyn, Va.	1915–19	9.71	1.74	10.36	3.00	1.74	36.9	58.0
Do.	Amarillo, Tex.	1915–19	9.61	1.73	10.62	3.06	1.67	33.8	[a] 57.4
Do.	Chico, Calif.	1916–17, 1919	8.77	1.74	10.41	3.03	1.57	34.8	58.8
Amarillo, Tex.	Rosslyn, Va.	1915–19	8.56	1.64	13.45	3.32	1.71	32.0	58.6
Do.	Amarillo, Tex.	1915–19	8.77	1.62	13.39	3.25	1.71	32.0	58.3
Do.	Chico, Calif.	1916–17, 1919	7.81	1.68	13.52	3.72	1.69	33.2	60.3
Chico, Calif.	Rosslyn, Va.	1915–16, 1918–19	8.88	1.61	9.86	3.36	1.62	37.3	59.1
Do.	Amarillo, Tex.	1915–16, 1918–19	9.04	1.56	10.32	3.52	1.61	37.3	59.5
Do.	Chico, Calif.	1916, 1918–19	8.45	1.58	11.75	3.60	1.85	37.4	59.2
Feterita:									
Arlington, Va.	Rosslyn, Va.	1915–19	10.03	1.63	11.30	2.94	1.48	41.3	59.2
Do.	Amarillo, Tex.	1915–19	9.63	1.64	11.13	2.89	1.40	40.9	57.9
Do.	Chico, Calif.	1916–17, 1919	8.78	1.60	10.63	2.82	1.45	40.8	59.2
Amarillo, Tex.	Rosslyn, Va.	1915–19	8.93	1.63	14.32	3.09	1.67	35.3	[a] 56.6
Do.	Amarillo, Tex.	1915–19	8.81	1.65	14.35	3.10	1.74	34.7	[a] 56.2
Do.	Chico, Calif.	1916–17, 1919	8.30	1.55	14.35	3.20	1.64	36.8	58.0
Chico, Calif.	Rosslyn, Va.	1915–16, 1918–19	9.43	1.55	10.73	3.17	1.49	38.3	58.9
Do.	Amarillo, Tex.	1915–16, 1918–19	8.83	1.55	11.34	3.30	1.50	40.6	59.2
Do.	Chico, Calif.	1916, 1918–19	8.89	1.60	11.55	3.38	1.77	35.6	58.3
Dawn kafir:									
Arlington, Va.	Rosslyn, Va.	1915–19	9.68	1.57	11.25	3.38	1.53	22.6	[a] 60.7
Do.	Amarillo, Tex.	1915–19	9.93	1.59	10.92	3.25	1.55	22.9	60.3
Do.	Chico, Calif.	1916–17, 1919	9.00	1.61	10.60	3.45	1.61	22.0	60.8
Amarillo, Tex.	Rosslyn, Va.	1915–19	9.06	1.72	12.92	3.36	1.82	18.9	[a] 58.8
Do.	Amarillo, Tex.	1915–19	8.59	1.81	13.15	3.35	1.83	19.1	58.4
Do.	Chico, Calif.	1916–17, 1919	8.22	1.74	13.33	3.48	1.92	17.9	[a] 56.6
Chico, Calif.	Rosslyn, Va.	1915–16, 1918–19	8.83	1.64	10.89	3.52	1.68	20.0	59.4
Do.	Amarillo, Tex.	1915–16, 1918–19	9.23	1.56	10.83	3.35	1.69	20.9	59.9
Do.	Chico, Calif.	1916, 1918–19	9.01	1.54	11.27	3.66	1.79	20.5	58.7

SUMMARY.

Crop and place of growth.	Seed from—	Years.	Water.	Ash.	Protein (N. × 6.25).	Fat.	Fiber.	1,000 kernels.	Bushel.
Dwarf milo:									
Rosslyn, Va.	3 stations	13	9.46	1.73	10.47	3.03	1.67	35.2	[b] 57.7
Amarillo, Tex.	do	13	8.47	1.64	13.45	3.39	1.71	32.3	58.9
Chico, Calif.	do	11	8.82	1.59	10.54	3.48	1.68	37.3	59.3
3 stations	Rosslyn, Va.	14	9.06	1.67	11.32	3.22	1.70	35.3	58.4
Do.	Amarillo, Tex.	14	9.15	1.64	11.53	3.26	1.67	34.2	[b] 58.4
Do.	Chico, Calif.	9	8.34	1.66	11.90	3.45	1.70	35.1	59.4
Feterita:									
Rosslyn, Va.	3 stations	13	9.58	1.63	11.08	2.89	1.44	41.0	58.7
Amarillo, Tex.	do	13	8.74	1.62	14.34	3.12	1.69	35.4	[b] 56.8
Chico, Calif.	do	11	9.06	1.57	11.18	3.27	1.57	38.4	58.8
3 stations	Rosslyn, Va.	14	9.47	1.61	12.22	3.06	1.55	38.3	[c] 58.3
Do.	Amarillo, Tex.	14	9.11	1.62	12.34	3.08	1.55	38.6	[c] 57.8
Do.	Chico, Calif.	9	8.66	1.58	12.18	3.13	1.62	37.7	58.5
Dawn kafir:									
Rosslyn, Va.	3 stations	13	9.62	1.59	10.97	3.35	1.56	22.6	[c] 60.6
Amarillo, Tex.	do	13	8.69	1.76	13.10	3.38	1.85	18.7	[d] 58.2
Chico, Calif.	do	11	9.02	1.58	10.97	3.50	1.71	20.5	59.4
3 stations	Rosslyn, Va.	14	9.22	1.64	11.74	3.41	1.68	20.5	[c] 59.6
Do.	Amarillo, Tex.	14	9.25	1.66	11.69	3.31	1.69	21.0	59.5
Do.	Chico, Calif.	9	8.74	1.63	11.73	3.53	1.77	20.1	[e] 59.0

[a] Data for 1917 not included. [b] Twelve years only. [c] Thirteen years only. [d] Eleven years only. [e] Eight years only.

Table XXII shows that the conditions under which the crop is grown have much more effect on its composition than the source from which the seed is obtained. For instance, Dwarf milo grown at the Arlington Experimental Farm, Rosslyn, Va., during the five years from 1915 to 1919, inclusive, shows only very slight variation in chemical composition from seed produced the previous year at Arlington and at Amarillo. Results are available from crops grown at Arlington from Chico seed in only three of the five years, and this naturally causes some variation from the averages of the crops grown from Arlington and Amarillo seed, but in general the composition is practically the same. In the same way milo grown at Amarillo from seed from each of the three points is very similar in composition, but is lower in water content and in ash and considerably higher in protein and fat than milo grown from the same seed at Arlington. Milo grown at Chico from seed from the three sources shows rather more variation than that grown at Arlington and Amarillo. The grain grown at Chico shows a slightly higher water content than that grown at Amarillo, but considerably less than that grown at Arlington. The ash and protein content of the Chico milo is less than that grown at Arlington and decidedly less than that grown at Amarillo. Milo grown at Chico has about the same percentage of fat as that grown at Amarillo and is slightly lower in fiber.

In general, the same observations may be made with regard to feterita and Dawn kafir grown at the three stations. The variation between crops grown from the same seed at the three stations is greater than that between crops grown at any one of the stations from seed from the three sources. The moisture content of the seed grown at Chico is intermediate between that grown at Amarillo and at Arlington. The Amarillo seed is materially higher in protein in each case, and is also higher in fiber. The variations in ash and fat are not marked.

SUMMARY.

The data on the date of seeding, spacing, and environmental experiments with grain sorghums, as presented in this bulletin, may be summarized briefly as follows:

(1) The yields are influenced by seasonal conditions to such an extent that no one date of seeding is best for all years. The average yield in a series of years is the one safe basis for practice.

(2) All the varieties did not give the highest average yield from the same date of seeding. Some yield better from early seeding than others.

(3) Dwarf milo produced the best average yields from sowing on the normal date, about May 23; Dawn kafir from the early date, May 10; and feterita and Manchu kaoliang from the late date, about June 10.

(4) In the 6-year period from 1914 to 1919, inclusive, Dwarf milo in rows spaced 3½ feet apart, made the highest average yield, 30.8 bushels, with 12 inches of row space to the plant. In rows spaced 7 feet apart during this same period, the highest average yield, 33.2 bushels, was made by the plants spaced from 8 to 12 inches apart in the row.

(5) The rows spaced 7 feet apart with 6 inches of row space to the plant averaged 32.8 bushels per acre in this 6-year period, which is 2 bushels more than was made by the corresponding rate in rows spaced 3½ feet apart, and practically the same average yield as obtained from the 8 to 12-inch spacing.

(6) Spacing the rows 7 feet apart is a slightly surer way to grow a grain crop than spacing them 3½ feet apart, but the latter method will produce a higher average total crop yield.

(7) Dawn kafir produces the highest average yields from plants with 15 to 19 inches of row space in rows spaced 3½ feet apart, and from plants with 4 to 5 inches of row space where the rows are spaced 7 feet apart. The 6-year average yields from these rates were 23.2 and 23.9 bushels, respectively.

(8) Dwarf milo seed grown at the Arlington Experimental Farm, Va., produced as high yields and a crop otherwise as good at Amarillo, Tex., as home-grown seed.

(9) Feterita seed grown at the Arlington Experimental Farm, Va., and sent to Amarillo, Tex., averaged 4 bushels more than the home-grown seed in the 6-year period from 1914 to 1919, inclusive, and Dawn kafir from the same source averaged 2.6 bushels higher in this same period.

(10) The yield data presented from all the experiments show conclusively that Dwarf milo is by far the better variety to grow under conditions such as those at the Cereal Field Station, Amarillo, Tex.

(11) In the environmental experiments in which Dwarf milo, feterita, and Dawn kafir were grown for several years at the Arlington Experimental Farm, Va., Amarillo, Tex., and Chico, Calif., from seed produced at each of the three stations, it was shown that the source of seed had practically no influence on the growth of the crop and on yield. Chemical analyses of samples from these crops showed that environmental conditions, such as soil and climate, had much more influence on the chemical composition of grain-sorghum seed than did the sources of the seed from which the crop was grown.

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MARKETING HAY AT COUNTRY POINTS.

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CONTENTS.

Ever since hay has been marketed extensively the hay trade has constantly wrestled with the vexing problem of what to do with low-grade hay—that is, hay that has been improperly prepared or is of a mixture that causes it to be regarded as of a low grade. Such hay is hard to dispose of. Indeed, so serious has this perplexing problem become that at present the only solution has seemed to lie in keeping this kind of hay entirely off the market.

Since this trouble has been in existence for years, it might be supposed the producer had made an effort to correct a practice which is causing him a loss of thousands of dollars annually. That he has not done so is due to two important facts: (1) The producer and the dealers do not as yet agree as to what constitutes quality in hay, and (2) many producers lack vital market information regarding the preparation of hay for terminal and consuming markets.

A recent and comprehensive survey of the important hay markets of the United States has revealed the rather striking fact that a large percentage of our present marketing difficulties originates on the farm, that a thorough knowledge of market requirements on the part of the producer would result in less low-grade hay, and that this would in turn solve in part at least the ever-present problem of what to do with low-grade hay. The purpose of this bulletin is to

53222°—21—Bull. 977——1

give briefly accurate information regarding the preparation and marketing of hay at country points.

EFFECT OF PRESENT METHODS OF PREPARATION.

Quality of hay is at present indicated largely by its color, which is used to gauge the stage of maturity at which it is cut. The hay that grades highest, and consequently brings the most money, is usually that having the best natural green color. Hay dealers can tell from the color whether hay was cut early, medium, or late, and in their opinion the best hay is the early cut hay and the poorest that cut late.

IMPORTANCE OF TIME OF CUTTING.

Early cut timothy means timothy cut just as the plant is coming into full bloom: medium-cut hay is hay cut just after full bloom: and late-cut hay is hay cut entirely after bloom or when the seed is formed or up to the time it is almost matured. The same rules apply to most of the other grass hays and somewhat to many of the legume hays.

The average hay grower, however, in some sections at least, does not agree with the terminal market theory of quality as indicated by color. Many producers prefer medium or late cut hay, especially for horses, because it is easier to cure and is not so "washy" as early cut hay.

Since this difference of opinion will probably exist for some time, it would seem highly advisable for the producer to meet the demands of the trade, in so far as he is able, by cutting hay intended for market at the time demanded by the market and by cutting hay for use on the farm or for the local market at a little later period. By so doing he would get more for his market hay and yet would have the kind wanted for his own use.[1]

There are a number of factors which tend to prevent hay from being cut at the proper time to make the highest quality of market hay. These relate to farm economics, such as the interference of competitive crops, the availability and use of labor, and improved hay-making machinery. Unfavorable weather during hay harvest is responsible for much improperly prepared hay in many parts of the tame-hay section.

Carefully conducted studies of methods of making hay and use of labor and equipment in many important hay-growing sections have shown that the average hay grower does not do the best he can in the matter of saving his hay crop. The Department of Agriculture is prepared to furnish detailed information regarding

[1] Recent investigations in hay standardization show that hay graded low on account of brown leaves only, in some instances, may be hay cut rather early or just as the plant is coming into bloom.

the best methods to use on individual farms in the more important hay-producing sections of the United States. (See list of haymaking bulletins on p. 28.)

IMPROPER CURING.

Present trade rules governing the grading of hay say that the better grades shall be *properly cured* and *sound*. This is another way of saying that only hay having a good or natural green color will bring top prices. The general quality of hay varies because of the influence of such factors as methods used and weather conditions.

Men in the hay trade claim that there has been a change in the methods of making hay in the eastern part of the timothy and clover section. This would seem to be borne out to some extent by the comparatively recent changes in trade rules or grades. A few years ago practically all sets of rules for grading hay contained a grade known as "choice" timothy. When this grade was in effect considerable "choice" timothy was marketed, but the quantity has gradually diminished and this grade has been eliminated by most trade organizations. The claim is made that there is such a small quantity of "choice" timothy that it is no longer necessary to retain this grade.

Country shippers in New York State say that when hay was cured in the cock there was plenty of "choice" hay, but since the side-delivery rake and the hay loader have come into extensive use "choice" hay has gradually disappeared. In fact, some shippers claim that they can detect hay handled with these implements as far as they can see it. In other words, they believe that the new method of curing does not produce so good a quality as the old method of curing in the cock. Complaint has also been made concerning the lowering of the quality of hay in other States where these implements are in general use. The trouble results not from the implements themselves, but from the way in which the side rake and loader are used. When hay was cured in the cock and was not cocked soon enough, it resulted in the same quality as is now obtained when the side rake is not used soon enough. If hay is raked as soon as it is well wilted and considerable curing is done in the windrow, a good quality of hay will result. If, however, the hay is permitted to cure entirely in the swath and the loader follows immediately behind the side rake, the chances are that the hay will have lost so much of its natural green color that it will not grade as "choice." This change has been brought about largely by the shortage in farm labor, and hay growers will have to learn how to use the side rake and loader most efficiently before they can expect to make good marketable hay.

There is a regional difference in the quality of hay brought about almost entirely by weather conditions. In certain parts of the Middle West and West there are sections where good hay is generally produced because of the almost ideal weather during the haymaking season. Consequently the average quality of the hay is far above that in a section where good haymaking weather is the exception rather than the rule. There are also variations in the general quality of hay within a given locality, caused by methods of curing. It has been found in some instances that one or two counties supply the larger portion of hay for a certain market, while other counties, perhaps nearer to market, are avoided by the city hay dealers. This means that producers in the one section have learned how to cure their hay to suit the demands of their market, while those in the adjoining section have failed so to prepare their hay and consequently there is no demand for it under normal conditions.

RED OR BROWN BLADES.

The most prevalent fault with improperly cured timothy hay is the presence of red or brown blades, sometimes accompanied by brown heads. Such blades are very noticeable, and hay containing such blades in any quantity—say 50 per cent—will not usually bring top market prices.

Red or brown blades are not always accompanied by many brown heads, because such heads usually occur only in late-cut hay, whereas red or brown blades may occur in hay cut in bloom.

It is not known how the actual nutritive value of brown timothy blades compares with that of natural green blades. If this were known it would undoubtedly throw considerable light on the actual value of different grades of market hay and might even effect a change in the demand for certain grades.

UNDERCURED OR HOT HAY.

Hay that reaches the market in the condition usually termed as "hot" is improperly cured. Such hay is usually baled from the swath, windrow, bunch, or cock. Producers are sometimes deceived by the appearance, especially if the leaves are dry, and believe that the hay is ready for baling and for marketing. "Hot" hay is regarded with suspicion by dealers and seldom brings a good price. Frequently "hot" hay sells for a low price, and after it has been "conditioned" by spreading out the bales in a warehouse until it is cool, it is resold at a good profit. But in such cases the producer or shipper sustains the same loss as if the hay could not be conditioned.

The liability of hay to arrive in the market hot is sometimes governed by the distance from market and the time in transit. Hay that probably would not heat when the haul is short and a comparatively short time elapses while in transit, might arrive in the market hot or even spoiled if kept a long time in transit. It will not pay the average producer or shipper to take any chances on having his hay arrive on the market in a heated condition, since there is no demand for this kind of hay.

STAINED AND BLEACHED HAY.

Stained hay is not wanted in any market. It is regarded as fit only for bedding, for feeders believe that stained hay is neither nourishing nor palatable. Producers do not give much thought to hay that is stained in spots when feeding it on the farm. They know that the animal will eat the good hay and leave the stained parts. The dealer and feeder, not knowing how much stained hay is contained in a bale, either refuse to purchase such hay at all or buy it at a price low enough to make ample allowances for the stained portion. This applies to all kinds of market hay, with the exception of alfalfa. The amount of bleached hay allowed in alfalfa is exceedingly small in the higher grades.

WET AND SNOWY HAY.

Hay wet either by rain or snow causes considerable trouble in markets. Most of the trouble occurs during the winter months, when hay containing snow is baled. During cold weather the hay will remain dry and many producers and shippers either overlook or ignore the snow when they ship the hay. When snowy hay reaches the South or when the weather turns warm the hay becomes wet and sometimes heats and becomes moldy.

In some parts of the South this phenomenon is called a second "heating" or sweating and dealers do not regard such hay as having been properly prepared. A legitimate business can not be built up or maintained if shippers continue to sell such hay as first-class, properly cured hay. The fact that shipper or producer failed to learn that snow was in the hay has led to endless trouble and loss of money.

MUSTY OR MOLDY HAY.

Musty or moldy hay is an indication of improper curing or of spoiling by rain or snow after it has been put into the barn or stack. Such hay is not palatable and is not very salable, because if any bad hay shows on the outside of the bale the feeder has no way of estimating the amount of bad hay there may be inside the bale. Unless hay is abnormally high in price, it is far better to feed moldy or musty hay on the farm rather than try to market it, especially on the terminal markets, where it may have to pass an official inspection.

FAULTY METHODS OF BALING.

In some markets size and weight of bales is an important factor, since there is sometimes a difference of several dollars a ton in the same grade of hay in small or large bales. In some sections producers could easily find out to what markets their hay is likely to be shipped. Then, whenever it is within their power to do so, they should have their hay properly baled with respect to size and weight of bale.

The reasons for the demand for certain sizes and weights are numerous and are not always based on facts. They will be discussed in a subsequent bulletin dealing with the marketing of hay in terminal markets.[2] In this matter the producer can easily afford to meet the demands of the market. The only exceptions would be when the proper-sized press could not be obtained or when the demand is for such small, light bales that the minimum weight could not be loaded into the ordinary sized box car. About the only way to overcome this exception would be to sell the hay " shipper's track."

If producers and country shippers could have the opportunity of following their hay to its final destination and observing the effect of improper baling, with respect to the number of broken bales and the amount of loose hay that occurs when hay is improperly baled, they would see that the loss caused by improper baling totals thousands of dollars annually.

Broken bales are caused by the improper placing of wires; in some instances, by the use of too few wires.[3] In some of the eastern markets two-wire bales do not bring so high a price as three-wire bales. Dealers say that they are tired of the loss sustained by two-wire bales. The only way they can induce producers to use three wires is by offering less for the two-wire hay than it is really worth as a feed, or by paying a premium for three-wire bales.

" ACCORDION " BALES.

" Accordion " bales are not in demand when properly baled hay is available. An " accordion " bale is one that will open out like an accordion when the wires are taken off and it is pulled from both ends. The charges are matted together and it is very difficult to separate the proper amount for feeding each animal. This kind of bale is caused either by overfeeding the press or by using a type of press that does not separate the charges or turn down the " overlap " at each stroke of the plunger.

Bales having sloping ends and ragged edges or improperly placed wires are classed, by present rules, as improperly baled. The pressing of improperly baled hay can be prevented only by the producer, because baled hay is in that small class of agricultural products which remains as prepared on the farm until consumed.

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[2] Collier, G. A., and McClure, H. B.: Marketing Hay Through Terminal Markets. U. S. Department of Agriculture, Bulletin 979.

[3] See McClure, H. B.: Baling hay. Farmers' Bulletin No.1049.

"SANDWICHED" HAY.

It is a waste of time, energy, and money to "sandwich" hay, especially if such hay is shipped to a terminal market, because the "sandwiching" is likely to be detected, and the shipper will have to stand a heavy discount. "Sandwiched" hay is hay that contains any stained, bleached, moldy, or rotten hay. The unintentional, careless sandwiching of hay is inexcusable even when the hay is baled by a custom presser, for the producer should be present and see that all unmarketable hay is cut out and thrown to one side. Shipping this kind of hay is often the cause of the shipper's failing to get a "repeat" order from his customer. In some markets dealers keep each other informed concerning shippers who ship such hay or attempt to perpetrate this or other sharp practices.

If hay is in such bad condition that it is not possible or feasible to prevent the baling of all of the bad hay, the best practice for the shipper is to invoice the hay for just what he knows it to be, stating the amount of sandwiching, so the receiver will know that the shipper is not trying to deceive.

It is not always possible for a shipper to load a car uniformly, and in such instances proper invoicing will enable the shipper to dispose of his sandwiched hay to good advantage and avoid entirely disputes and consequent losses.

PLACING THE RESPONSIBILITY FOR BAD BALING PRACTICES.

It is the unanimous opinion of the hay trade, in practically all parts of the country, that something should be done to put a stop to bad baling practices. "Sandwiching" and placing incorrect weights on tags fastened to bales are two practices that should be done away with, because these practices are responsible for a large percentage of disputes between shipper and receiver.

In many instances the shipper or producer-shipper is obliged to rely on the custom baler's weights, since wagon scales are not accessible. Incorrect tag weights are usually the result of carelessness or dishonesty on the part of the presser and producer-shipper.

Many in the hay business are in favor of licensing custom balers and making them responsible for tag weights and the prevention of "sandwiching" or "veneering" hay. In some States, for instance New York State, the department of weights and measures has done excellent work in bettering tag weights. The improvement was brought about by fines imposed on custom pressers. Usually after one fine the presser made sure that his weights were correct. In other States it has not been possible to follow this method to prevent this practice.

PRODUCTION OF UNDESIRABLE MIXTURES.

The production of undesirable mixtures for the market will cause a loss to the producer as long as the market does not want such mixtures. In other words, *certain mixtures are discriminated against regardless of their true nutritive or feeding value.* The producer may know positively that certain mixtures are palatable and contain more total digestible nutrients than the kinds now in greatest demand, yet he is powerless to make feeders realize their value.

The introduction and general use of a new kind or mixture of hay is a very slow, laborious undertaking. It has taken a long time to create a demand on the market for clover, even alsike clover, and it took even longer for alfalfa to find its proper place on the market as a feed for horses.

At present "grassy" hay is discriminated against very severely and is often referred to as "trash," yet the producer, in many instances, prefers this kind of hay to straight timothy. If such hay as redtop, properly cut and cured, and timothy, containing appreciable amounts of fine grasses, properly cut and cured, are generally found to be equal to or better than straight timothy, then the discrimination against them will gradually disappear. But this will take time, and until the true worth of such mixed hays is determined by actual feeding test it is folly for producers to continue to expect to get top prices for this kind of hay.

It is only when hay is very scarce and consequently high in price that certain kinds of "off-grade" hays are profitable to the producer. Good timothy with a mixture of perhaps 30 per cent of fine grasses having a natural green color, better than the timothy itself, has been graded as "sample" hay, which commands a very low price in comparison with that of timothy hay.

An undesirable mixture often causes considerable trouble. This trouble begins when the producer undertakes to dispose of it to the country shipper or to ship it himself. In the first place, to the producer it is first class or No. 1 hay, and in his opinion should command top prices. If he sells it to an experienced shipper, the price received will not be satisfactory to the producer, because he knows that it is perhaps excellent in color and is, to him, the best grade of hay. Under the circumstances he is likely not to believe the shipper when told that such hay is not No. 1, but is "sample" hay under present rules for grading. If the producer becomes suspicious, or is dissatisfied with the price offered by the shipper, and attempts to market it himself, he may think that the receiver is trying to deceive him when he claims that the hay is not of the grade called for in the contract. About the only way to avoid trouble with undesirable mixtures is for the producer to cease growing such hay and to produce only the kind in demand in the markets to which his hay is usually shipped.

MARKETING HAY AT COUNTRY POINTS.

It is not the purpose of this bulletin to advocate any particular method of marketing hay, such as selling to country shippers, shipping by producer direct to consumers or commission men, or selling through county agents. Present methods of marketing hay at country points as found by a survey covering practically the entire country will be discussed.

FUNCTION OF THE COUNTRY SHIPPER.

A reliable country shipper performs a real, definite service in many hay-growing sections. This is especially true in sections where the farms are comparatively small and hay is produced for the market in comparatively small amounts, from one-half up to 4 or 5 carloads. The country shipper renders a direct service by providing a cash market for the producer's hay. In fact, he does more than this, because he relieves the producer of all responsibility in finding a market for his particular grade of hay and the subsequent trouble that so often arises in the marketing. In other words, the farmer's risk is ended when he delivers his hay to the shipper's warehouse or the car. Then the shipper's risk begins and does not end until he receives his money for the hay, which may be several months or even a year later.

Marketing hay is often a hazardous undertaking, unless a number of conditions are right—a combination that is not likely to continue for any great length of time. In order to market hay successfully the shipper must have (1) sufficient capital to allow plenty of time for settlement; (2) a knowledge not only of the grades used, but how each grade is interpreted on each market or by each receiver not located in a terminal market; (3) a knowledge of the kind and grade of hay in demand in each of the markets to which he desires to ship; (4) a knowledge of the receiver's financial standing; and (5) above all else, knowledge of whether the receiver is honest or resorts to any dishonest practices. In other words, it requires considerable experience and costs money to learn how to make a success as a shipper of hay under present conditions, and it is very doubtful whether it will pay the average producer of a small or medium-sized hay crop to ship his own hay, except in rare cases, such as when he has a definite grasp of all of the five prerequisites. Action based on a thorough knowledge of these factors constitutes a large part of the functions of the country shipper.

53222°—21—Bull. 977——2

COMPETITION BETWEEN SHIPPERS.

There is sometimes considerable competition between shippers in producing territories. The most common kind is the competition between regular shippers who live in the same territory and who have built up a business and are in it to stay. Their relations are more or less friendly, and such competition acts to stimulate the country market.

SPECULATORS.

Speculators work in divers manners. Lack of space does not permit a full discussion of the workings of speculators. One or two illustrations will serve. "Foreign" speculators are those who think that prices are going to advance considerably in the immediate future. They appear in a producing section and contract for hay at a price which the country shipper can not afford to offer. In many instances no money is paid down to bind the bargain, because the producer is so elated with the high price he believes he will get upon delivery of his hay. If the market does strengthen, the deal goes through; but if the market fails to advance and the price drops, the speculator suddenly leaves the region. Sometimes a few dollars per ton are paid down, and if the speculator has to break his bargain he will sometimes go to the regular country shipper and try to get relief by turning over the business upon receipt of the money paid out. When this is done, the regular shipper has the hard task of trying to convince the producers that the speculator's high price was all wrong in order that he may be able to buy hay at what it is really worth. Such speculators cause a great deal of trouble and dissatisfaction and serve no legitimate aid in the marketing of hay.

LEGITIMATE "OUTSIDE" BUYERS.

"Outside" buyers sometimes come into a territory and work somewhat as do the speculators, in that they pay a higher price than the regular shipper can afford to pay. A case of this kind occurs when the outside buyer has a large order to fill at a very good price and does not have enough hay in his own territory to fill it. He is perfectly justified in advancing prices in the territory in which he works, but it is not often that he buys at such high prices for a very long time. When the "outside" buyer is operating, it naturally hinders the resident shipper's business. One reason why the outside buyer can afford to pay very high prices is that he may be shipping the hay into a territory with which the resident shipper is unfamiliar. There may be a marked difference in the manner of interpreting grades in this market and in the one to which the resident shipper usually ships his hay. These operations work more or less hardship on the resident buyer, because producers are very loath to believe that the latter can not pay as much as the "outside" buyer.

TRACK BUYERS.

Track buyers who deal in hay operate in much the same manner as track buyers who deal in grain. Some large terminal-market receivers and shippers employ track buyers who travel through the hay-producing sections and purchase hay direct from either country shippers or producers. Occasionally track buyers are not connected with a city firm, but are in the business for themselves alone. In this case the terms of sale should be very carefully made in order that there will be a clear understanding as to the manner and time of payment.[4]

GENERAL PRACTICES.

How best to market hay is a problem that needs to be given more careful consideration by many hay producers. Those who do not have sufficient help to harvest their hay or do not own baling presses should become familiar with the merits of different methods of marketing their crop.

MARKETING STANDING OR UNCUT HAY.

The sale of standing or uncut hay is not common in the timothy and clover sections. Sometimes when the producer is so rushed with other crops that he is obliged to neglect hay until too late to secure good quality, he will endeavor to sell his crop as it stands. The three main difficulties in this method of marketing are (1) to find a buyer, (2) to agree on the yield, and (3) to reach an amicable agreement regarding the price of uncut hay in comparison with that of properly cured hay ready for the market.

If the buyer is a farmer, it frequently is somewhat easier to agree on the yield than if the buyer is a shipper or someone who is not familiar with the producing power of the farm or hayfield. To calculate the percentage of dry or marketable hay from the yield of standing hay it will be necessary to know roughly the average shrinkage of hay in curing.[5] The amount of water in unwilted timothy is about as follows: Minimum 47 per cent; maximum 78.7 per cent; average 61.6 per cent. The average amount of water in well-cured barn or stack hay, ready for baling, is 12.8 per cent. The average amount of water in red clover when uncut is about 70 per cent, and when ready for baling about 10 per cent. Alfalfa when uncut contains a little more water than clover and when ready for baling contains a little less.

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[4] A full discussion of how track buyers operate is given in U. S. Department of Agriculture Bulletin 979, Marketing Hay Through Terminal Markets. 1921.

[5] See McClure, H. B.: The Shrinkage of Market Hay. U. S. Dept. of Agriculture Bulletin No. 873, 1920.

A knowledge of the labor requirements in haymaking will be necessary in arriving at the market value of uncut hay, as it will enable both seller and buyer to calculate how much should be deducted from the market price for this labor.

MARKETING WINDROW OR COCK HAY.

Selling hay in the windrow or in the cock is seldom practiced in the tame-hay sections. Of the two methods, selling cocked hay occurs oftener than selling in the windrow. There is little time to find a buyer when selling windrow hay; and if this method is to be followed, the producer should make the sale before the hay is cut. Hay in the cock may safely remain in the field longer than that in the windrow, but hay in the cock seldom has a good color if left for more than a week. The logical market for hay sold in the windrow and cock is the local market. Feeders of loose hay often purchase enough during haymaking time to last for several months, and it is this class of feeders who furnish a market for the comparatively small percentage of the hay crop sold in the windrow or cock. In arriving at the actual market value of windrow or cock hay it will be necessary to estimate how much to allow for the extra water contained in the hay.

The average of all available analyses shows that the maximum water content of timothy hay ready to be put into the barn or stack, which has been cut early to full bloom, is about 29 per cent, and for that cut late bloom to early seed about 22 per cent. Under average conditions timothy probably does not contain more than about 20 per cent of water when put into the stack or barn. The average water content of alfalfa and clover is a trifle higher than of timothy when ready to be put into the stack or barn.

MARKETING BARN AND STACK HAY.

The general practice in the timothy and clover section is to sell hay loose in the barn or stack. That is, the terms regarding price per ton are made before the hay is baled. This practice results in a very material loss to thousands of producers every year, and causes country shippers to lose money in many instances. Sometimes the producer alone loses, sometimes the shipper alone loses by this rather crude method of marketing.

The trouble with this method is that the shipper can not tell what kind of hay he is buying by merely looking at the hay in the top of a mow or on the outside of a stack. The producer ordinarily has a knowledge of the percentage of the different grasses, clovers, weeds, stubble, trash, etc., in his hay, but he is not likely to say much about this knowledge when trying to sell his hay.

The average producer does not know the grades as applied in the city markets, and he almost invariably claims to have a much higher grade than the hay would grade on the city market. Under such circumstances the country shipper, in buying unbaled hay, must often set a price low enough to cover inferior hay in the middle of the mow or stack. This necessary practice, on the part of the shipper, often causes an appreciable loss to the producer whose barn or stack of hay runs true to the grade of hay that can be seen when the sale is made. On the other hand, the shipper sometimes takes the producer's word regarding hay and finds out later, when the hay is being delivered, that the quality has been misrepresented, and as a result suffers a heavy loss.

It is the consensus of opinion among country shippers that the average hay grower does not know the grades of hay, and also that the buying of hay on such producer's word only is a hazardous method.

The shippers themselves are responsible in many instances for the lack of knowledge regarding grades on the part of the producer. In purchasing hay from producers the shipper rarely disputes the grower, who says that his hay is "choice" or No. 1, but simply pays what the hay seems to be worth. It is often for this reason that producers have come to have incorrect ideas as to the grade of their hay.

MARKETING HAY IN THE BALE BY THE PRODUCER.

The only solution of present difficulties encountered when hay is sold in the barn or stack is to sell it after it has been baled. If this were done, the shipper would have an opportunity to see just what he is buying and could determine the actual amount of the different grades present and would be able not only to protect himself, but to pay the producer the proper market price for all of the hay offered for sale. As it stands to-day, when the shipper loses on a bad lot of hay from one producer he is obliged to try to make up the loss on the good hay purchased from other producers. In general, shippers who buy small lots of hay, say from one-half up to 2 or 3 carloads, from a single producer would welcome the idea of buying hay by grade from the producer.

In some sections selling hay in the bale is practiced rather extensively. In the "Black Belt" of the South alfalfa and Johnson grass hay is baled before it is sold. Considerable prairie hay is sold in the same manner. This method of preparation before selling was brought about because baling from the windrow or cock requires less labor than any other method.

When hay is hauled to the shipping point as soon as it is baled, the shipper can inspect it as it comes in; and if there is any variation in grade, the question can easily be settled on the spot to the satisfaction of both parties to the transaction. In the "Black Belt" those who do not sell as soon as the hay is baled put their hay in warehouses, where it will be protected from the weather until it is sold. It is easier to judge the general quality of baled hay in a warehouse than of loose hay in the barn where only the hay on top can be seen.

TERMS OF SALE BETWEEN PRODUCER AND SHIPPER.

Terms regarding location.—When a producer offers his hay for sale, the first thing the shipper wants to know is where the hay is located with reference to the shipping point. Shippers who ship from several points are not always able to have a representative present when the hay is loaded into the car by the producer. When a car is loaded at a distant siding or town, it is rather expensive to the shipper to send one of his men to that point at the time the hay is to be delivered, because sometimes the man will spend half a day only to find that the producer has decided not to bring the hay on that day. Then, too, sometimes it comes in so slowly that the whole day is spent in loading a 10-ton car.

The next thing the shipper wants to know is how the hay is stored, whether in the barn or stack. Hay often remains unbaled for several months after the sale has been made, and if it is stack hay it may deteriorate considerably in a comparatively short time, especially if the stack is small or not well built or both. Shippers who do not have a hay warehouse at each shipping point must necessarily take many chances when buying hay to be delivered direct to the car. It also frequently happens that the hay the shipper bought for No. 1 will run very uneven in quality, and if he does not have a warehouse in which to put the off-grade hay, he is obliged to place several grades in a car. If the hay purchased is located so that it can be delivered to a shipping-point warehouse, the shipper has a chance to keep out the poor hay and load cars as desired.

Terms regarding quality.—One of the greatest sources of trouble and dispute between producer and shipper is for the shipper to take the producer's word regarding the quality or grade of hay offered for sale. Though it is true that some producers know the grades of hay in a general way, it is the opinion among shippers that the majority of producers either do not know the market grades of hay or they make deliberate misstatements when describing the quality of their hay.

It is equally true that many shippers drive hard bargains when they buy hay from the producer. In other words, the producer thinks it is to his interest to make it appear that his hay is better than it really is, and the shipper thinks that he gains by discrediting the quality of the hay. Investigations conducted by the Bureau of Markets have shown that the majority of country shippers find it to be good business to pay exactly what any particular grade of hay is worth. Consequently, they desire to deal only with producers who are honest. In order to make a deal, however, it is necessary for shipper and producer to come to an agreement as to the price of the hay in question. If the interested parties attempt to agree on the real quality or grade the chances are that they will fail to reach a satisfactory agreement. Few shippers now attempt to buy hay by grade. If they do, they appear to accept the producer's ideas, but they do not pay him what that grade is worth if the hay in question is not really of the grade the producer thinks it is.

The more common method is for the shipper to learn all he can about the mixture and quality by talking with the producer and inspecting the hay in the barn or at the stack and then make an offer on the ton basis. By this method there is no chance for argument regarding quality, and the producer can either accept or reject the price offered. As the matter stands at present the true grade of hay and the market price are determined almost solely by the shipper, and it must be admitted that this practice does not work toward bettering the marketing of hay at country points.

Terms regarding baling.—The percentage of hay growers who own baling presses is very small in the timothy and clover growing sections, where the bulk of the market hay is produced. Consequently, when hay is to be marketed, either the producer or the shipper must have the hay baled. In some sections the shipper pays for the baling, and this may lead to trouble for one or both parties as well as the custom baler, depending upon the manner of paying.

One rather general method is for the shipper to pay the producer, who in turn pays the money over to the man doing the baling. By this method the presser is really working for the producer even though it is the shipper's money that pays for the baling. The producer is supposed to oversee the work in a general way and is responsible for the baling of the hay in the proper manner. If the producer merely tells the operator of the press to throw out the worst of it but to bale all hay that is not too bad, it frequently happens that too much of the bad hay is baled with the good. This causes the shipper an endless amount of trouble, especially if he has relied upon the producer to have it properly baled and is not present when the hay is loaded into the car. It has been found that many disputes between shipper and receiver are due to the fact that the shipper did not see the hay put into the car, but trusted the producer to see that the hay was baled properly.

Another common method is for the shipper to do the baling. In such cases the press operator is working directly for the shipper.

who should keep closely in touch with the pressing. Terms of sale by which the shipper does the baling should be very specific concerning the baling of hay in any way off-grade, so that the producer will not make trouble regarding the rejection by the presser of any hay that would cause the consignment to be graded down when it arrives in a terminal market.

Terms regarding payment.—Terms regarding method of payment for hay should be clearly understood when the transaction is made. Considerable hay is sold by verbal agreement, and if all of the terms are not made clear, trouble may arise later, especially if there is a change in the market. If the price goes up very much some producers will try to break the agreement. The same holds true with some shippers when the market declines.

In some instances it is good business for the shipper to make a small initial payment and take a receipt, so that he will have something to show in case trouble arises. It is not customary to pay in full for hay before it is delivered unless it is measured in the barn or stack at the time the sale is made. Speculators are often able to contract for the delivery of considerable hay without paying out any money, but a payment of a dollar per ton should be just as binding as if three-fourths of the agreed price were paid when the sale is made. It is fair to both parties if the balance is not paid until the hay is delivered.

Terms regarding time of delivery.—Terms regarding time of delivery are usually very important. A sale wherein the producer agrees to deliver the hay whenever notified is likely to be unsatisfactory to both parties. It may be rightly assumed that the shipper will ask for delivery of hay when he can sell it advantageously unless he has plenty of storage space, in which case the producer would be allowed to deliver the hay as soon as he pleased. If the price of hay drops soon after the producer sells, it may be several months before he will be asked to deliver it. Shippers sometimes want hay delivered on very short notice. This may happen at a time when the roads are almost or entirely impassable or when there is a rush of farm work that must be done by the farmer. Again, the shipper may delay the delivery until the new crop is ready to cut and the farmer needs his barn room for storing the new crop. Other instances could be cited to show the necessity for a clear understanding regarding the importance to both parties as to the time of delivery.

Terms regarding place of delivery.—Terms regarding place of delivery are sometimes important. Farmers naturally do not wish to haul any farther than necessary, although instances can be cited where it might be to the shipper's advantage to insist on the longer haul, as to a siding where wagon scales are accessible. If the hay carries tag weights, the producer will naturally insist that the hay be delivered to the siding and that the shipper accept the tag weights. If the shipper has reason to believe that the tag weights are incorrect, either because they were incorrectly marked when the hay was baled or because there has been shrinkage since the hay was baled, he will want the hay delivered where it can be weighed on wagon scales. It often works out when the producer, whose tag weights are suspected of being incorrect, insists on delivering to a point where wagon scales are not accessible that the shipper will make a rough estimate of the amount the tag weights are off and lower his price per ton accordingly.

Responsibility for damage before hay is delivered.—The problem of ownership of hay that is damaged by water or destroyed by fire after hay has been sold but is still on the producer's premises is a vexing one. It is more than this, for it almost invariably causes bitter controversies and often lawsuits before the matter is finally settled. In some States at least the law bearing on the point in question is not clear, as is evidenced by the frequency of suits, especially when hay is damaged by fire.

Verbal contracts do not amount to much when water or fire damages hay after the sale has been made. A written contract is the only kind that should be regarded as binding when hay becomes damaged.

CONTRACTS.

It is good business practice to use a written contract, especially if it is fair to both parties. There are many types of contracts drawn up by shippers that vary only in minor points. The following contract, used by a large shipper in New York State, will serve to show the general trend of shippers' contracts.

ORIGINAL TO BE BILLED TO JOHN SMITH.

————, N. Y. ————, 19—.

Mr. ————, P. O. address ————, sells and John Smith, of ————, N. Y., buys the commodity ————, described as follows ————.

CUSTOMARY CONDITIONS COVERING THIS CONTRACT.

Delivered to the buyer's warehouse or into cars at ————, N. Y.

Seller agrees all hay to be of the same quality throughout, as shown on outside of mows. It is mutually understood and agreed upon that if moldy, stained, or off-colored hay or hay of inferior quality to that shown on the outside is found in the mows, balers may stop pressing or bale the same for the seller. When hay is not delivered from press to the cars or buyer's warehouse, it is to be stored by the seller in such a manner that it can not become damaged, and is to be delivered on board the cars or at the buyer's warehouse at the direction of the buyer.

It is mutually agreed upon and understood that delivery is to be made and title pass when hay is placed on board the cars or in the buyer's warehouse, and in case of damage by fire or water prior to that time, it shall be the loss of the seller. Seller agrees to deliver the hay into the car or buyer's warehouse entirely dry and in good condition. It is understood and agreed between ————, seller, and John Smith, the buyer, that this crop of ———— is insured for the full value, or will be insured by the seller in event any money is advanced on crop, so that John Smith will not be held in any way responsible in case of loss or damage by fire, water, or other damage before delivery at car or warehouse.

Seller ————————————
Buyer————————————
Per ————————————

Subject to delay in delivery on account of embargoes, car shortage, strikes, or other causes beyond the seller's control.

Producers do not like contracts.—It is a rather difficult undertaking to induce the average farmer, in some sections at least, to sign a contract. The longer the contract is, the less likely he is to put his name to it, because he does not like to sign one that is full of conditions. According to the contract here shown, the hay must be of the grade showing on the top of the mow. It has already been explained that there may be a considerable variation in the mow or stack run of hay. If the producer knows that there is inferior hay in the mow, out of sight of the buyer at the time the sale is made, he may refuse to sign the contract or he may sign it and afterwards claim that the hay all runs even.

Some shippers claim that when one has the opportunity of buying a farmer's crop it is necessary to make one price and take all of the hay, no matter how poorly it turns out. After the contract is signed and inferior hay begins to show up the buyer has a very difficult task to convince some producers at least that there is a decided variation in quality.

Farmers break contracts.—Buyers sometimes expect that farmers will break their contracts. Once in a while, a farmer who has signed a contract gets a better offer from another shipper, and refuses to bring in the hay to the man with whom he signed the contract. Sometimes the better price is only a small advance of 25 cents per ton. The farmer knows that he is tied up by legal contract that would be binding if taken into court, but the shipper very seldom if ever takes the matter into the courts. The only thing the shipper would gain would be to teach producers of hay a costly lesson, for the lawyer's fees would probably amount to more than the shipper's profit on the hay.

Buyers also frequently fail to fulfill verbal contracts, and sometimes when the market has declined they either refuse to take the hay or delay moving it until the producer must sell it to someone else to get it out of the way for a new crop.

Real value of a contract.—Notwithstanding all that has been said against contracts, there is real value in the contract method of marketing. A contract settles definitely the matter of the ownership of the hay as long as it is on the producer's premises. Therefore it is a valuable instrument, because it protects the shipper against loss or damage by water or fire until it is actually in his possession, and it actuates the producer to take good care of his crop until it is delivered.

BUYING AND SELLING HAY BY GRADE ON THE FARM.

Hay is not generally sold by grade on the farm, and until producers are educated to see the benefit of this practice it will not come into general use. Real selling of hay by grade on the farm takes place when the shipper makes the producer an offer for each grade that is likely to be found in the stack or barn when the hay is baled. As the hay comes from the press it should be sorted into grades before storing, so that when it is delivered a wagonload will be of one grade only. As each load is delivered a tally is kept of the number and weight of bales of each grade and payment is made accordingly.

The reasons why this method of marketing is not in more general use to-day are: (1) It is a new method of doing business, and (2) many producers believe that the shipper always wants to get ahead of the producer by grading down the good hay. This theory is in general incorrect, because many shippers wish to make only a fair profit and are very anxious to use this method, as it does away with a great deal of loss caused by the old "guess" or "sight unseen" method.

Instances have been noted where shippers buy the majority of their hay by grade on a written contract. To sell hay by grade on the farm it is necessary for the producer to have implicit confidence in the honesty of the shipper. It is also necessary that the shipper never abuse this confidence by grading the producer's hay carelessly.

FACTORS WHICH PREVENT BUYING AND SELLING BY GRADE ON THE FARM.

The one great outstanding factor that prevents the general adoption of the method of selling hay by grade on the farm is the lack of uniform grades. This lack affects both producer and shipper. The producer has no way at present of learning the true grades of hay. For instance, if a farmer grows timothy containing one-third of fine tame grasses and cuts and cures it properly, it may have a better color than good "standard" timothy, yet it will not bring as good a price as No. 2 timothy with a poorer color.

The shipper at present grades his hay according to the way his receiver grades hay. That is, to one customer he is obliged to ship real No. 1 hay, while to some other customer he can ship a poor No. 2 and it will be received as a No. 1 hay. If the shipper varies in grading hay as it is being received from the producer, he will not be able to continue the use of this method very long in any community.

If uniform grades and an effective, unbiased inspection service were to be adopted in terminal markets it is believed that most shippers would feel entirely satisfied to have the hay graded by an official inspector and settle with the producer on the basis of such inspection. By this method the producer could easily learn the grades of hay and in a short time would actually be able to sell his hay by grades on the farm after it was baled, sorted, and piled for inspection by the shipper.

COST OF MARKETING HAY BY THE PRODUCER.

COST OF BALING.

The largest single item of cost in preparing hay for the market is that of baling. Only the large hay growers own baling presses. The most of the baling of market hay, in the timothy and clover section, is done by custom pressers. These men usually start up their presses after the hay has gone through the "sweat" in the stack or barn, in September, and bale more or less continuously until the next crop is ready to be harvested.

The present price for baling is much higher than just before the war, ranging from $2.50 to about $4 per ton. In many instances the producer furnishes the wire and the labor required to get the hay from the stack or barn to the press feeder. In addition it is sometimes necessary for the producer to board the regular press crew, consisting of three or four men. Considering that a two-horse press will turn out about 10 tons per day, and a power press from 12 to a little over 20 tons per day, it will be noted that baling is a rather costly item if the crew's board is added to the other costs.

Under present conditions it is probable that many producers could well afford to own presses for baling their hay. If desired, considerable pressing could be done for others near by, and thus the cost of repairs, interest on the investment, and replacement charges per ton would be at the minimum for the producer's hay.[6]

COST OF DELIVERING.

The producer usually agrees to deliver his hay at a point designated by the shipper at the time the sale is made. Shippers do not as a rule have means of bringing in hay from the country, as it would hardly pay them to maintain horses or trucks just for hauling hay. The

[6] A full discussion of crew arrangement and cost of baling hay is given in Farmers' Bulletin No. 1049, "Baling Hay."

average producer does not object to delivering hay if the time of delivery does not come when there is other pressing farm work or when the roads are in bad condition.

Most of the hay in many sections is hauled during the fall, winter, and early spring, when producers are not exceptionally busy with their field crops. Since hay is delivered without outlay for the hiring of extra help, either men or teams, producers do not count the cost of delivering hay, as they would if the actual cost of marketing were being ascertained. There is very little accurate data on the cost of hauling and putting hay into the car or warehouse.

The data in Table 1, obtained in making an economic study of the cost of hay production in northeastern Oklahoma in the winter of 1917, will serve to show the comparative cost per ton of hauling hay from 1 up to 10 miles.

TABLE 1.—*Prices paid for hauling baled hay to market.*

Distance.	Usual rate per ton.	Distance.	Usual rate per ton.
Miles.		*Miles.*	
1	$0.25 to $0.35	6	$1.25 to $1.35
2	.50 to .60	7	1.35 to 1.50
3	.75 to .80	8	1.50 to 1.75
4	.90 to 1.00	9	1.75 to 2.00
5	1.10 to 1.25	10	1.75 to 2.00

METHODS OF HANDLING HAY AT SHIPPING POINT.

INSPECTION AND WEIGHING OF HAY.

The inspection of hay at the shipping point as it is delivered from the farm is rarely ever a really thorough inspection. The time to teach producers market grades is when the hay is brought to the shipper's scales or warehouse or the car. It too frequently happens that the shipper will inspect a wagonload of hay casually as it arrives and notice that it contains two or three grades, yet will say nothing about grades to the grower. If the grower has described the hay, as, for instance, good No. 1 timothy, he is likely to go away with the idea that he has just delivered some very good hay, while, as a matter of fact, the best of it may not be better than a good No. 2 hay. Shippers usually only object to hay that is so obviously off grade that it will not pay to try to ship it, as they know it will be graded as "no grade." Many shippers insist that such hay be taken back by the grower.[7]

LOADING DIRECTLY INTO CARS.

The most common method of handling hay as it comes in from the country is to load it immediately into cars and ship it to market.

[7] See Collier, G. A., and McClure, H. B.: The Weighing of Market Hay. U. S. Department of Agriculture, Bulletin 978.

Under certain conditions this is satisfactory, while under others it is anything but satisfactory. The success of this method of handling hay depends upon several factors: (1) Kind or grade of hay handled; (2) amount to be handled in a given length of time; (3) ability of the shipper to get the required number of cars when they are needed. If only one car is to be loaded, it will be necessary for the shipper to see that the amount needed to fill the car is fairly uniform in quality. If he has purchased a carload from a single producer whose entire lot varies in quality, it will be necessary to have some other producer bring in sufficient hay of the desired grade to make up a carload.

It is such a difficult matter to get two producers or more to bring in practically the same grade of hay that many shippers let the small producer who has a single carload of hay bring it all in and load it into the car. Right here is one of the greatest faults found to-day with the hay business, namely, loading cars unevenly. Such cars cause trouble all along the line.

Formerly shippers did not experience much difficulty in procuring cars as ordered. With sufficient cars and plenty of hay coming in, it is a comparatively easy matter to inspect hay by the wagonload method and direct the driver to place his load in a certain car. By this method the shipper might in one day load several cars of the better grades and be able to put all the lower grade hay into a single car. Thus the shipper could make an honest invoice on each car and avoid trouble, which he could not do if he had to work 2 or 3 tons of off-hay into the corners of the car, where it could not be detected until the car was unloaded.

In recent years shippers have experienced great difficulty in procuring cars when needed. The only solution of the trouble caused by inability to get several cars at once, so that hay may be graded as it is loaded, is for shippers to provide warehouses for the sorting and storing of hay where it may be kept until they can procure cars.

USE AND VALUE OF WAREHOUSES.

Shippers are divided in their opinions as to the use and value of warehouses at country shipping points. Some have been very successful in warehousing hay, while others think that warehouses are merely a needless expense. It all depends upon the conditions under which the shipper operates.

The value of a warehouse depends upon: (1) Volume of business; (2) number of shipping points; (3) location of the warehouse (shipping point) with reference to the direction of shipment; (4) obtaining of billing in transit privileges.

If a shipper does all or the larger percentage of his business at one shipping point, there is little question about the success of warehousing hay. If, however, he has a number of shipping points, then it becomes a question whether it would pay to build warehouses at these various points or to try to run all of the hay through the home warehouse or to do without warehouses.

The location of the warehouse with reference to the other shipping points and the direction of shipment to the terminal markets has an important bearing upon the value of a sorting warehouse. A sorting warehouse is one used to sort or separate hay shipped from storage warehouses or brought in from surrounding territory. If the hay purchased at the various shipping points necessitates a "back haul" it will seldom pay to run the hay through a warehouse. If hay purchased at various shipping points can be routed so as to pass through the home shipping point en route to market, a sorting warehouse can be used quite advantageously, provided the shipper has been able to secure billing in transit privileges.

If hay can be billed so that it may be put through a warehouse in transit it will give the shipper an opportunity to load cars uniformly. Many shippers think that if every shipper could run his hay through a warehouse it would result in doing away with all the trouble caused at present on account of "plugged" cars and uneven loading. Some shippers are not in favor of warehousing hay. They claim that a shipper's competitor who loads in the ordinary manner often gets the same price as does the shipper whose hay has been put through the warehouse at an added expense. Such hay does not necessarily bring any more money per ton. This is particularly the case during times of advancing markets.

In general, but little is gained in using a warehouse unless the hay is sorted and graded as it comes in, because filling the warehouse in a haphazard manner makes it practically impossible to load uniform cars when the time comes to place the hay in the cars.

Some interesting information regarding the value of warehouses has been obtained in Aroostook County, Me. The shippers in this county do not have any trouble about uniform loading. Practically all the hay grown for the market in this county is put into barns, where it is safe from weather injury. As soon as it is baled it is hauled to the shippers' warehouses and is sorted and graded as it goes in. When the shipper desires to load a car of any grade of hay no difficulty is experienced in loading the car uniformly. Many shippers who do not sort hay as it comes in say that they can not load cars uniformly because they have to trust ignorant laborers who do not know the grades of hay. In the Aroostook County warehouses inexperienced men can be used as efficiently as experienced warehousemen, because it is necessary only to tell them where to get the hay for each car, as the hay has been previously graded.

COST OF WAREHOUSING HAY.

Data are lacking on the actual cost of warehousing hay under different conditions. A statement of the usual cost will enable shippers to form some definite idea of the general cost of warehousing. When hay is put through a warehouse in transit, the stop-over privilege costs about $3.50 per car. Unloading into the warehouse costs about 35 cents per ton additional. The total cost of unloading, putting the hay through the warehouse, and back again into the car costs about $1. This charge is the cost of labor only and does not include overhead charges. such as repairs, interest on investment, insurance, and depreciation on the warehouse.

A WELL-EQUIPPED WAREHOUSE.

The following description of a well-equipped warehouse is given for the benefit of those who are considering the building of warehouses in which to sort and grade hay. The warehouse herein described is located in northeastern Michigan, has been in operation for several years, and is considered to meet all of the requirements of a country warehouse.

It is equipped with motor-driven machinery so arranged that with the help of about six men, it can unload, grade and store a car of hay in about 30 minutes. A car can also be reloaded in about the same time. As the hay is unloaded from the cars it is placed upon a chain elevator and conveyor, which takes it to a grading platform on the fourth floor of the warehouse. At this platform a man grades each bale as it arrives and places it in one of the three chutes which lead from the platform to the different locations on the three lower floors of the warehouse. By operating levers which control gates in these chutes, hay can be placed in nine different locations in the warehouse.

The grading platform and the conveyor which brings the hay to the grader are shown in figure 1. This figure also shows the opening to one of the chutes and the levers which control the gates or switches. Another conveyor on the lower floor carries the hay from the warehouse to the car and is so arranged that the hay from the second and third floors can be placed in the chutes and be delivered to the reloading conveyor. The estimated cost of handling hay through this warehouse is $1.50 per ton.

DISADVANTAGES OF WAREHOUSING.

Aside from the added cost of handling, some shippers claim that warehouses are a disadvantage to them for the reason that when the farmers know that the shipper has storage space for their hay they will insist on bringing it in at times most convenient to them, so that the shipper is forced to store the hay and often must sell it at a loss because of a decline in the market before he can make a sale or obtain cars for reshipment. In other words, under certain conditions he is forced to become a speculator in hay and generally he will pay a price which will protect him against all possible risks.

METHODS OF LOADING CARS.

Many cars are improperly loaded, the bales not being so placed as to utilize all of the space. A visit to any terminal market that receives hay loaded by producers will reveal a surprisingly large number of cars improperly loaded.

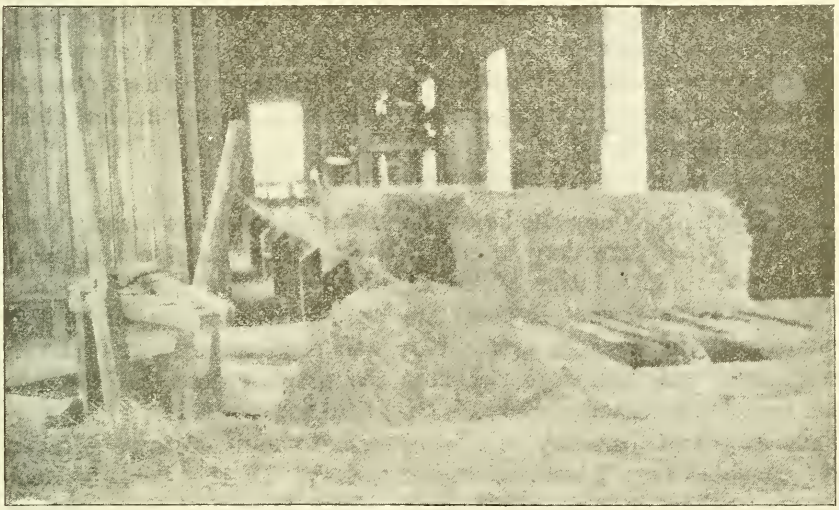

FIG. 1.—Grading platform and conveyor.

When loading bales 14 by 18, 16 by 18, or 17 by 22 inches the hay should be loaded in tiers across the end of the car. Either four or five tiers can be loaded in each end of the car, depending upon its length. Usually four tiers are loaded into each end of a 34 or 36 foot car. Five tiers can be loaded into each end of a 40-foot car. Bales should be loaded flat, i. e., with the wires down, or on edge, or part flat and part on edge in the tiers. They are placed flat or on edge as is necessary just to fill the space. Usually five or six bales can be placed in each row of the tier. In an ordinary 36-foot box car, which is about 8 feet high and 8 feet wide, 36 of the 14 by 16 bales can be loaded or about 30 of the 16 by 18, or 25 of the 17 by 22 bales. The doorway of the car will hold about as many bales as the two tiers, usually 6 to 10 bales more. The average 36-foot car will therefore hold from about 250 of the larger bales to 350 of the smaller bales.

The large five-wire bales should be loaded differently from the sizes just mentioned. Usually two of the large bales laid end to end will reach across the car from one side to the other and four of the bales one on top of the other, flat sides together, will reach to the top of the car. One tier of the large bales will, therefore, generally contain about eight bales. It is sometimes possible to place one row of bales on end and thus get an extra bale into the tier. From 10 to 14 tiers can be loaded into the car, depending upon the length of the car, so that a carload of five-wire bales will contain from 90 to 125 bales.

Except when shipping new hay loaded very loosely, there should not be much difficulty in loading cars up to the minimum weight required. In sections where hay is baled with power presses, very little trouble is experienced in loading a car to its minimum weight. In the prairie-hay section hay baled from the windrow with horse presses, for shipment to the South, often does not weigh more than 70 pounds to the bale. This type of bale makes it difficult to load cars to the minimum weight, especially in some of the smaller, older types of equipment.

LOADING NEW HAY.

In shipping new hay the bales should be loaded more loosely than old hay. When new hay is crowded close together (in the bale) it prevents the circulation of the air and heating is likely to occur. It has been found that if bales are loaded on end and allowed to remain a slight distance apart, they will tend to dry out while in transit and will therefore not heat too much unless the hay has been very inadequately cured.

The length of time hay will be in transit should always be taken into consideration when loading new hay. If the haul is comparatively short it is not necessary to allow for circulation between the bales. Hay that will probably be in transit more than a few days should be loaded so as to prevent heating as much as possible. It often happens that hay baled from the windrow, swath, or cock, is apparently cool when loaded, but arrives "hot" in the market. In some such instances shippers question the statement of the receiver when he reports that the hay has arrived "hot." It is much better to hold newly baled hay in storage for a few weeks so that it will cure thoroughly than to run the risk of its heating and spoiling in transit.

LOADING CARS UNIFORMLY.

The uneven loading of cars is a practice that is constantly causing a great deal of trouble in the hay industry in many parts of the country. The trouble is caused by the fact that shippers fail to invoice cars properly when they are not loaded uniformly. This omission has at least two causes: (1) The shipper is not aware of the fact that there is a variation in the hay or (2) low grade hay is deliberately put in with the better hay in order to make a little more money out of the deal.

The hay standardization office of the United States Department of Agriculture has some very striking evidence of intentional "plugging" of cars. In one instance 25 bales of "Sample" timothy were put into a car containing 241 bales of No. 1 timothy. A separation analysis of one of the bales of off-grade hay showed it to contain 55.30 per cent of timothy, 39.50 per cent of volunteer wheat hay, and 4.50 per cent of weeds.

When cars are intentionally loaded unevenly an attempt is always made to put the poor, low-priced hay in the corners or under the good hay so that it can not be detected by a car-door inspection. Indeed, some shippers often succeed temporarily in this crooked practice when hay is given a "plug" inspection.

The old practice of invoicing all of a carload of hay as of the grade of the best hay is no longer considered an honest practice. In some of the markets receivers have begun to take steps that will tend to discourage the practice of loading cars unevenly, and inspectors are placing the lower grade on shipments which contain more than a reasonable percentage of such lower grade hay.

The hay-marketing survey, previously referred to, has shown that two grades or more of hay may be loaded into a car and no trouble will result if the shipper invoices the hay for just what it is and not as all being of the best grade.

PUBLICATIONS OF THE U. S. DEPARTMENT OF AGRICULTURE RELATING TO HAY.

Baling Hay, Farmers' Bulletin No. 1049.

Hay Stackers, Farmers' Bulletin No. 1009.

Hay Caps, Farmers' Bulletin No. 977.

Labor-Saving Practices in Haymaking, Farmers' Bulletin No. 987.

Curing Hay on Trucks, Farmers' Bulletin No. 956.

Haymaking, Farmers' Bulletin No. 943.

A Study of Haymaking Crews and Labor Costs, U. S. Department of Agriculture Bulletin 578.

Harvesting Hay with the Sweep Rake, Farmers' Bulletin 638.

The Shrinkage of Market Hay, U. S. Department of Agriculture Bulletin 873.

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Contribution from the Bureau of Markets and Crop Estimates
H. C. TAYLOR, Chief

Washington, D. C. ▼ November 17, 1921

THE WEIGHING OF MARKET HAY.

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CONTENTS.

A better understanding is needed among those interested in the marketing of hay as to the weighing methods in use throughout the country. It is the purpose of this bulletin to describe the various methods and practices now in use, so that the merits of all may be studied and compared in order that those methods which are an improvement over others may be adopted for the improvement of marketing facilities, and that careless, inefficient, and unprofitable practices may be discontinued.

There are four general methods of weighing hay. These are by the bale, by the truckload on hand trucks, by the wagonload or motor truckload, and by the carload, but for each method there are numerous variations caused by the use of various kinds of scales, the manner in which the weights are obtained, and the method by which they are recorded and preserved for future reference.

WEIGHING BY THE BALE.

Weighing hay by the bale is practiced principally by producers and balers in certain sections of the country, the timothy-producing sections of Michigan and New York probably being the most representative. Hay is sometimes weighed by this method in terminal markets, where tagged weights are recognized as official[1] or when

[1] By "official" is meant that the agency, by whose authority the certificate is issued, guarantees the correctness of the statements contained therein and assumes the liability for any loss or damage which may be caused by any errors on the part of its agents.

it is desired to weigh only a few bales from a carload to check up or verify the weights shown on the tags. Retailers of hay also frequently weigh hay by the bale.

Small platform or dormant scales having a weighing capacity of from 500 to 800 pounds are commonly used. The dormant scale is used only when the bales can be weighed in a warehouse, as it can not be moved about and is therefore not practicable for other locations.

WEIGHING AT TIME OF BALING.

In some sections hay is almost always weighed when baled, in order that the baler may know for how much hay he should make a charge for baling. He usually owns his scales and carries them along with the baler from place to place. It often happens that the scales are very much jolted in moving and sometimes will not weigh correctly after being set up again. While the error may not amount to more than 2 or 3 pounds in one bale it will make a considerable difference in the weight of a carload. Scales should always be handled carefully while being moved and should always be adjusted, balanced, and tested in some reliable manner before another lot of hay is weighed upon them. Perhaps the simplest and easiest way by which small platform scales may be tested is with a 50 pound test weight. Such test weights are manufactured by most scale companies and may be obtained at a small cost.

RECORDING THE WEIGHTS.

It is as important that the weight be correctly read and carefully recorded as that the scale weigh accurately. It is the practice in some sections to use only the numbers ending in 0 and 5 when weighing bales of hay. This is sometimes designated as the "give and take" method and consists in giving the weight designation to the number ending in 0 or 5 nearest to the actual weight. For example: The weight of a bale weighing 107 pounds would read 105 pounds, while if it weighed 108 it would be called 110 pounds. It is claimed that in weighing a large lot of hay, a wagonload or a carload, the total of the weights will be approximately correct, but it has been found that this is not an established fact and that weights obtained by this method frequently vary from 25 to 50 pounds on a ton of hay. The difficulty seems to be that the weigher "takes" more often than he "gives." To be really accurate the actual weight as shown by the scale should be recorded.

METHODS OF RECORDING WEIGHTS.

Bale weights are recorded on tally sheets or on tags, the latter being attached to the bale. When it is desired to have only the total weight of a lot of hay the weights are generally listed on a tally sheet as the bales are weighed, and when the weighing is finished these amounts are added to obtain the total weight of the hay. To avoid errors the weight of every bale should be tabulated and the number of drafts should be checked with the number of bales weighed.

Tags upon which the weights of the bales of hay have been placed are used for recording weights when it is desired that knowledge as to the weight of each bale shall be available to the various agencies interested in the marketing of the hay. These tagged weights are frequently used through all the transactions connected with the marketing of the hay. Each person who wishes to know the weights of a given number of bales copies the amounts from the tags onto his tally sheets, from which total weights may be obtained.

KINDS OF TAGS USED.

Various kinds of tags are used, varying from a piece of paper to a small piece of wood (see fig. 1). Cardboard or a heavy stock of paper similar to that used for shipping tags is most frequently employed, and the size of the tags varies from that of a strip about 1 by 2 inches to a piece about 2 inches square. Some tags of standard size and quality are found, but the greater number are still cut from any available material by the producer, baler, or dealer who tags the hay. In some sections small wooden tags similar to those used in marking trees and shrubs for shipment are used instead of paper, as they are more substantial and can be more easily attached to the bale. New York and some other States have laws regulating the size of the tags. Such laws were found necessary because of abuses in the use of wooden tags. Occasionally large pieces of wood or small slabs weighing one or more pounds were found, which added materially to the weight of the bale.

ATTACHING THE TAGS.

Tags are attached to the bales by placing them under one of the baling wires. The hay hook used for handling the hay is usually forced under the wire, which is pulled away from the bale sufficiently to allow the tag to be placed under it. The hook is then removed and the tension of the wire holds the tag in place.

It is better to place the tag on the end of the bale, because in that position it is not so likely to be torn off in the handling of the hay. It is more difficult, however, to place it on the end of the bale, because of the great pressure of the hay against the wires at that point, and it is therefore more often placed upon the side of the bale. It has been stated that, while a few tags are lost in handling, if the hay is well baled and the tags are carefully attached but little difficulty is experienced from the losing of the tags, whether placed upon the sides or the ends of the bale.

OTHER USES OF TAGS.

Besides being used for designating the weights of the bales, tags are sometimes used for advertising purposes and for grade or quality

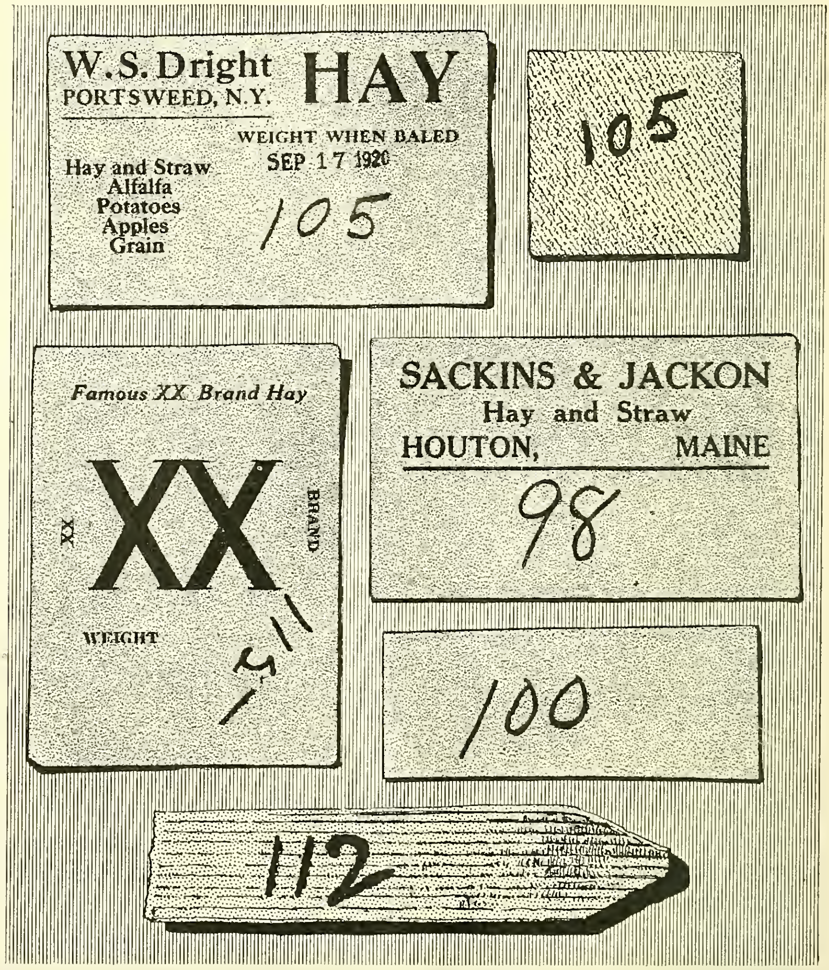

FIG. 1.—Types of tags used in various sections for tagging the weight of bales of hay.

designations. Producers and dealers who wish to become identified with the hay they produce or ship frequently have name and address printed upon the tags. They consider this good advertising, as they reach a number of prospective purchasers of hay at very small expense.

Other handlers of hay use the tags as a means of denoting the quality of the hay as well as the weight. This is usually done when the shipper makes a specialty of a certain kind or grade of hay. He uses a trade name or brand to represent the kind of hay handled, such as "Alpha Brand" or "Omega Brand," and generally endeavors to have the quality of the hay uniform and equal to a certain recognized grade. The purpose of this "branding" and of the use of the name on the hay is to build up a demand for the hay marketed by the shipper. Both are effective methods of advertising, providing the producer or shipper is able and willing to maintain the standard of the output. Any deviation from the standard claimed, however, would be as widely advertised (and probably more so) as a continued adherence to it.

In some States balers are required by law to place a tag upon every bale, giving the weight of the bale and the name and address of the baler. In these States the balers are usually the weighers of the hay, and the purpose of the regulation is to enable the sealer of weights to know who is responsible for any incorrect weighing of the hay. The letter of this law is not always followed, however, for the dealer handling the hay often has his own name placed upon the tag as the baler or weigher. In such instances the person actually doing the weighing becomes the agent of the dealer and the dealer therefore becomes liable under the law for the correctness of the weights.

The reason for not having the baler's name appear upon the tag is usually the desire of the dealer to prevent the ultimate buyer of the hay from establishing business relations direct with the baler. However, there are various other reasons, such as the desire for uniformity of tags, for using the tags as an advertising medium, etc., which may cause the dealer to take upon himself the responsibility for the correctness of the weights.

The date on which the hay is weighed is not entered on the tag, but the Bureau of Markets believes that such a date is desirable, as it would be of great assistance in determining when the hay should be reweighed.

VARIOUS PRACTICES AFFECTING TAG WEIGHTS.

When hay is weighed correctly by the bale and care is exercised in marking the weight upon the tags and in attaching them to the bale little difficulty is experienced with bale or tag weights. There are, or have been, certain practices, however, which tend to make bale or tag weights unreliable and unsatisfactory. Probably the most important of these is careless weighing. The bales are placed upon the scales, the poise weight is moved along the beam hastily until the beam begins to rise or fall (whichever the case may be), but the bale is removed or pushed off the scale to make room for another before the beam comes to a balance. Such weights may easily be incorrect to the extent of from 5 to 10 pounds. The argument in defense of this practice is that while some bales will be overweight, probably a like number will be underweight, so that the total weight of the whole lot will be approximately correct.

Another practice which does not insure correct weights is that of weighing a few bales, usually from 10 to 25, and using their average weight to compute the weight of the entire lot. This is not only the practice of some balers, but is a recognized method of weighing in some of the larger terminal markets.

It is claimed that in some markets if, when making this test weight, it is found that the bales actually weigh more than is indicated on the tags, the tag weights are used as the official weight. One instance is related where a shipper whose returns from a terminal market were always a few hundred pounds short of his invoiced weights hit upon the plan of marking the weights on the tags of a few bales near the doorways a few pounds less than the actual weights, his thought being that when it was found that the actual weights were more than the amount indicated on the tags, the invoice weight supposed to be computed from the tag weights would be accepted, and he therefore would be paid the full amount of his invoice.

The careless or improper marking of the tags causes considerable trouble and loss to handlers of hay and should be discontinued. The most flagrant practice is probably that of marking the tags before the time they are to be used. The numbers placed upon the tags are those supposed to represent approximately the weights of the bales made by the press that will bale the hay. Sometimes a few of the first bales pressed are weighed and the tags for these and the remainder of the hay are marked from these weights. In the latter instance the weight on the tags would become average weights similar to those obtained in the terminal markets by weighing a few bales from each car. The difficulty, however, is that the bales may not run uniform throughout the carload, but may vary as much as 25 pounds, because it is frequently necessary to loosen or tighten the tension on the bales as hays varying in texture or moisture content are being baled.

PROPER METHODS OF WEIGHING BY THE BALE.

To weigh hay correctly by the bale it is necessary:

First, to have reliable scales in good condition and in balance (see fig. 2).

Second, to weigh each bale carefully, making sure that it is properly placed on the scales and is not in contact with other bales or objects.

Third, to have the beam come to a balance before the weight is determined or the bale removed. The actual weight should be recorded, and if the bale is to be tagged the actual weight should be marked plainly upon the tag. It is no more difficult to place the actual weight upon the tag than a weight ending in 5 or 0, for if the

FIG. 2.—Weighing hay by the bale. Hay should be so placed on the platform that it does not touch other parts of scales, and the beam should be allowed to come to a balance.

bale has been properly weighed the actual weight is shown on the beam.

Fourth, a tag should be attached as securely as possible to the bale and should be of material of such durability as will stand handling and shipping (fig. 2).

WEIGHING AT WAREHOUSES.

At many country points and at most of the terminal markets there are warehouses in which hay is stored and from which it is later shipped or hauled out by wagon or truck. When the hay is weighed into these warehouses three types of scales are used—the platform scale, the dormant scale, and the steelyard. The first two are in very common use, but the latter is now used only in cotton sections, where cotton is stored extensively in the same warehouse.

When the platform scale is used the hay is usually weighed one bale at a time in the manner already described, but as most of the hay in the warehouses is weighed while being taken in or out, the dormant scale can be used to the best advantage, as the hay can be weighed while on the hand trucks en route to the car or warehouse.

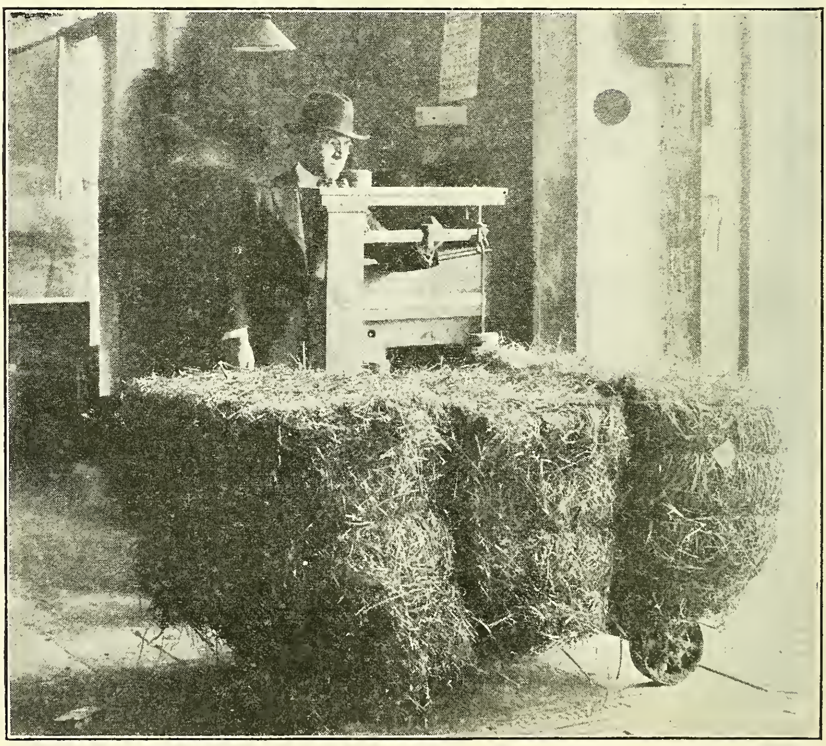

Fig. 3.—Weighing on dormant warehouse scales. Trucks are usually used when weighing on such scales, and care should be taken to see that tare weights of all trucks used are uniform and that proper tare is allowed.

WEIGHING ON THE DORMANT PLATFORM SCALE.

Hand trucks hold from 3 to 5 or more of the medium-sized bales, but those holding 3 such bales are the more generally used, as they are more convenient to handle and to load and unload. When two or more trucks are used at any one warehouse they are usually standardized as to weight and that amount of tare weight is set upon the scale beam. This facilitates the weighing, as the weight then indicated by the poise weight on the beam when it comes to a balance is the net weight of the hay. This method of weighing hay has been adopted as the official method in several of the large markets and rules designed to make it accurate and reliable have been adopted by the various exchanges and boards of trade.

The most important provisions of these rules are those relative to the balancing and adjusting of the scales, the correct allowance for the weight of the trucks, the correct weighing of each draft, the proper tabulation of the weights, the accurate totaling of the number of bales weighed and of the weights of all the drafts, and the transmission of the official weights to the proper officers.

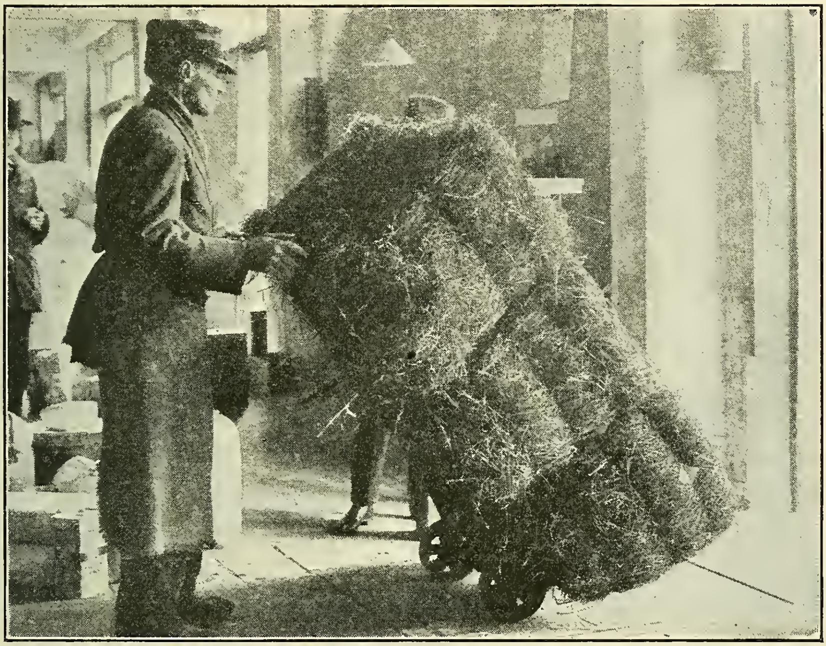

FIG. 4.—Improper method of weighing hay on trucks. The trucker should place the truck on the scale and remain away from it while it is being weighed.

BALANCING AND ADJUSTING THE SCALES.

When official weights are to be obtained it is usually required that the scales be examined to see that they are in order, are free from dirt or other obstructions, and are in balance. They should also be tested frequently with one or more of the standard 50-pound test weights.

After the scales are balanced and adjusted the trucks are weighed and adjusted until their weight is uniform. The weights of the trucks are adjusted to uniformity, usually by adding or taking off a washer or two usually kept at hand for that purpose. It frequently happens, however, that nails or bolts are used in making the adjustment, and a sufficient number are tied to the frames of the various trucks until all are of equal weight. When all are found to weigh the same amount the tare weight is set at the proper amount and the scales are ready to begin the weighing of the hay (fig. 3).

WEIGHING THE DRAFT.

As the hay is trucked onto the scales, 3 or more bales at a time, the weight is determined and the amount is placed upon a tally sheet. While frequently 5 or even more bales are placed upon the trucks at some warehouses, the number is usually the same for each truck during the weighing of any lot of hay.

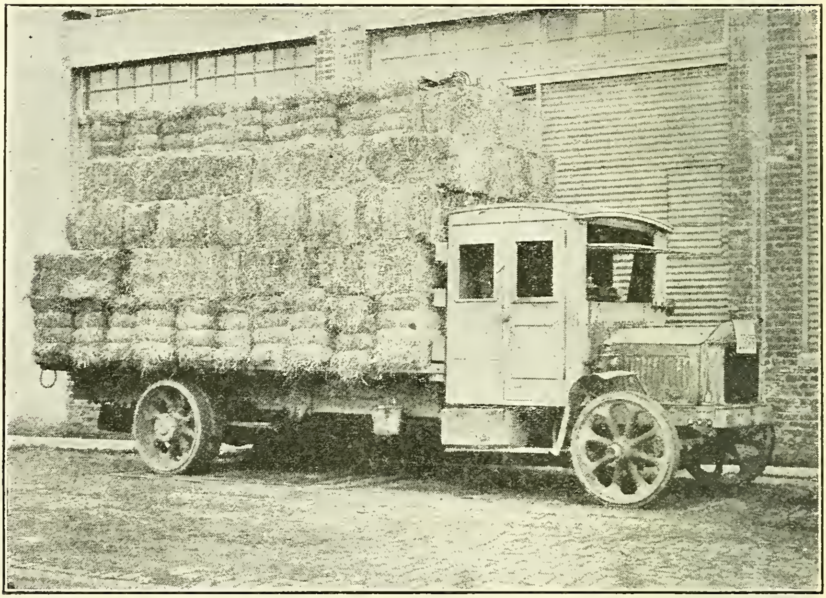

FIG. 5.—Weighing on wagon scales. Much hay is now weighed on trucks and care should be taken to see that the truck is properly located on the scale and that the driver is either on or off when obtaining both the gross and tare weight. It is considered the better practice to have the driver always off the load while weighing.

The trucks are wheeled upon the scale and are usually set down, so that all bearing points are upon the scale. Instances have been noted, however, where the trucker balanced the truck on the scales upon the wheels so that it would not be necessary to lift the truckload again when it was desired to wheel it away after being weighed. Weights obtained in this manner are very likely to be inaccurate, and the practice should not be allowed in obtaining either official or unofficial weights (fig. 4).

Only when the truckload of hay has come to rest upon the scales should it be weighed. The poise weight should then be carefully moved upon the beam until the beam comes to a balance.

TABULATING THE WEIGHTS.

The weight is then placed upon the tally sheet, and this should be done before anything else has an opportunity to distract the attention of the weigher. To prevent errors from this and similar causes the tally sheets are sometimes arranged so that the weights may be tabulated in groups corresponding to the tiers of hay loaded into the cars. If care is taken in unloading the hay from the car and the weigher is notified by the truckers when each tier or section of the car is completed, the tabulation may be checked with the number of bales in the tiers as unloaded and the chances of errors greatly diminished. It is almost necessary to use some system of checking if the weights are to be tabulated correctly. A form for a tally sheet which will meet these requirements is shown on page 12.

TOTALING THE WEIGHTS.

After all the hay has been weighed, the weights of all the drafts are totaled and this is the weight of the lot or load of hay. In several of the important hay markets inspectors or supervisors appointed by the commercial trade associations make frequent visits to the warehouses when hay is being weighed and inspect and check up the work of the weighers, assist in totaling the weights, and in some instances collect the tally sheets for the hay and take them to the office of the chief weighmaster.

In markets where no supervisor is employed the tally sheets are mailed, usually each evening, to the office of the chief weighmaster, who issues an official certificate of the weight as shown by these tally sheets. If the lot of hay weighed was a carload the initial and number of the car from which the hay was taken or into which it was loaded is shown on the tally sheet and on the official certificate. If the lot was less than a carload some other means of identification, such as the number of bales or the quality of the hay or the name of the owner, may be used.

When hay is weighed on dormant platform scales at warehouses located at country shipping or distributing points where there are no official weighers or supervisors the same general methods are used as at the terminal markets, but frequently no special forms of tally sheets are used and the weights are recorded in shipping books or notebooks or on anything that may be at hand.

It is thought that some of the difference between shippers' and receivers' weights of the same lot or carload of hay is caused by carelessness in the matter of recording the weights. A draft may be omitted or the weights may be tabulated in such a careless manner that the number of bales or drafts can not be checked or the total correctly obtained. Whoever is responsible for the weighing

TALLY SHEET.

(Small drafts.)

.... 192–..
(Place.)

.... weigher.

Car initial ....

Size of bales ....

Car number ....

Seal numbers ....

Doorway.		Brake end.										Opposite end.									
		First tier.		Second tier.		Third tier.		Fourth tier.		Fifth tier.		First tier.		Second tier.		Third tier.		Fourth tier.		Fifth tier.	
Number bales.	Weight.	Number bales.	Weight.	Number bales.	Weight.	Number bales.	Weight.	Number bales.	Weight.	Number bales.	Weight.	Number bales.	Weight.	Number bales.	Weight.	Number bales.	Weight.	Number bales.	Weight.	Number bales.	Weight.
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Total bales ....

Total weight ....

of a lot of hay owes it to the other interested parties to so safeguard the weighing and tabulation that he can be certain the weight obtained is correct.

WEIGHING ON WAGON SCALES.

In some hay-shipping sections practically all the hay shipped is weighed by the wagon or truckload on wagon scales. This method of weighing is used extensively also at terminal markets and in distributing sections.

AT SHIPPING POINT.

Some of the factors to be considered in the use of wagon scales at shipping points are the size and capacity of the scale, location, and general condition. Wagon scales may differ somewhat in construction, but the principal factors that might affect the accuracy of the weights are the size of the platform and location of the scale.

The platforms of most of the farm scales and of many others are about 14 feet long. This is sufficient length to allow for the weighing of almost any wagonload without the team, but unless the team is unhitched from the wagon while the draft is being weighed more accuracy in weighing could be obtained on scales with a platform of sufficient length to hold both the wagon and the team.

The capacity of the wagon scales generally used varies from 2 to 10 tons or more. The 5-ton scale is used extensively, but since the advent of the motor truck, scales of larger capacity are more desirable. When loads of greater length or weight than the length or capacity of a scale are to be weighed it is often the practice to weigh one-half of the load at a time. This is done by drawing first one end of the truck or wagon onto the scales and weighing it, then the other end and adding the two weights, taking the sum as the total weight. This is not a desirable practice, because any unevenness of the ground will throw the load out of level and the weight then will not be accurate.

The location of the scale is also an important factor. It should be located at a well-drained and easily accessible place, preferably in an inclosed building which will protect it from unfavorable weather. Some scales are said not to require a foundation, but whether it is a scale supposed to require a foundation or not, it will give better service if placed solidly upon a concrete or masonry base that will prevent the corners or any part of the frame from getting out of level. Care should be taken that all bearings work freely and that the platform does not bind or come in contact with the frame. Loose hay and trash should be kept swept away from the scale, and if there is a pit under the scale it should be well drained and kept free from dirt. The approaches to the scale should be nearly level, with just enough incline to prevent the water from running toward the scale.

TESTING AND BALANCING THE SCALE.

The same care is necessary in testing and balancing the wagon scale as with the portable or dormant platform scale. Scales should be examined and tested frequently by an experienced scale man and they should also be kept in good repair and in balance. When scales are under cover and in a dry place they do not require balancing so frequently as when situated in the open, but considerable soil or trash may be carried upon them, especially when roads are in bad condition. At such times it is necessary to balance them several times a day, whereas in dry weather probably once each day would be sufficient. Scales located in the open must be balanced more frequently, especially in rainy weather, as they will absorb several pounds of moisture during a shower and will lose it again quickly when the sun shines upon them.

WEIGHING THE DRAFT.

To obtain the correct weight of a draft requires care and accuracy on the part of the weigher. In weighing hay, especially loose hay, the wagon must be entirely on the scale and the load must not be in contact with the sides of the scale house or beam box. Care must be taken that the presence of the team does not influence the weight. If a motor truck is used, it should be brought to rest in proper position on the scale, and if the running of the motor disturbs the weighing it should be stopped (fig. 5).

There should be a fixed rule as to whether the driver should be weighed with the load, but as a general practice it is better always to weigh the load without the driver or any other objects on it or on the empty wagon when the tare weight is taken. This will prevent any mistakes caused by the weigher forgetting what was weighed on or off the load. Numbers of instances have been found of errors caused by allowing loads to be weighed on which were farm implements, bags of grain, or other articles which were not on the truck or wagon when the tare weight was obtained.

TABULATING THE WEIGHTS.

It is as important that the weights be recorded accurately as that the hay be weighed correctly. At country loading points it is generally impossible to have a sworn weigher in charge of the scales, and the weighing is usually done by the owner of the scales or by one of his employees. The qualifications of the weighers in such instances are but ordinary intelligence, the ability to do the physical act of weighing, to read the amount indicated on the beam or by the weights, and to write the amount upon a scale ticket or book.

In many instances but little system is used in recording the weights and the amounts of the gross, tare, and net weight are written upon any blank piece of paper, the unused part of an envelope, a shingle, or a piece of board.

A better method, however, which is in use at many country points, is the use of scale tickets in duplicate or a scale book in which the weights may be recorded on a stub for future reference as well as upon the tickets, which may be detached and given to the driver of the wagon or the owner or buyer of the hay.

At some points where considerable weighing is done registering-beam scales are now used. These scales differ from others only in the construction of the weight beam. These beams are so made that the entire capacity of the scale can be indicated on the beam and there is a mechanical device on the poise weight which will print upon a ticket inserted in it the amount of the weight indicated by its location on the beam. This device eliminates the possibility of misreading the weight indicated by the poise and other weights used on other scales, but it does not insure correct tabulation or totaling of the weights of the various drafts.

AT TERMINAL MARKETS.

Wagon scales at terminal markets do not differ from those used at shipping points, but where railroads, public-service agencies, exchanges, or other commercial bodies furnish official weight certificates for commodities weighed by them, certain qualifications, and frequently bonds, are required of the weighmasters, and their work is under the supervision of a chief weighmaster, who sees that the various regulations are complied with.

Official certificates are not necessarily more accurate or of more value than certificates issued by any financially responsible individual. Interested parties are protected against dishonest weights by law if they desire to avail themselves of its protection. Section 10 of the interstate commerce act provides that any person who, by an act of false weighing or false report of weight, shall be deemed guilty of a misdemeanor, and shall upon conviction thereof in any court of the United States of competent jurisdiction, within the district in which such offense was committed, be subject to a fine not exceeding $5,000 or imprisonment in the penitentiary for a term of not exceeding two years, or both, in the discretion of the court, for each offense.

Probably the reason official certificates are considered with more favor by the trade than private certificates is because more care by means of supervision and various regulations is usually taken to insure their correctness.

QUALIFICATIONS OF OFFICIAL WEIGHMASTERS.

The ability to read and write and to operate a scale are practically the only qualifications required of those who are appointed as official weighmasters in the various markets. In some places where the scales are owned or maintained by the railroad companies, employees who have become incapacitated for other work are made weighers. Bond for the honest and faithful performance of duty is required of the weighmasters in some markets, while at others an oath is sufficient. Where supervisors are employed they must meet the same requirements as the weighmasters, except that in some instances they may be required to furnish a larger bond.

DUTIES OF WEIGHMASTERS.

Aside from the weighing duties, the weighmasters often have other duties which vary greatly in character. At railroad team tracks, where the weighing duties are not heavy, the weighmaster is often the yardman and polices the yard, together with keeping a record of the cars received at the yards and forwarded from them. He also directs the teams to the proper cars; in fact, looks after everything in connection with the freight received in the yard of which he has charge.

If the weigher is an employee of a warehouse owner he may also do any of the various duties connected with the business of his employer.

TIME AND WORK REQUIRED.

There are no fixed rules as to the hours or amount of work required that are applicable to all official weighmasters. The hours of work are usually those prevailing in the markets or territory in which the work is done. At the railroad yards it is often necessary for the weigher to be on hand at an early hour in order that he may check up the cars in the yards and learn the location of the various cars to be unloaded. These yards may then be closed at an early hour in the afternoon, or another weigher may come on duty at the expiration of the work period of the first weigher. The work periods now are generally about eight hours, but many weighers frequently work overtime and receive extra pay for the extra time.

OFFICIAL WEIGHTS AT TERMINAL MARKETS.

The official weighing of hay in the large markets is confined almost entirely to hay shipped to those markets, and a composite description of the various methods of weighing and the supervising of the weighing on wagon scales used at these markets is as follows: The owner or purchaser of the hay, or his representative, drives his team or truck to the scale nearest the car to be unloaded, which has been designated as a scale where official weights may be obtained, and presents to the weighmaster an order from the seller or owner for the hay. This is the weigher's authority to weigh the loads to be hauled from the car. This order usually contains the car initial and number, together with the name of the buyer, and is signed by the seller.

At St. Louis, where the Merchants' Exchange maintains a supervisor at each team track scale where hay is weighed, this order is presented to the supervisor instead of the weighmaster. The supervisor, after making a record of it, issues another order, which contains the wagon number, the car number and initial, and the name of the buyer. This order is then presented to the weighmaster, who, after obtaining the tare weight, places that amount upon it and gives it to the driver. At most other markets the weigher, upon receipt of seller's order, weighs the empty wagon or truck and places the amount of the tare weight, together with the car initial and number from which the hay is to be taken, upon a weight ticket, which is then given to the driver.

Upon receiving the tare weight the driver proceeds to the car containing the hay which he is to haul, as shown upon the weight ticket, and proceeds to obtain a load of the hay. In several of the large markets an inspector is stationed at the wagon track yards whose duty it is to police them and to see that drivers obtain their loads from the proper cars. They indicate by a check mark or their initials on the weight ticket that this has been done. At some markets these inspectors are in the employ of the railroads and at others they are employed by the commercial exchanges. When the load has been obtained it is weighed on the same scales on which the tare weight was found, and this gross weight is then also placed upon the ticket taken by the driver with the load.

In all cases a copy of the weights is kept by the official weigher and is forwarded by him when the weighing of the car is completed, or at the close of the day, to the office of the chief weighmaster, who issues an official certificate for the total amount of the weights of each car. Where supervisors are also employed the weighmasters usually turn over the weights to them, and they, in turn, after recording the amounts, forward them to the chief weighmaster.

WEIGHING FROM PRIVATE TEAM TRACKS.

Firms operating private warehouses or having private sidings and desiring to have official weight certificates issued for hay weighed by them usually have one of their employees designated as an official weigher. When such an employee is so designated he becomes subject to the rules and regulations of the weighing department of the commercial exchanges. In markets where bonds are required of the weigher he, or his employer, must furnish a bond of a specified amount for the proper performance of his duties. Some weighing departments have official weighers who can be furnished to the various private warehouses on request and can be sent from place to place as the need for them occurs.

The rules of the various exchanges usually provide that weighers at private warehouses may be changed from time to time at the option of the chief weighmaster. If he is an employee of the warehouse owner, he may be dismissed as an official weigher at any time that his services are not satisfactory to the chief inspector or in compliance with the rules and regulations of the weighing department or the exchange, but no regular system of rotation of weighers at warehouses has been reported at this time.

OBTAINING THE TOTAL WEIGHTS.

After all the drafts have been weighed the amounts of the various drafts are totaled. This work is done by one or more of several agencies, which vary at the different markets. In some instances the weights are totaled by the weigher, in others by the supervisor, or the figures denoting the amount of the various drafts may be sent to the office of the chief weighmaster, where all clerical work will be done.

At this point, investigations show, most of the systems of official weighing are weak. Complete information necessary for preparing an official weight certificate which would be fair to all parties concerned is frequently not furnished to the office of the chief weighmaster.

NUMBER OF BALES UNLOADED FREQUENTLY NOT GIVEN.

The item most frequently omitted is that stating the number of whole bales unloaded and the number of bales from which the wire may have been broken, or the amount of loose hay, if any (fig. 8).

The rules of most markets provide that the weighing charges shall be paid by the shipper, and it would seem therefore that the service was performed for his protection as well as for the protection of the buyer. There are several ways in which losses in weight may accrue between the time the hay is loaded into the car and when it arrives at its destination, but with the exception of shrinkage by loss of moisture or shattering all losses will be indicated by the difference between the number of bales loaded into the car at point of shipment and the number received at destination. It has happened that hay has been stolen from cars at point of shipment, en route, or while in the railroad yards at destination. The handling of the cars in switching or shipping has jarred open the doors and allowed some hay to fall out before the fact was noted and the door closed. Cars have been switched from unloading yards before all the hay has been taken out. Parts of carloads have been destroyed by fire and damaged by water during the process of unloading. The liability for such loss or damage is upon those responsible for it or in whose possession the hay was when the loss occurred. It is usually customary, and in some cases necessary, for the shipper to present the claim for loss against the railroad, or other agency responsible for it, and he must have the proper facts to present with the claim in proof of its justness if he would be reimbursed.

The fact that fewer bales were unloaded from a car than were loaded into it, together with statements of the loading and unloading weights, is the strongest proof of a loss, and the shipper is entitled to, and should have, together with an official weight certificate, an official statement as to the condition of the car and the number of whole and broken bales or amount of loose hay unloaded from it. In a number of large markets it is not now possible to give such a statement, because no record is kept of the number of bales unloaded from the cars.

NUMBER OF DRAFTS SHOULD BE RECORDED.

A record of the number of drafts weighed from each car should also be furnished the chief weighmaster and all drafts from any carload should be weighed upon the same scale. An instance was noted recently in a large market which issues official certificates, of a claim by a shipper of a loss of about 9,000 pounds on one car of hay shipped to that market. An investigation disclosed the fact that the hay was weighed over two different scales and there seemed to be a strong probability that one draft was not weighed at all. Conditions making such practices possible should be eliminated, and it is thought that they could be eliminated by proper policing and weighing regulations.

THE WEIGHT CERTIFICATE.

Because of the difference in the weighing practices at the different markets the form and contents of the official weight certificates are not uniform. In most instances, however, the official certificates now in use give only the car initial and number and the total net weight of the hay (fig. 6).

The illustrations on pages 20 to 23 are copies of certificates used in several of the important markets. The reader will note that several do not state the number of bales weighed. Only one provides for the weight of the loose hay, and none of them contain all the information necessary for the preparation of a claim for a loss or shortage in weight.

Official certificates would be made of more value to those interested in them if more detailed information were given and if items which would better identify the hay were added.

NEW ORLEANS BOARD OF TRADE, LIMITED.

HAY INSPECTION AND WEIGHING DEPARTMENT.

CERTIFICATE OF WEIGHT of........BALES HAY, weighed for account of M..
Car No. and Initial........................ Ex...........................

Good.................................... Bales weighing............pounds.
Old stained...
Car stained...
....
....
....
New Orleans, La.,..................19... ....
Secretary.

FIG. 6A.

No..........
STATE CERTIFICATE OF WEIGHTS AND MEASURES. ORIGINAL.

AUSTIN, TEXAS........................
Weighed for..............................of ....Texas,
the following articles consigned or sold to...................................
of........................, Texas. Weighing charges..............

Article.	Gross wt.	Tare.	Net wt.	Condition.	Remarks.
....	....	....	....	....	....
....	....	....	....	....	....
....	....	....	....	....	....
....	....	....	....	....	....
....	....	....	....	....	....
....	....	....	....	....	....

This is to certify that I have this day weighed the above described articles and that the weight and conditions, as set forth, are true and correct.

....
Certified Public Weigher.
By..................Deputy.
Driver on / off
Precinct No........., ...County.

FIG. 6B.

OFFICIAL CITY SCALES.
1605 Nineteenth Street.
BONDED.

W
T
Price..........

No. 2.

DENVER, COLO....................191..

....

Load of.................

From...................

To....................

Gross						Lbs.
Tare						Lbs.
Net						Lbs.

....
Weigher.

FIG. 6C.

Car.	Wagon.	Destination.	Bales.	Gross.	Tare.	Net.

FIG. 6D.

CAIRO BOARD OF TRADE.

HAY DEPARTMENT.

OFFICIAL CERTIFICATE.

CAIRO, ILL.,....................

This is to certify that I have weighed the contents of car.......... For .... and found same to contain .... pounds of hay.

...................., Weighmaster.

...................., Deputy.

Bales.	Grade.	Weight.
....	....	....
....	....	....
....	....	....

Condition of car.

Roof..........................

Doors.........................

Sides.........................

Seals ..{Side.......................
Side.......................

FIG. 6E.

WEIGHT CERTIFICATE

[ORNAMENT.] Issued by

KANSAS CITY HAY DEALERS ASSOCIATION

KANSAS CITY, MO.,.................... No......

This certifies that our sworn and bonded Weighmaster weighed car as specified below at .... from .... Ry. and that the weights shown hereon are correct.

Consignee.	Car No.	Initials.	Contents.	Bales.	Weight.	Total weight.
....	....	....	....	......	....	....
....	....	....	....	......	....	....
....	....	....	....	......	....	....
	Broken bales av'g. wgt.					

Shatterings Estimated .... lbs.
Not included in total weight.

....
Weightmaster in charge.

FIG. 6F.

(ORIGINAL)

Department of Supervision of Weights, of the Merchants Exchange of St. Louis.

Office of
JOHN DOE,
Supervisor,
Merchants Exchange.

ST. LOUIS, ...

This certifies

that

....

actually saw the weighing of the contents of

Car.........initial.........on the.........day of.......
Loaded at

....

And the same contained

Lbs. of......................

Fee

..............................Supervisor.

Side seals Side seals End

FIG. 6G.

Form 8-B ORIGINAL No. ......

OUT—OFFICIAL WEIGHT CERTIFICATE

CINCINNATI GRAIN AND HAY EXCHANGE

This certifies that CINCINNATI, OHIO, ...19..

Car.................. No...................

was officially weighed by deputy weighman.......................and that the weight is

Weight gross..........lbs.

.... Tare..........lbs.

.... Net...........lbs.

.... Net...........lbs.

.... Net...........lbs.

Length of car.........feet. .... Net...........lbs.

Marked capacity......lbs. .... Net...........lbs.

Condition of car........Examined by............Line delivered to..........

SEALS

Side.......... ....,

Weighmaster

Side..........

End.......... By...................

FIG. 6H.

An official certificate should state the date of weighing, the initial and number of the car in which the hay arrived; the number of drafts in which the hay was weighed from the car; the size of the bales (stating the exact measurements, the number of wires, or the commercial size designation); the number and weight of the whole or unbroken bales; the number and weight of the broken bales; the weight of the loose hay; the name or title of official weighing the hay; and the official record number. A space should also be provided for noting the condition of the car. Such a certificate is shown on page 25.

All these items are essential if an official certificate is to serve as evidence of the outturn weights of a car of hay and conditions affecting them, and is to be used to substantiate claims for losses in weight that may occur some time during the course of marketing. Anyone interested in such claims is entitled to the necessary information, and it should be furnished on the official weight certificate for which a charge has been made, presumably of a sufficient amount to pay for adequate service (fig. 7).

.... 192..
Name of City. Date.

THIS IS TO CERTIFY THAT THE HAY contained in car ....

No. .... was weighed this day by .... and the correct weight was found to be as follows:

.... Whole bales: Gross........lbs. Tare........lbs. Net..........lbs.
Number.

.... Broken bales: " ....lbs. " ....lbs. " ....lbs.
Number.

Loose hay: " ....lbs. " ....lbs. " ....lbs.

Total net weight............lbs.

Size of bales .... Car weighed in .... draughts.

Condition of car was as follows ....

Official record No. ....
Chief Weighmaster.

Official seal ( ). ....
Deputy Weighmaster.

Last date on which scales were officially tested ....

FIG. 7.—Form of official certificate which will provide necessary information upon which to base a claim for loss in weight.

WEIGHING ON RAILROAD TRACK SCALES.

There are no data available relative to the amount of hay weighed on railroad track scales, but such weights are used in some territories to a considerable extent. Railroads weigh shipments over their lines in order that proper freight charges may be assessed.

These track scales are maintained at convenient points which are designated as track scale stations and cars to be weighed are switched over the scales at these points and the weights obtained.

OBTAINING THE WEIGHT.

Methods of weighing the gross and tare differ slightly at different scales. The usual practice is to pull or push a train of several cars over the scales and to stop, as each car comes onto the scale, a sufficient length of time for the weigher to obtain the weight of the car. The car is sometimes uncoupled from the other cars at both ends, sometimes at only one end, but the most common practice is to stop the car on the scale with the slack taken up so that the coupling at either end does not bind with the couplings of the cars attached.

It is claimed that when the couplings do not bind cars can be weighed accurately by this method. The difficulty is that it is frequently impossible to stop cars so that couplings will be entirely free from the influence of the cars attached to them. There is also the danger during the rush of weighing that the car will not be brought to a stop upon the scale and the weigher is then compelled to "catch" the weight as the car passes slowly over it. Weights obtained in this manner are likely to be inaccurate, are not fair to anyone concerned, and should not be used as official weights.

The correct way is to weigh the car standing still and uncoupled at both ends. As the scale track, when a car is on it, is lower than the track adjoining at each end, if the slack is taken up taut, especially in a long string of cars, the weight indicated will be less than the actual weight. Conversely, in a long string, with no slack taken up, the weight indicated will be greater than the actual weight.

Care must be taken also in weighing cars during a high wind, as the weight of a car may vary several hundred pounds between the highest and lowest pressure of the wind.

Some railroads have installed automatic weighing devices at scales where considerable weighing is done, which greatly facilitate the weighing and guarantee correct weighing if properly operated. The device or recorder is attached to the end of the weight beam and eliminates the use of the poise weight. The movement of the beam, which is regulated by balance weights in the mechanism, causes a wheel upon which weight designations are set in type to revolve until the number indicating the weight of the load is in position to print the amount upon a ticket.

Tripping levers are placed alongside the car rail at each end of the scale which indicate the passing of the car onto and off the scale and also operate the printing mechanism. Cars which are to be weighed are pushed upon the scale or rolled onto it from a slight incline or hump. A ticket is placed in proper position in the recorder mechanism. As the car passes clear of the first tripping device onto the scale, the beam comes to a balance automatically and the printing arrangement is released and stamps the weight in 100 pounds upon the ticket. As the car passes off the scale the second tripper is operated and sets the weighing attachment for the next car.

It is claimed that this weighing mechanism will weigh and record the weights accurately so long as the car does not pass over the scales at a speed greater than 5 miles an hour. It is necessary for cars to be free from each other, however, and unless the first car has passed the second tripping arrangement the following car can not be weighed.

THE TARE WEIGHT.

When cars are weighed by railroad companies the tare weights stenciled on the cars are usually used, as there is no opportunity to weigh the empty car. Railroad cars are weighed when put into service and usually after any extensive repairs have been made. New cars are also generally reweighed after they have been in service for some time, when the material may have seasoned and dried out. The weights as found at such weighings are stenciled upon the side of the car and are used as the weight of that car until it is reweighed. Any repairs made by private shippers, any coopering that may have been done, any loss of doors or lining, or any other damages are not included in the stenciled weights. Snow or ice on the car will materially affect its weight, as will also excessive moisture.

It is therefore true that the stenciled weight frequently does not represent the current weight of the car, and net weights obtained when using stenciled weights may be incorrect to the extent of several hundred pounds. If stenciled weights are to be used as tare weights it should be known that no changes have been made in the car since it was last weighed and stenciled.

A more satisfactory method of weighing by railroads would be to have the scales located at terminal markets and the loaded cars weighed as they are being switched to the warehouses and the empty cars weighed as they are taken away. Care would still be necessary, however, to keep the cars as free from snow, ice, trash, and other encumbrances when weighing the empty car as when weighing the load.

The weighmasters at some railroad track scales estimate the weight of any snow or ice that may be on the cars and add that amount to the tare weight, together with an allowance of about 150 pounds for the brakeman on the car when it is allowed to roll onto the scale from a hump or incline. A tolerance of from 200 to 500 pounds is not considered excessive in this class of weighing, and it seems doubtful whether such weights are sufficiently accurate to be relied upon as a basis for invoices or for claims for shortages or overcharges.

The condition of the scales is also an important factor. Unless scales are kept in repair, free from snow and ice, and in balance, the weights obtained from them will not be accurate. Track scales are usually tested with a test car. This car consists of a collection of large test weights mounted upon a set of trucks and kept at a constant weight. Most railroad systems have a test car operating upon their lines continuously, which visits each scale about once each month. Heating systems are also installed at many of the modern railroad track scales which keep the scales dry and free from ice and snow.

PRIVATE TRACK SCALES.

While the greater part of the hay unloaded at warehouses is weighed over platform or wagon scales, a number of dealers and warehousemen have track scales at their warehouses, over which they weigh the commodities they handle.

The same rules relative to the care of the scales that apply to wagon scales apply to track scales. They should be kept free from trash, and if not under cover must be kept free from snow and ice. They should be tested frequently and balanced daily, or even oftener, if weather or other conditions make more frequent balancings necessary.

At some warehouses scales are so placed that the car remains upon them while it is being loaded or unloaded; at others they are placed so that cars are moved over them when being switched to and from the warehouse. There is no material difference as to which location is used, but care must be taken to see that the car contains the same equipment when being weighed loaded and empty.

ACCURACY OF WEIGHTS.

All things considered, weights obtained on track scales in proper condition and located under cover are subject to fewer chances for error than weights obtained by any other method. The load is weighed in one draft, which overcomes the danger of omitting the

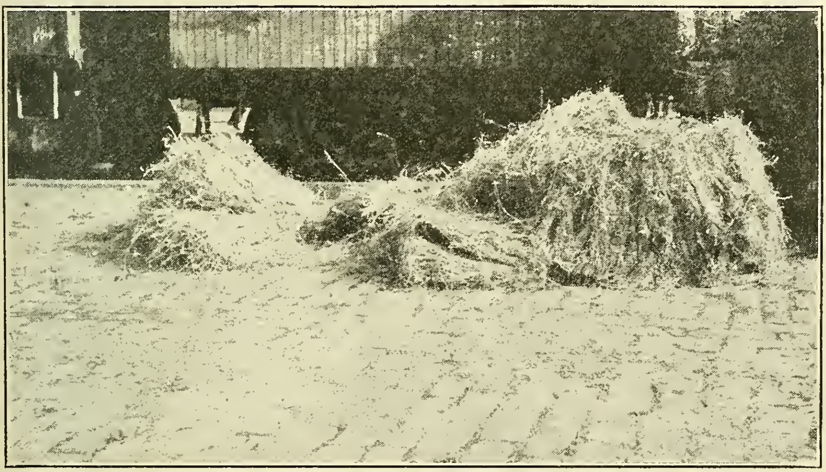

Fig. 8.—Broken bales, showing how losses may occur in terminal markets.

weights of any draft, as is possible when weighing on platform or wagon scales.

The tare is also obtained in one draft, frequently without any movement of the car from the time the gross weight was obtained, so that about the only chance of error is in tabulating the weight. If a registering beam is used, this chance of error also is eliminated.

Because of the great cost of track scales, however, and the fact that their use would be confined in most cases to one warehouse, they are frequently impracticable and generally can not be maintained, except by railroads or large concerns.

CERTIFICATES FOR TRACK SCALE WEIGHTS.

Certificates of weights for track scales should differ but little from other weight certificates, but since the weight is obtained in one draft the number of drafts need not be shown. All other items are of equal importance, whether weighed upon platform, wagon, or railroad scales.

TYPES OF SCALES COMPARED.

It can scarcely be said that any type of scale properly adjusted and balanced is more accurate and reliable than any other type of scale. The chances for an error, however, are greater when certain types of scales are used. When weighing hay in drafts of from 1 to 5 bales at a time each draft must be weighed very carefully, for the reason that a great number of drafts are necessary to weigh the amount in a car of hay and an error of only 1 pound on a draft when only one bale is being weighed at a time will amount to from 250 to 350 pounds on a car. If the hay is weighed on wagon scales, where only four or five drafts are sufficient to fill a car an error of 10 pounds on a load would make a total error of only about 50 pounds on a car. It is therefore apparent that the chances of error decrease as the number of drafts decrease. There are other factors, however, which affect the weighing on wagon and railroad scales. Some of these are the failure of the weigher to note whether the same persons or objects are weighed with both the gross and tare weights on wagon scales and the difficulty of obtaining a correct tare weight of cars weighed on track scales.

The convenience or practicability of a certain type of scale may be the principal reason for its use. A baler who must carry his scale with his baling machinery must use a small platform scale. Dealers owning warehouses may also find it more convenient to use platform or dormant scales, while farmers or country shippers who own wagon scales prefer to use that kind.

RELIABILITY OF WEIGHMASTER.

Since the type of scale does not necessarily affect the accuracy of the weights, it is apparent that the efficiency and reliability of the weigher is of great importance. All weighmasters should know enough about the mechanism of a scale to keep it in proper adjustment or at least to know when it is not in proper adjustment. They should know how to do the physical act of weighing properly and how to record the weights accurately and systematically. They should realize the responsibility of their position and should know the loss and trouble any error on their part is likely to occasion.

PROPER RECORDS.

Scales may be properly adjusted and weighers may be accurate and efficient, but if the weights are not properly recorded and the proper data furnished with them they lose a great part of their value to the interested parties. In the weighing of market hay accurate and complete records of all weighing operations should be made and recorded by every interested party, from the producer to the consumer.

The producer should have an accurate record of the amount of hay baled, so that he can settle his account with the baler and can intelligently offer his hay for sale. If his hay has been weighed on a small platform scale and been tagged, he should record the weights on a tally sheet similar to the one suggested in this bulletin.

WEIGHT CERTIFICATE FOR COUNTRY HAY SHIPPER.

.... 1921.
(Place.) (Date.)

This is to certify that I have weighed correctly and loaded into car ....
(Initial.)

number .... bales of hay weighing ....lbs.
(Number.)

The hay was weighed and loaded as follows:

Datailed weighing information.					Detailed loading information.		
	Bales.	*Lbs. gross.*	*Lbs. tare.*	*Lbs. net.*		*Brake end.*	*Opposite end.*
1st load....	......	......	......	......	1st tier......	....Bales.	......Bales.
2nd "	......	......	......	......	2nd "	.... "	...... "
3rd "	......	......	......	......	3rd "	.... "	...... "
4th "	......	......	......	......	4th "	.... "	...... "
5th "	......	......	......	......	5th "	.... "	...... "
6th "	......	......	......	......	Doorway	.... "	...... "
7th "	......	......	......	......	Total.......	....	....
8th "	......	......	......	......	Size of bales.	....	....
Total.....	......	......	......	......	Seal numbers	....	....

....
(Weigher.)

Last date on which seals were officially tested ....

FIG. 9.—Form for weight certificate for country shippers.

The country shipper should also have a correct record of the amount of hay bought from each farmer and also of the amount loaded into each car. If the hay is bought from the farmer on tagged weights the shipper should know that the amount marked on the tags represents the current weight of each bale. He should also use some form of tally sheet which will give him an accurate idea of the number and weight of bales bought. If the hay is bought on the condition that it is to be weighed over wagon scales a record should be made of the number of drafts and of the gross, tare, and net amount of each draft. It would also be well to have the number of bales of each draft recorded on the weight ticket or in the scale book.

When the shipper loads the hay into a car the number of bales in each tier and in the doorway should be recorded, together with the total number of bales and the total weight, and these data should be furnished the buyer of the hay on a weight certificate signed by the shipper or the weigher. (Fig. 9.)

In terminal markets all data relative to the weight should be carefully recorded. These data should include the number of bales found in each tier and in the doorway when the car was unloaded; the total number of whole and of broken bales, together with their total net weight, and the weight of any loose hay; and information as to the condition of the car and seals upon arrival. The number of bales in the tiers and doorway can be used as a check against other counts of the bales and should be given when possible, but is not so important as the total number of whole and broken bales. The latter should always be given, as it is as important as the count of any other commodity where a carload is composed of smaller units.

The official weight certificate has already been described on page 24, and the data which should be given on it are stated there.

Receivers and consumers who weigh the hay received by them should furnish the shipper the same character of information as that suggested for the terminal markets, as all the information mentioned is required in case anyone interested in the hay desires to present a claim to the transportation company or other agency for any loss in weight.

Receivers should always weigh the hay which is received by them in order that they may be sure no loss has occurred in shipment and no error has been made by the shipper.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 979

Contribution from the Bureau of Markets
and Crop Estimates
H. C. TAYLOR, Chief

Washington, D. C. October 22, 1921

MARKETING HAY THROUGH TERMINAL MARKETS.

By G. A. Collier, *Investigator in Hay Marketing*, and H. B. McClure, *Specialist in Hay Marketing*.

CONTENTS.

Unusual difficulties are encountered in the marketing of hay. In the first place, it must be marketed in the same physical condition in which it is produced and can not be conditioned or graded in the same manner as fruit, grain, or vegetables. Another difficulty at present is the lack of uniformity in business practices. This is due principally, it is thought, to the fact that the business is comparatively new and is not yet sufficiently organized to overcome the wide variations in the trade practices in the different markets. The differences in the character of the hay marketed in the various sections of the country and the variations in the demand for the different kinds of hay are also factors which have hindered uniformity. Grading and weighing methods have not been standardized to any great extent and many losses and much difficulty is attributed to this fact.

Shippers and dealers in different sections of the country have formed organizations for the purpose of improving methods and practices in the marketing of hay. These have no doubt accomplished a great deal, but there is still need for much improvement in the methods of weighing and inspection and for more uniformity in the trade practices in the various markets. There also seems to be a need for a better understanding between shipper, dealer, and receiver and a greater spirit of fairness in the dealings between the different factors interested in the marketing of hay.

53884°—21—Bull. 979——1

The purpose of this bulletin is to describe the customs and practices prevailing in the various markets in order that producers and others interested in the marketing of hay may know and understand the conditions that must be met in the handling of that commodity. The information contained in this bulletin was obtained from a survey covering practically the entire country, including all of the important hay markets.

Three rather well-defined agencies have grown up in the United States for the marketing of hay. These are country shippers in producing sections, dealers and commission merchants in terminal markets, and wholesalers and retailers in consuming sections. The activities of each of these agencies are fairly well defined and each serves a particular purpose. Not all marketed hay passes through all three of these agencies, but a large part of it does and the most economical method of handling at this time, seems to be that which employs one agency to collect the hay into shipping quantities, another to locate the best markets and forward the hay to them, and another to distribute in the quantities desired by the consumer. Efforts have been made from time to time to eliminate one or more of these agencies in order to lessen the cost of distribution, but at this time the bulk of the hay is probably marketed by the method just described, or some modification of it.

COUNTRY SHIPPERS.

The country shipper collects the different lots of marketable hay in his territory into carload or shipping quantities. In large surplus producing sections he may devote his whole time to this business, in fact may own warehouses and employ several other men; in smaller producing sections he may ship hay as a side line of some other business.

In grain-producing States the grain merchant is frequently the hay shipper. In some sections the cattle buyer is the hay shipper. Where the amount of hay shipped is not sufficient to pay a man to devote his whole time to the business it is usually handled by a person engaged in the marketing of some other important product of that territory. It is also frequently true that the producer who raises several carloads ships his own hay and possibly some of his neighbors' hay.

Individual producers, however, usually do not ship their own hay unless they are close to a good market or unless they have a sufficient amount to warrant spending the time and money necessary to locate a buyer. The greatest difficulties that producers encounter in the shipment of their own hay are the lack of information as to the grade requirements and trade practices prevailing at the terminal markets and the lack of sufficient hay to build up a permanent trade if they desire to ship direct to consuming territories. Consumers who must have a constant supply prefer to deal with those upon whom they can depend for shipment whenever supplies are needed. The latter difficulty has in some places been overcome by the formation of cooperative shipping organizations which are able to meet the requirements of consumers in regard to quality and supply.

THE BUSINESS.

The number of cars of hay handled by country shippers varies greatly. In sections which have only a small surplus a shipper frequently does not handle more than 10 or 15 cars a year and these in connection with some other business. In other and larger producing sections a shipper may handle and ship from 100 to 500 cars from his immediate territory. It appears, however, that on an average, 200 to 300 cars represent a good year's business for a country hay shipper, unless he ships from a number of different points.

Management.

Some time and experience are required to build up a profitable shipping business. The country shipper must be in a position to meet all competition and pay the producer the best market price, all factors being considered. To do this he must in turn be able to market the hay advantageously. Upon the solution of this problem depend his success and the measure of his service to the producer. If in the marketing of hay he can not render service equal to the amount charged for his service he is not an economical factor in its distribution.

To market his hay successfully the shipper must first know the requirements of the various available markets, as to the character of hay and the size and weight of bales. Some markets pay a premium for straight unmixed timothy hay; others pay as much for good light clover mixed as for straight timothy. Large bales weighing from 200 to 250 pounds sell at higher prices than the smaller bales in some markets while in others the opposite is true. In some sections hay must be "tagged" with the weight upon each bale, in other sections such weights will not be accepted. The shipper must, therefore, familiarize himself with all the conditions and must also select honest and reliable receivers. To obtain this information and experience may require several years, depending upon the ability of the shipper.

Capital.

The capital required depends principally upon the volume of business transacted. The dealer who ships only an occasional car needs but little more money than the value of one car of hay, while the dealer who stores a large amount or who ships a large number of cars in a short period of time requires capital equal to the value of the hay stored or of the hay in transit. While banks will advance about 80 per cent of the value of drafts drawn against shipments of hay and will loan money upon hay in storage, it is usually required that the shipper's credit be equal to the risk assumed by the bank in making such loans and advances. At the same time, if shipping facilities are good and the hay is delivered promptly at destination rather a large business may be conducted with limited capital, probably not exceeding $3,000 to $5,000.

In sections where buyers will pay drafts drawn at sight, the shipper can conduct a larger business on less capital. for the reason that he is without the use of his money only as long as it takes the draft to reach the buyer's bank at destination and the remittance to return to the shipper's bank. In many sections, however, buyers will pay drafts drawn "on arrival" only. In this case the shipper must finance the shipment during the whole time it is in transit and if his capital is limited he is often forced to curtail his shipments until the proceeds are received from drafts for cars previously shipped. When freight movement is slow or shipments are rejected because they are not up to grade, or not delivered according to contract, or for some other reason, the shipper with limited capital is frequently greatly handicapped. These business difficulties of the country shipper, however, are seldom shared by the producer, who is usually paid cash for his hay when it is delivered to the car for shipment.

The amount of speculation practiced in the marketing of hay seems to be very limited. Some shippers with warehouses fill them with hay when cars are not available or prices seem relatively low. Other shippers frequently contract for considerable hay to be shipped in 30 to 60 days at the convenience of the producer. In both instances, however, the shippers are merely accumulating sufficient stocks to insure a constant supply for their customers. A few instances, however, have been reported where shippers expecting an urgent demand for hay have bought up large quantities, securing ownership by the payment of a nominal sum. In such cases contracts are frequently broken if the market does not move in the desired direction.

Shippers permanently located in a territory usually handle hay in the same way as any other commodity and generally upon a reasonable margin of profit.

LOADING THE CARS.

The manner in which cars are loaded is a factor which frequently has considerable influence upon the price for which the hay sells. Hay from a shipper who has a reputation for always loading cars uniformly generally sells at a premium over hay from a shipper whose loading methods are unknown to the buyer. Hay loaded carelessly into a car invariably brings less money in an open market than that loaded in an orderly and systematic way. Uniform loading as understood by the trade in the various markets is the loading of an entire car, or designated part of a car, with hay of the same character or quality in a systematic manner.

Methods.

The proper method of loading when the bales are of the sizes designated as quarter or third bales, i. e., bales ranging from 14 by 16 inches to 17 or 18 inches by 22 inches, is in tiers of 16 to 25 bales each, beginning at each end of the car and tiering toward the doorway. Figure 1 illustrates the method of loading in tiers. Four or five tiers can usually be loaded in each end of a car up to the doorway.

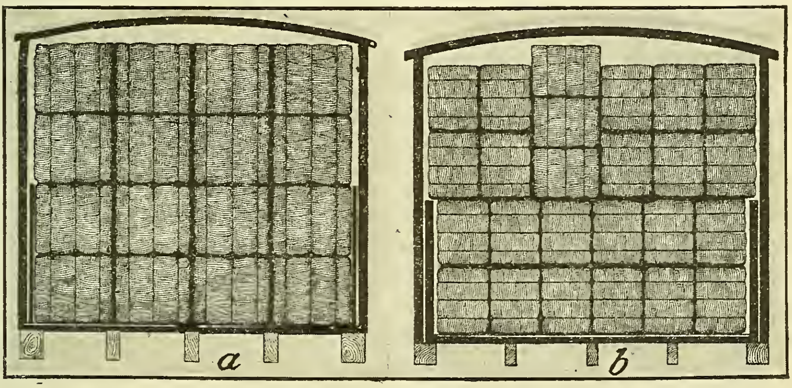

Fig. 1.—Proper method of loading cars to utilize all the space: (*a*) Bales 17½ by 22 inches, 16 bales per tier; (*b*) bales 14 by 18 inches, 25 bales per tier.

Two tiers can usually be loaded in the doorway and if the bales are not too long should be loaded so that the ends of the bales are exposed to view. It also adds to the appearance of the car if any unevenness in the length of the bales in the doorway is allowed for on the back of the tiers. This keeps the longer bales from projecting into the doorway and interfering with the closing of the door.

The large box-press bales weighing from 175 to 225 pounds must be loaded differently. In most cars such bales seem to load best by placing two together end to end across the car and flat upon the floor, then placing two more on top of them and continuing in this manner until the tier is full, always beginning at the end of the car. Eight bales can be loaded in each tier in most cars. Tiers are then added until the car is filled. When, because of the space consumed by the lining in a car, two bales will not fit into the car end to end, four bales are set on end, flat sides together, then four more on top of them, either on end or flat, as in the tiers first described. As a rule, however, that method of loading is best which allows the greatest number of bales to be loaded in a regular order, because it is always possible to load as many or more bales in regular order as in any other way and buyers prefer that the hay be loaded in systematic order.

An exception to the rule just stated should be made for the loading of new hay. This hay, when baled from the windrow or early in the season, may contain so much moisture that it will heat and mold if packed too closely in the cars. When loading new hay, the bales should be placed on end and far enough apart to leave a small space for the circulation of the air between the bales. It can then be shipped a considerable distance without danger of heating and spoiling. It is usually impossible to load a car to the required minimum weight by this method but the premiums which early arrivals of hay on the market usually command are generally more than equal to the added cost of freight.

Warehousing.

The facilities of the shipper constitute a principal factor affecting the loading of cars. If the country shipper has a warehouse into which he can place the hay as delivered by the producer it is always possible for him to grade the hay properly and to load the cars uniformly. This, however, is not always done. The hay as received may be of fair uniformity as to grade, and competition for business, especially if the demand is poor, may be such that the shipper can not incur the expense of warehousing the hay and at the same time meet the prices at which hay is being offered by his competitors.

No complete data are available as to the cost of marketing hay through a warehouse. Shippers estimate the cost at amounts ranging from 75 cents to $1.50 per ton. In one instance, however, an accurate record was kept of the cost of warehousing hay on rather a large scale. In 1910 a company composed of prominent and experienced hay dealers was formed at Cleveland, Ohio, to handle hay in an up-to-date manner through a modern warehouse. Railroad facilities were good and no charges were made for switching hay to or from the warehouse. It was the purpose of the company to buy from country points where loading facilities were poor and ship on transit privileges to the Cleveland warehouse, where the hay was to be unloaded, graded, reloaded, and forwarded to consuming sections. The handling facilities were modern and labor costs were not high. It was found, however, that the cost of unloading, classifying, grading and reloading the hay was $1.09 per ton. The cost of the same operations in a warehouse not so efficiently operated would no doubt be higher, while at country points where the labor required could be used for other purposes when not needed for handling hay the expense would probably be slightly lower. Practically all the handling of hay at warehouses is done by laborers and no machinery other than hand trucks is used. A few warehouses in the country are equipped with machinery for handling the hay and a considerable part of the work is done mechanically. In a warehouse located at Saginaw, Mich., the hay is unloaded from the car onto chain conveyers which carry it to the top floor and over to a grading floor located above the central part of the warehouse. An experienced grader stands at the end of the conveyor and classifies the hay. When classified it is pushed into one of three chutes which lead from this floor to three different locations on each of three floors below. Switches or gates

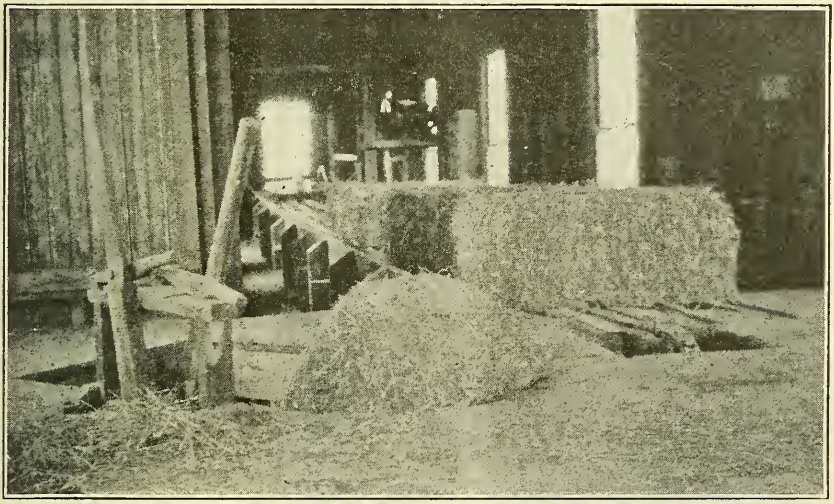

Fig. 2.—Grading floor in Michigan warehouse. The bales are graded as they are delivered by the chain conveyor. When graded the bales are placed in one of three chutes which delivers them to the floors below. The entrance to one of the chutes is shown at the left. The levers control the gates on the floors below.

in these chutes may be set so that the hay can be placed in the desired location on any of the three lower floors. It is then piled with other hay of similar quality (Figs. 2 and 3). When the hay is to be reloaded it is placed in the same distributing chutes with the switches set so as to discharge the hay onto a conveyer on the ground floor, which delivers it to the car. By this method a carload of hay can be unloaded, graded, and stored quickly or reloaded into another car. With 10 men this complete operation, with the exception of the reloading, can be accomplished in 15 minutes. Six men usually are employed, however, and it takes about an hour to unload, classify, and store the hay in the warehouse. It is estimated that the cost of handling hay through such a warehouse is about $1.50 per ton.

Another factor entering into the cost of warehousing hay is the "transit privilege." Some railroads allow dealers owning warehouses situated on their lines the privilege of unloading hay into their warehouses, of grading it, storing for a period not exceeding 6 months, reloading and rebilling it upon the through rate. While the stop-off charge is from $2 to $3 per car, this is more than covered in most instances by the difference between the through rate and the combination of local rates which would apply if the hay were shipped only to the warehouse, and after a time reloaded and shipped to a consuming market. Many roads do not allow transit privileges, however, which is probably one of the reasons that practically no hay warehouses are in operation in some sections of the country.

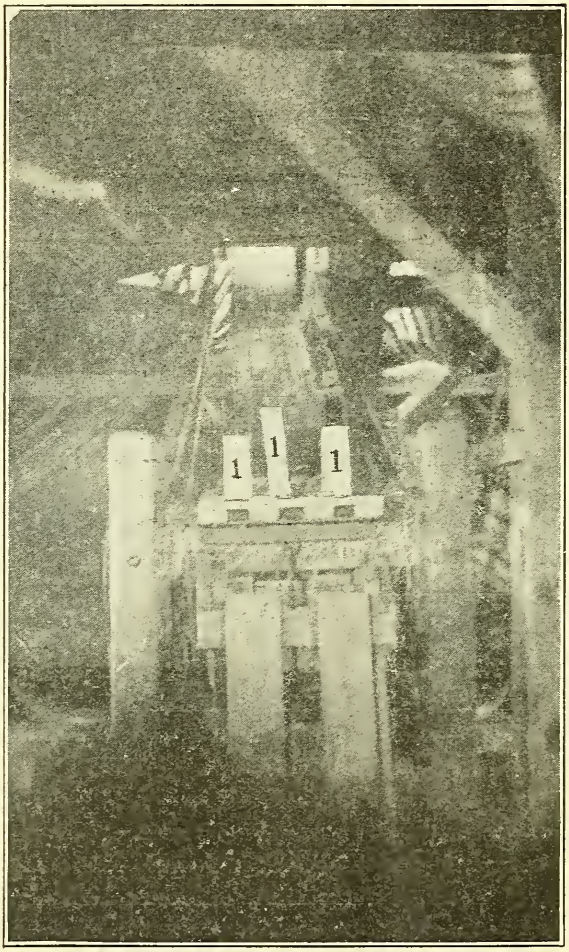

Fig. 3.—One of the gates in distributing chutes. When the pieces numbered 1 are in the position indicated the bale is stopped and its weight opens a trap door in the bottom of the chute. This allows the bale to drop into another chute which delivers it to the floor below. When the pieces numbered 1 are pulled down by the levers shown in Fig. 2 the bale shoots over the trap door onto this floor.

While no complete data are available as to the costs of marketing hay through a warehouse, studies and observations made indicate that on an average hay that has been classified and graded by being handled through a well-equipped warehouse would have to sell about $1 above the price of hay loaded directly into the car. It is asserted that while buyers are frequently dissatisfied with hay that is not of uniform quality throughout the car, they frequently will not pay the extra amount charged for the classified hay.

Plugging.

Country shippers sometimes indulge in certain unfair practices. The most prevalent of these is the "plugging" of cars. "Plugging" consists of placing one or more bales of inferior hay in the tiers of good hay. This inferior hay is usually loaded only in the tiers back from the doorway, where it will not be seen during the inspection which is now conducted in most markets, and where the buyer will not find it until he has paid the draft and has the car partly unloaded. In some cases it is evident that hay of inferior quality has been deliberately placed in tiers with hay of the quality stated in the terms of sale with an unmistakable intent to defraud. Country shippers loading direct from wagons may also be guilty of this practice.

Shippers engaged in plugging excuse their acts by claiming that the feeding value of the lower grade hay is about equal to that of the higher grade, that since such hay is produced it must be marketed, and that this is about the only means of disposition. Receivers in consuming sections say that the practice is not confined to any one shipping section and estimate that probably 10 per cent of all cars received show evidence that inferior hay has been intentionally loaded with the better hay.

Regardless of the conditions under which plugging practices are carried on, they are unfair and dishonest, and commercial organizations interested in the marketing of hay can advance the cause of improved marketing methods by penalizing or barring from membership and privileges shippers or dealers guilty of such practices.

Difficulties.

Country shippers who do not own warehouses often find it almost impossible to load cars of uniform quality because of certain conditions of production, handling, and transportation.

The methods of growing, curing, and storing affect the quality of hay. Producers in some parts of the country are very careless with their meadows and instead of plowing and reseeding them when weeds, grass, or briers appear, they continue to cut the hay as long as there is a trace of the original kind of grass planted. Hay cut from such meadows can not be of uniform quality and if loaded directly into a car is sure to cause trouble and loss. Again, some of the hay, even from a clean meadow, may get wet and damaged in curing. If the producer places this hay with the good hay in his mow or stack the quality of the product when baled out for market will not be uniform. Some bales will be of good quality and some of poor quality and some bales will contain both good and poor hay. It is almost impossible to classify and grade this kind of hay even through a warehouse. Improper storage may also cause considerable difficulty and does not contribute to uniform loading. Hay stored in barns which are out of repair is frequently damaged from the weather. A leak in the roof may cause a damaged spot several feet in diameter and several feet deep in the mow. Although the baler may not intend to mix this damaged hay with the good, part of the bales are likely to contain some of the damaged hay and if these bales are not separated from the others they will probably cause a discount on the price of the whole carload. Similar troubles may be experienced when hay is baled from a stack from which all weather-damaged hay has not been taken before baling. Damaged hay left on the sides of the stack is sure to appear in some of the bales, so that the quality of the lot will not be uniform.

The quality of a car of hay may not be uniform because of conditions of handling. Several different lots may be loaded into the same car. Where country shippers have loading sidings but no warehouses, the hay is generally loaded into the cars just as it is delivered by the producer. If the shipper or his representative is present to see that the hay delivered corresponds in quality to the grade bought he may sort out the badly damaged bales and refuse to take them. Frequently, however, the shipper has bought the hay by the lot at a specified price and the producer insists on delivering without regard to variation in quality. If enough hay is being delivered to load several cars at a time the shipper may be able to classify the hay and load the different grades into different cars, provided he can get the cars as needed.

Some shippers depend upon producers to load their own hay, and this practice often causes considerable difficulty. Because of their lack of opportunity to familiarize themselves with the grades of market hay, producers usually do not comprehend the need for loading cars exclusively with hay of a certain grade or mixture. They usually assume that the best grade of hay is the kind relished by their own stock, but grades based principally upon color and mixture are used as the basis of quality by buyers and receivers. Producers, therefore, can not be expected to classify and load their hay according to the grades desired by a buyer in some section of the country the requirements of which they have had no opportunity to learn.

Ability to obtain cars as needed is one of the factors in uniform loading. The shipper may order two or more cars to be placed at his loading point and may receive assurance from the railroad agent that they will be there on a certain date. He therefore arranges with the farmers from whom he has bought lots of hay to begin delivery on that date. The short time allowed by railroads in which to load cars makes it necessary to begin loading promptly after the cars are placed. When hay must be hauled some distance, the shipper frequently arranges to have some of it on hand when the cars arrive.

It very often happens, however, that the shipper does not receive the number of cars ordered. If he has ordered four he may receive two. When this occurs some of the hay intended for the other cars must be loaded into those received, as it is usually impossible to persuade the producer to haul the hay back to his barn and deliver it at a later date. This circumstance results in loading cars of a mixed quality unless all the hay of the various lots is of the same quality, which is frequently not the case. Again, the lots of hay delivered may be in excess, possibly 10 or 12 bales, of the capacity of the car. By the terms of the sale this hay must be accepted by the shipper, who, not having place to store it, places it into another car being loaded at the same time, but which possibly contains hay of an entirely different quality. This accounts for the few bales of clover or clover mixed which receivers sometimes find in a carload of timothy.

Some shippers who do not have regular hay warehouses have small storage sheds or barns where they place the few bales of hay of inferior quality or of different grade which the farmers deliver with their other hay. When enough has accumulated to make a carload it is loaded and shipped to some market where it can be graded and sold on its merits.

As the marketing of hay is conducted at this time, it is part of the business of the country shipper to know the quality and grades of hay that are desired by buyers in the various markets, and the distant buyer certainly has a right to expect the country shipper to know the character of hay contained in the cars he is offering for sale.

The function of the country shipper is to collect into shipping quantities the various lots of hay which producers have to sell, and to see that they are weighed correctly and classified and loaded so that the quality of the hay will be as uniform as possible and of the grade specified. If he does not do these things he is not rendering a service commensurate with the charges exacted and should not be considered as an economical factor in the marketing of hay.

SALES AGENCIES.

There are a number of agencies to or through whom the country shipper may sell, and the terms of sale vary as the hay is sold to different buyers, in different sections, or under different market conditions. The four principal agencies are consumers, wholesalers and distributors, track buyers, and terminal markets. These may not all be available at the same time, but one or two are always in the market and afford practically as continuous a market for hay as exists for grain.

Consumers.

Sales may be made direct to the consumer. Shippers located in sections tributary to large consuming markets can very conveniently make sales and shipments direct to consumers who are carload buyers of hay. It is also possible to sell to consumers located in more distant sections, but there is more difficulty in establishing and maintaining a business contact with such customers. When dealing with near-by consumers the seller can keep in touch with the needs of the customer by personal visits or by telephone and thus anticipate his needs and be in a position to fill them promptly. When the buyer is located at a distance, more difficulty is experienced by the shipper in supplying his needs. After a shipper through advertisements, correspondence, or visitation, either personal or by a representative, has secured a number of consumers as customers, he still has the problem of holding their trade.

The desires of shippers to obtain the highest market price for their hay and of the buyers to obtain their hay at the lowest market price are the principal reasons for the practice of marketing direct from country shipper to consumer. Some buyers are of the opinion that they can obtain better hay, or at least hay better suited to their needs, if they can buy direct from a reliable shipper located in a territory producing the kind of hay desired. On the other hand, consumers in some sections prefer to buy only from a broker, distributor, or local representative of the shipper. The difficulty of obtaining the quality desired and of creating and maintaining satisfactory business relations seems to be the principal objection to buying direct from country shippers.

Although the country shipper may sell direct to the consumer, he must meet competition from other shippers. To do this successfully he must make an effort to obtain his customers in the territory to which he has the most advantageous freight rates; he must learn the character and grade of hay that his customers desire and need and must have and maintain a supply sufficient for his customers' needs at all times.

Difficulty of maintaining a satisfactory supply is one of the important reasons accounting for the relatively small amount of hay marketed direct from shipper to consumer. It takes either a long time or considerable expense to obtain good customers in distant markets, and if the dealer can not make shipments as the hay is needed, the customer is forced to seek a new source of supply and is then generally lost to the shipper. It is therefore necessary for shippers to have a good volume of business distributed throughout the year or a large storage. Many country shippers do not have these.

Because of light crops in some sections and heavy crops in others, the direction of movement is frequently changed and shippers who have established a good business with consumers in a particular territory find that they can not meet the competition from shippers located in the sections of temporarily heavier production. It therefore has developed that the marketing of hay direct from country shipper to consumer is confined largely to shippers tributary to large consuming sections or markets, or to shippers or associations with a storage or a large volume of business well distributed throughout the year.

The terms of sale depend somewhat on the method employed in making the sale. If the sale is by personal call or telephone, or even by letter, the terms respecting grades are usually more descriptive. Grade designations may not be mentioned, the sales being made on description, using local terms, such as "good feeding hay," "half and half," "good dairy alfalfa," "choice barn hay," etc., both buyer and seller being familiar with the quality of the hay to which the various terms are applied in their section or market.

Sales by letter may be made on the same trade terms; but as sales by letter are usually made when the buyer and seller are located at more distant points, there may not be the same mutual understanding of local trade terms. It is therefore generally necessary to use more widely known terms, such as No. 1 timothy or No. 1 alfalfa. A description of the hay, however, is usually added in order that there may be the best understanding possible.

In sale transactions by telegraph, brevity and the use of code words make it necessary to use grade designations only and both buyer and seller must have a definite idea as to the character of the hay represented by the various grade designations. The lack of an understanding of such grade terms on the part of some consumers is probably partly responsible for their reluctance to buy hay in this manner. The telegraph is most satisfactory in transactions between those who have a thorough understanding of trade and grade terms and the market needs of the various sections. It can be used advantageously between dealers in markets or territories using the same grade standards and trade rules.

The advantages to the country shipper of selling his hay direct to the consumer may be summarized as follows: Better prices because of the elimination of intermediate handling costs, including commissions, inspection charges, etc.; and less difficulty with grades because of the absence of technical grading and because of a better understanding brought about by the use of terms descriptive of the character of the hay.

The disadvantages are: The difficulty and expense of obtaining and maintaining a good list of customers; the difficulty of keeping supply and demand equalized; and the losses caused by refusals and rejections for various reasons on the part of the buyers.

Rejections are no doubt the cause of the greatest loss which the shipper is likely to encounter. Some buyers reject hay unfairly when conditions make it disadvantageous for them to accept it. Large shippers with representatives in the various consuming sections can usually, through the efforts of their salesmen or representatives, arrange a settlement that prevents a heavy loss; but smaller shippers conducting their business by letter or telegraph frequently suffer severe losses from this practice.

Wholesalers and Distributors.

After the consumer, the next most direct agency to which the country shipper may sell his hay is the wholesaler or distributor in consuming sections. Sales may be made to them direct in the same manner that sales are made to consumers. In some sections, notably the South, wholesalers and distributors generally prefer to buy through a broker or other representative of the shipper for the reason that the broker or representative is located in their market or at least in near-by territory and as an agent of the shipper is conveniently at hand if any difficulty arises relative to the sale or shipment of the hay.

SALES THROUGH BROKERS.

Brokers in practice are shippers' agents. Their business is to sell to the dealers in their market or territory the commodity handled by the dealer or shipper whom they represent; the prices are fixed by the shipper. Brokers are located in all the principal markets and distributing points in the South and at many markets in other sections of the country. They handle the hay on a brokerage or commission basis and their rates range from 25 to 75 cents per ton. The usual brokerage fee at present is 50 cents per ton. Brokers should not be confused with commission merchants who operate in northern and western markets, for the services rendered by these two classes of dealers vary considerably.

Sales are usually made in the following manner: A shipper having hay for sale telegraphs a broker whom he has already engaged to represent him in a certain market, giving the broker the prices, grades, and number of cars he has for sale. The broker is frequently instructed to sell subject to the shipper's confirmation, in order to make sure that the hay has not been sold by brokers in other markets who may have been engaged to sell the same hay. Unless there is an unusual demand in a market the broker can probably sell only a part of the cars offered by the shipper. For this reason several brokers are instructed to sell the hay.

Upon receipt of the wire from the shipper, the broker canvasses by telephone or in person the various buyers in his market, offering the hay at the price quoted by the shipper, plus his brokerage fee, provided it has not already been included in the quotation. If he is able to sell one or more cars of hay he immediately wires the shipper to book the order, giving the name of the buyer and the quantity and grade sold, together with the terms of sale as to time of shipment, etc. If the offer from the shipper is subject to confirmation the shipper telegraphs to the broker or buyer a confirmation of the sale, provided the hay offered has not already been sold by another broker. A written confirmation is usually also sent to the buyer and the broker's account is credited with the amount of brokerage earned by the sale. In case the hay has been sold, the order is not accepted unless the shipper has obtained or can obtain other hay to fill the sale and the broker is so advised.

Brokerage settlements are usually made between the shipper and broker at the end of each month. Some shippers remit brokerage only for the hay which has already been shipped on the orders received. While such settlements are accepted by most brokers it is generally held that brokerage is due and payable when the actual sale has been consummated. Some difficulty occasionally arises because of the refusal of shippers to pay brokerage on shipments which have been rejected upon arrival by the buyers. Brokers consider this practice unfair. On the other hand shippers claim that brokers are sometimes unfair and that in order to make sales they make promises to buyers which shippers know nothing about and which they can not fulfill. Such practices may increase brokerage accounts but they often cause rejections.

While the broker's responsibility is supposed to end with the consummation of the sale, most brokers are interested in maintaining profitable business relations with the shipper and buyer and continue to look after the interests of both in an impartial manner until the whole transaction is completed. Additional charges are seldom made for such services unless another sale is actually made. These extra services, however, frequently prevent heavy losses to shippers and also protect the buyer from inconvenience and loss.

TRAVELING SALESMEN.

In some sections a great deal of hay is sold by traveling salesmen representing large shippers or wholesalers. Country shippers doing only a small business yearly probably find it impossible as a matter of economy, to employ traveling salesmen; but larger firms frequently employ, and prefer, them to brokers. The salesman or representative is kept informed by letter and wire of the amount of hay the shipper has to offer from day to day and of the prices at which it may be quoted.

The salesman, while representing a shipper in a producing section, may be located in a consuming section and travel in neighboring territory where he is acquainted with the firms who are his customers or he may travel direct from the office of the shipper. His methods of making sales differ but little from those of a broker. He usually works on a salary, or a salary and commission basis, and probably covers a larger territory than most brokers. He not only makes sales but looks after collections and is expected to adjust any difficulties that may arise concerning shipments into his territory. He is also supposed to obtain new customers and keep old ones satisfied and to keep the shipper informed about the market situation in his territory. In general, he must be an efficient sales agency able to handle satisfactorily the hay offered by his employer, the country shipper. These salesmen frequently represent firms selling other commodities also, or they may sell other products for the same firm. Because of the large volume of business necessary to support salesmen for hay alone it is not possible for many shippers to employ them unless they buy hay at a number of points.

Track Buyers.

In some sections shippers who buy hay at a number of stations or from other shippers who handle only a few cars are called track buyers. A number of such shippers are located in New York, Ohio, Indiana, and Michigan.

Country hay shippers who have a small volume of business may often sell advantageously to track buyers, as the prices which they offer may yield a larger net return than sales by other methods. This is possible because of the better facilities for distribution that the larger business of the track buyer makes possible.

The track buyer usually confines his buying operations to a limited area which is small enough to permit him to keep in touch by telephone with the various country shippers from whom he purchases hay. This constitutes a near-by market for the shipper and because he can readily communicate with the buyer and fully describe the hay he has for sale, many of the difficulties relative to grade that are encountered when he attempts to ship his hay to distant markets are eliminated. Many track buyers pay sight drafts for all or a part, usually 80 per cent, of the invoice price of the hay. This is a distinct advantage to a small shipper with a limited amount of capital.

While track buyers are usually able to handle the hay offered by their customers and many of them have salesmen or representatives in consuming territories continuously, it sometimes happens that at certain periods because of a poor demand they can not buy and distribute the amount of hay that country shippers have for sale. It then becomes necessary for the shipper to find a new market, the requirements of which he may not know. This may cause him considerable difficulty and loss and is one of the unsatisfactory conditions that may arise if a country shipper relies entirely upon one marketing agency for the disposal of all his hay.

Track buyers usually distribute their hay through brokers or salesmen in consuming territories and seldom go to large markets except to dispose of a surplus. They usually do not operate warehouses but ship direct from country shippers' tracks or warehouses. When such dealers operate warehouses and handle hay through their warehouses direct from producer or from other country shippers, upon a transit privilege, they are in most sections termed wholesalers. The term track buyer is applied usually only to those who handle or bill the hay direct from loading track to destination.

Terminal Markets.

Another agency which is available to the country shipper in the marketing of his hay is the terminal market, and it is available when the others are not. While the prices obtained for hay shipped to terminal markets during periods when there is a demand from no other source may not be all that could be desired, these markets provide places for marketing surpluses.

There are no large public storage warehouses in any of the large central western markets but private storage space is sufficient to accommodate a considerable amount when prices are such that the owners consider it a good business proposition to store their hay. The railroads provide warehouses in several of the eastern markets, including New York and Boston. Many terminal markets also have excellent distributing facilities, being located at railroad centers which provide transportation at advantageous rates to large consuming areas. These markets may have but a small local demand and practically no storage but still handle a large amount of hay. Among such distributing markets are Kansas City, St. Louis, Omaha, Chicago, Memphis, and Cincinnati.

Country shippers who desire to ship to terminal markets advantageously must become familiar with practices and conditions prevailing at such markets. Among these the more important are the methods of weighing, of inspection and grading, the amount and kind of storage available, and the methods of rebilling cars. The last mentioned is important because it enables the shipper to know how to bill his cars to a market in such a way as to take advantage of the best rebilling privileges.

Many country shippers avoid shipping to terminal markets because of their lack of knowledge concerning the various methods of handling hay and because such shipments usually result in unsatisfactory price returns. The various practices prevailing at the principal markets will be discussed in another part of this bulletin.

53884°—21—Bull. 979——3

It is impossible to advise the shipper as to the times when hay may be marketed most advantageously at terminal markets, because successful handling depends to a great extent upon the ability of the shipper and upon his knowledge of the current market situation in the markets or consuming territory available to him.

METHODS OF SELLING HAY.

The profits of the country hay shipper depend as much upon the methods and terms of sale employed as upon the markets to which he sells. In fact the method of selling and the terms of sale are frequently the factors determining whether a sale is profitable or not. There are four different methods by which the shipper usually sells or markets his hay, namely, "shipper's track," "to arrive," "delivered," and "on consignment." These relate to the time at which the terms of sale apply.

"Shipper's Track."

The sales term, "shipper's track" means that the whole sale is consummated at the shipper's loading point and that unless otherwise specified all liability of the shipper ceases when the bill of lading has been signed by the railroad agent and the car has been accepted for shipment by the transportation company. The advantages of this method to the shipper are evident. He is not liable for any future losses that may occur and gives no further attention to the movement of the car. The difficulty is to find buyers who will purchase hay by this method.

The reliability of the shipper and the state of the markets are the principal factors entering into a sale of this kind. If the buyer is certain of the honesty and reliability of the shipper he may not hesitate to buy his hay "shipper's track," but if he has any doubt as to the shipper's knowledge or judgment of the character of hay loaded into the car or of his honesty, he will not buy by this method unless forced to do so by an urgent demand which he has been unable to fill in any other way. The method is entirely fair, however, and there is no good reason why hay should not be sold as freely by this method as by any other.

"To Arrive."

The term "to arrive" as applied to the marketing of hay is given slightly different interpretations in various sections of the country and by different dealers. It is frequently used synonomously with the term "in transit" and is applied to sales which are made while the hay is en route from shipping point to destination. The terms of such sales are usually the same as those of "delivered" sales. "To arrive" is also used to indicate shipments to be made at a future date.

and in such cases a limit is usually placed on the time at which such shipments may be made or may arrive.

The advantage of the "to arrive" sale, when the term is used to indicate that the shipment is in transit, is that it makes it possible for a shipper to bill out and ship his hay to some market or rebilling point and take advantage of any favorable market fluctuations while the hay is in transit. It frequently happens that a shipper who ships principally to consuming territories may not have sufficient orders at a particular time to take all of the hay that is being loaded. If the loaded cars are allowed to stand on shipper's track awaiting a sale, demurrage will accrue so the hay is billed to some terminal market or to some junction or rebilling point. If an order for such a car of hay is received from the section toward which the car is moving while the car is en route, it may be diverted from the original billing and billed to the new destination. Or if a different market from the one to which the car is billed seems more advantageous, the car may be sold to dealers there and diverted to that destination.

When the term is used to denote future shipment the principal advantage to the shipper is that he may sell his hay as bought from the producer and make shipment as it is delivered or as cars are available. This, of course, eliminates a great deal of the risk of marketing.

"Delivered."

On a sale "delivered," all terms apply at destination. The shipper assumes all the risk of delivery and while the price may have been decided upon previously the buyer makes no payment, and has nothing to do with the shipment until it is delivered in his market. Most of the sales to consumers and to distributors in consuming territories are made by this method.

Consignment.

A great deal of the hay marketed, especially that shipped to terminal markets, is consigned. The number of commission men located at the various markets whose only business is the handling of such shipments is indicative of the amount of hay consigned to the terminal markets.

Large markets provide a place where surplus hay may be marketed. Many of them have made a special effort to provide facilities for the most economical handling of the hay consigned to them. By providing special sale tracks or yards where all the hay may be placed and offered on a competitive basis for sale to the highest bidder, they have established an open cash market for hay similar to that provided for grain by the grain exchanges.

The broad, general character of the demands at terminal markets frequently makes it advantageous for shippers to consign their various grades of hay to them. Certain grades, because of their peculiar character, can generally be consigned to an advantage because they sell better when the buyer is at hand to see what he is buying.

However, only large markets with a large local demand or distributing markets with a broad shipping demand can generally be used advantageously for consignments by a country shipper. The needs of small markets are quickly filled and hay arriving when there is little demand must frequently be sold at a heavy discount to prevent demurrage or storage charges. To obtain the best results from consignments, shippers must themselves know the requirements and practices at the markets to which they consign their hay, as well as the facilities the markets have for handling. They must also keep informed as to supply and demand.

One of the principal advantages of consigning is that the shipper may offer his hay in large open markets and may have a representative trained in the practices of that market to look after his interests for him. If so instructed the commission merchant will dispose of the shipper's hay only upon his order so that the shipper may always control the sale. Another advantage of consigning is that it provides a means of marketing hay when it is difficult to sell it by any other method.

One of the principal difficulties which shippers are likely to encounter in consigning hay is the wide fluctuation in price which frequently occurs at markets where the bulk of hay received consists of consignments. When a good price and demand prevail at any market, all shippers naturally take advantage of those conditions with the result that receipts soon exceed the demand and prices decline sharply. All shipments are then diverted or stopped until another period of light receipts follows and prices advance. The same thing is then repeated. For this reason many shippers continually receive unsatisfactory returns for their consigned hay.

From observations made at a number of markets it appears that a policy of continued consignments is more satisfactory than consignments made only when prices are quoted unusually high at some market. Another difficulty arises from the fact that consignments are frequently subjected to more stringent grading rules at terminal markets than are enforced in some consuming sections so that although comparable grades are quoted higher, the hay does not actually bring so much money as when sold at a lower price to less particular buyers.

Shippers who are not familiar with the grade requirements and market practices at the markets to which they consign their hay are usually disappointed with the returns from consignments to those markets.

TERMS OF SALE.

The three general terms that apply to sales of hay refer particularly to the kinds of weights and grades and are designated as "shipper's weights and grades," "destination weights and grades," and "market weights and grades." These may overlap slightly in some instances and may be applied to the different methods of sale.

Shipper's Weights and Grades.

A sale by "shipper's weights and grades" means that the weight determined and the grade assigned by the shipper are to be accepted by the buyer as the weight and grade of the hay. Obviously this term is always applied to hay sold shipper's track and is seldom used except in a modified form in any other method of sale.

The buyer usually reserves the privilege of inspecting the hay to determine whether it is of a character which he considers representative of the grade bought. There is no good reason why shipper's grades should not be as reliable as buyer's grades, but it is argued that as the shipper already knows the quality, the buyer should have an opportunity to inspect the hay before paying for it. It seems, however, that the lack of uniform national grades, and of a uniform interpretation of existing grades, is the principal cause of the lack of confidence between the shipper and buyer relative to grades. It is probable that the unfair practices of some shippers, which have already been mentioned, have been to some degree responsible for this lack of confidence.

There is a much more general use of shipper's weights than of shipper's grades. In accordance with a practice now in rather general use, the buyer accepts the shipper's weights less an amount of 1 to 3 per cent, most generally 2 per cent, of that weight. This deduction is supposed to represent the loss in weight caused by the handling of the hay and is frequently deducted whether the actual weight as found by the buyer is that much less than the shipper's weight or not. Many buyers do not have weighing facilities and therefore accept the shipper's weight less the 2 per cent. When the bales are tagged the outturn weights are computed from the weights marked upon the tags but the 2 per cent is usually deducted. These weights are in effect, however, shipper's weights.

When distributors or consumers have weighing facilities they usually insist upon destination terms when buying from country shippers.

Destination Weights and Grades.

The term "destination weights and grades" is self-explanatory and leaves the determination of the weights and grades almost entirely with the buyer. When the shipper sells destination terms he is bound to allow any claims made by the receiver which are properly supported by weight and inspection certificate or by an affidavit by the receiver as to the outturn weights and grades. If there is a loss in weight and the amount indicates that the loss was probably caused in transit the shipper must handle any claim which is made, whereas if the hay has been sold "shipper's track" the responsibility of presenting the claim rests with the receiver.

Another term "shipper's weights and grades guaranteed" is sometimes used which although it sounds better to the shipper, means practically the same thing. If the shipper guarantees his weights and grades it must be to the satisfaction of the buyer. It is evident that if no unfair practices are indulged in by either the shipper or receiver there is no good reason why "shipper's weights and grades" should not be as reliable as destination weights and grades, especially if both receivers and shippers use their own judgment as to grades and have the same or similar weighing facilities.

Market Weights and Grades.

Hay shipped to or from a terminal market which maintains official weighing and inspection departments is generally sold "market weights and grades" as determined at that market. For example, hay sent by a country shipper to a dealer in Kansas City is sold on weights and grades determined there. The same thing is true on hay bought from Kansas City.

In support of the practice of requiring both the shipper and buyer to accept the official weights and grades of any specified market as final, dealers in terminal markets advance the argument that because both the weighing and inspection departments are maintained as impartial but qualified agencies, their findings as to weights and grades are generally considered more dependable than those of either an individual shipper or buyer. Many shippers and receivers do not agree with this claim.

However, from a survey made by the Federal Bureau of Markets, it appears that considerable effort is being made in many of the principal markets to maintain reliable and efficient weighing and inspection services. While these services are not perfect most of the difficulty experienced by shippers at the terminal markets is apparently caused by the sharp practices of some of the dealers rather than by inadequate facilities. This is also true of many of the difficulties between country shippers and buyers in consuming territories.

SHARP PRACTICES.

Certain unfair practices are carried on by some country shippers. The most common of these is the "plugging" of cars. This practice more than any other has probably caused buyers to demand destination terms. Another unfair practice is the shipment of hay of a lower grade than that specified in the terms of sale. When the demand is urgent it is thought that the buyer will be compelled to accept the lower grade because he can get no other before his stock is exhausted. Another is the delaying of shipments sold for deferred delivery beyond the time specified. This is done in order to obtain more money by shipping to some other market. Other hay is shipped on the former sale when prices have declined to the level at which the sale was consummated. In such instances shippers claim that producers have not delivered the hay or that they are unable to get cars for shipment. This practice can not be carried on except when demand is urgent and shipments are moving slowly.

In the matter of weights, shippers are sometimes guilty of adding a little, often as much as 1,000 pounds, to the actual weights when making their invoices. This is usually done to overcome any loss by handling, etc. If a buyer weighs the hay and makes a claim for the difference in weight or refuses to pay for an amount which his weights indicate was not in the car, the shipper, after a formal request for unloading weights, etc., usually pays or allows the claim. If the buyer does not weigh the hay the shipper is just that much ahead.

An instance has recently been reported to the Bureau of Markets where the members of a large hay firm doing a track business admitted that they always added 1,000 pounds to the weights furnished by the country shipper when invoicing the hay to their customers. They maintained that this was done to protect them against any mistake that the shipper might have made in weighing. They also maintained that as the weights were guaranteed to within 2 per cent, it was the duty of the buyer to weigh the hay, and if any error was found to make a claim against them for the amount of the shortage.

There are also several practices on the part of buyers which are considered unfair by the trade generally. In the matter of weights complaints are made that bales are broken in unloading and then not weighed; that drafts are frequently missed when the hay is weighed one or more bales at a time; and that many cars are weighed incorrectly.

The most serious charge against the buyers, however, is that of refusing to accept shipments when the market has declined. When shipments are rejected it is usually maintained that the hay is not of the grade bought. Judging from the information at hand the percentage of rejections by buyers does not seem to be any larger than the percentage of cars containing damaged and inferior hay forwarded by shippers. Various dealers estimate that the percentage in both instances amounts to about 10 per cent or 15 per cent of all hay shipped.

Trade associations have made numerous regulations designed to eliminate these unfair practices between shippers and buyers, but lack of enforcement authority and of an impartial agency to determine grades seems to be the principal cause of their inability to eliminate them. From its experience in the regulation of the inspection of grain and cotton, the Bureau of Markets believes that Federal inspection of hay made available to the interested parties in any controversy concerning grades would overcome many of the present difficulties and eliminate many of the heavy losses which are ultimately added to the cost of marketing.

The terminal markets are not free from practices which are frequently very unsatisfactory to shippers and buyers using them, but these will be discussed in describing the methods of marketing hay at terminal markets.

DEALERS IN TERMINAL MARKETS.

While the general methods of handling hay at the various terminal markets are similar, there are many practices that are peculiar to certain markets.

CLASSES OF DEALERS.

Dealers operating at terminal markets may generally be classed as brokers, commission men, receivers, and shippers. There is no sharply defined line between the various classes, however, for the reason that many dealers conduct their business in such a way as to place them in two or more classes at the same time. For example, it is frequently the case that brokers are also commission merchants, or commission merchants are also receivers and shippers, or, again, receivers are also shippers. The term "distributors" is sometimes applied to that class of dealers designated as shippers to distinguish them from country shippers.

Brokers.

Brokers operate usually in large consuming sections, but some are also located in other markets. Their business is primarily to sell hay as direct local representatives of the shipper. The activities of the broker in distributing markets in behalf of the country shipper have already been described, and the business of the broker in other markets is conducted in practically the same manner.

Commission Merchants.

There is considerable difference between brokers and commission merchants in most markets, and the services rendered are quite different. As has been stated, the broker assumes no financial responsibility for the commodity he handles, but always considers it as the property of the shipper. On the other hand, in most instances the hay does become the property of the commission merchant for a time.

In general practice the hay is billed to him either on "open" billing, i. e., direct on a straight bill of lading, or on an "order" bill of lading. On the open billing the shipper may or may not draw a draft against the consignee for a part of the value of the hay. Some shippers with large financial resources bill most of their hay to commission firms whom they consider reliable on open billing and do not make a draft against the shipment, but await full payment when the car has arrived at the market and has been sold. The advantage of this method is that when shipping to near-by markets demurrage or storage charges seldom accrue because of the nonarrival of the bill of lading, because the straight bill of lading is mailed direct to the commission merchant and therefore almost always arrives ahead of the shipment. On an "order" bill of lading the shipment is usually billed to the shipper's order and notation made to notify the consignee, which in this case would be the commission merchant.

While bills of lading are generally considered as representing the goods and their possession as conferring ownership, certain restrictions placed upon order bills of lading make them more valuable to those interested in their use. In the first place, since the shipment is billed to the shipper's order the carrier will not release it until the original bill of lading, properly indorsed by the shipper, is surrendered to the carrier's agent at destination. Because of this regulation this form of billing is especially advantageous to the shipper and it has become the practice for hay shippers to bill their hay "shipper's order" and to notify the commission firm which they desire to handle their hay at the terminal market. When the shipper obtains the bill of lading properly signed from the railroad freight agent at point of loading he draws a "sight" or "arrival" draft against the consignee for about 75 per cent of the value of the shipment and, attaching it to the bill of lading, places both in his local bank to be forwarded to the bank's correspondent or some other bank at the place to which the car is billed. The local bank, in many instances, enters the amount of the draft directly to the shipper's credit and he can draw checks against it immediately.

Banks prefer sight drafts payable to the payee upon presentation to those drawn to be paid upon the arrival of the car, and in many instances charge interest on the amount advanced from the date of deposit until the proceeds of the draft are received. Whether drafts are to be drawn at sight or upon arrival is a matter of agreement between the shipper and the commission merchant and the practice is influenced considerably by the financial standing and the reliability of both parties.

When the draft with the bill of lading arrives at a bank at destination, the bank notifies the commission firm upon which the draft is drawn and the latter immediately, or upon the arrival of the car (whichever time is indicated by the draft) pays the draft and thus obtains possession of the bill of lading. When the car arrives at destination the bill of lading is surrendered to the carrier and switching orders are given for placing the car in position for sale. The car is then sold for the account of the shipper by whatever method is used at that market. Some shippers consign their hay to be sold subject to their confirmation and require their commission firms to report any offers back to the shipper for confirmation before accepting them. Many shippers, however, leave the selling entirely to the judgment of the commission firm, thinking that their experience on that particular market qualifies them to make the most advantageous disposition of the hay.

When the hay has been sold, returns are made to the shipper showing the amount of the sale; the amount deducted as selling charges including weighing and inspection fees, trackage, demurrage charges, interest charges, commission, etc.; and the net proceeds. Interest charges are made only for the amount advanced on sight drafts or arrival drafts and are computed for the period between the time at which the draft is paid and the time at which the commission firm receives payment from the buyer. For arrival drafts this period should be only a few days, the time required to switch the car to selling yards and to make the sale, plus the one day which is allowed buyers in most markets in which to make settlement. If cars are unloaded in the terminal market, however, returns generally can not be made until the car has been switched to the buyer's warehouse and unloaded. In most instances buyers make an advance on the car of about the amount of the shipper's draft, and the shipper therefore should not be charged interest beyond one day at most after the date of sale.

Commission charges vary slightly but at present range from 75 cents to $2 per ton, or a minimum charge of $10 per car. This charge covers all the services rendered by the commission merchant in handling and selling the hay consigned to him.

Receivers.

Those dealers who buy hay to arrive or for shipment to a market are in some markets termed receivers. There is no clear-cut distinction between receivers and commission men in many markets, and the names are frequently used interchangeably.

The number of receivers in the markets varies with the character of business conducted. Some markets are almost entirely consignment markets and the greater number of the dealers are, therefore, commission merchants. There are several large markets, however, including Kansas City and Memphis, in which the dealers prefer to buy their hay outright from the shipper. When receivers have representatives in the producing sections to buy from shippers, the hay is usually bought shipper's track, the price paid being determined by the buyer's judgment as to the market grade of the hay. When buyers do not go into the territory the trades are made by letter and wire and the terms generally provide that destination weights and grades, market grades and destination weights, or market grades and weights shall be accepted by the shipper.

The shipper seemingly encounters more difficulty and dissatisfaction in marketing his hay by the last-named terms than by any other. The advantages of using these terms have already been described; the difficulties encountered are caused principally by the lack of uniformity in the application of the market grades. The manner in which misunderstandings arise can best be illustrated by a description of two sales made under different market conditions.

Mr. A. is a country shipper and Mr. B. is a receiver located in a terminal market, let us say Chicago. Having decided to sell some hay at Chicago Mr. A. writes to Mr. B. who he has been informed is a reliable receiver, asking for an offer on two cars of No. 1 timothy. Mr. B. immediately wires Mr. A. an offer of $25 per ton for the two cars of No. 1 timothy, prompt shipment, delivered at Chicago. Since no terms are mentioned it is understood that Chicago weights and grades are to govern the settlement. Mr. A. accepts the offer, loads and ships the hay immediately, and it arrives in Chicago in due time. In the meantime, light receipts and an urgent demand cause the market to advance $2 per ton between the date on which the hay was purchased and the time it arrives. The cars are placed upon the sales tracks and Mr. B. goes out to inspect and sell the hay. Upon personal inspection he finds good timothy hay of uniform quality, but scarcely good enough for No. 1 timothy. However, because of the demand he is able to get an offer of $1 more per ton for the hay as it shows at the car door, than he had expected when he bought the hay. He, therefore, accepts the offer and feels that he has made both a good purchase and a good sale. As soon as the hay is unloaded and the weights are obtained, returns are made to the shipper at the contract price. Mr. B. says nothing about the grade of the hay and since he made a satisfactory sale does not have it officially inspected.

About two months later Mr. A. notices that the market shows signs of weakening and decides to offer two more cars of hay to Mr.

B. at $25, the price paid for the other two. The hay he offers is a part of the same lot, which was of uniform quality, as the first two cars. Mr. B. also notes the weakened condition of the market and wires an offer of $24 per ton for the two cars of No. 1 timothy for immediate shipment, usual terms. Mr. A., having the hay already loaded, accepts the offer and bills it out immediately. When the hay reaches the market receipts are considerably in excess of the requirements of the trade, there is practically no demand, and the price of No. 1 timothy has declined to $23 per ton. Buyers are more particular and will not pay full price for anything but strictly No. 1 timothy. Mr. B. tries to sell the hay, but he can get no better offer than $22. Several buyers tell him that his hay is only a good No. 2 timothy. He knows that technically this is true, so rather than take a loss he decides to have it officially inspected.

Seeing the inspector in the yards, he calls him over to the cars and states the case in words something like these: "Say, Brown, I have two cars of hay here which I think grade about No. 2 timothy. I bought them for No. 1, but I don't believe they will grade that. I wish you would inspect them and give me a certificate of grade for both cars. See the brown blades on all of the bales. There are too many of them for No. 1 hay. It was cut a little too late, and three bales up near the top are stained. They are really No. 3 hay. I have an idea that the hay will run worse back from the doorway. However, you are the inspector. All I want is a fair deal." Since the hay is really not No. 1 the inspector issues a certificate for grade No. 2 timothy.

No. 2 timothy is selling at a discount of $2 under No. 1, so Mr. B. wires Mr. A. as follows: "Your two cars of hay in to-day. Grades No. 2. Can accept on sale at $3 discount." Because Mr. A. has no other orders at that time and also because of the expense of reconsignment, he accepts the offer and obtains $21 per ton instead of $24 for his hay. Besides losing the $3 per ton Mr. A. also loses faith in the honesty of Mr. B. and decides not to ship to him again. He can not understand why his hay is accepted as No. 1 when the market is good, but graded No. 2 when the market is declining. On the other hand, Mr. B. says that Mr. A. does not give him fair consideration: that he accepted the first two cars of Mr. A.'s hay which were really not No. 1 and gave him a No. 1 price for them because he himself had a profit; in that light Mr. A. should not object when Mr. B. took only what was really due him on the second lot.

There is no way of knowing how many similar instances occur at the various markets, but they are of a sufficient number to make it desirable that organized markets take some notice of the matter of acceptances and rejections and subject them to some uniform rule. In many markets shippers can not demand the inspection of their hay, as such services are available only to the dealers in the terminal market who are members of the trade organization which employs the inspectors. Such practices also show the need of impartial inspection available to all parties interested in the hay. Such inspection is now provided for in part by a law recently passed by Congress.

Shippers at Terminal Markets.

Many large hay markets have a very limited local demand but a large shipping demand. At such markets there are usually some dealers who confine their business to buying hay offered for sale on their market and shipping it to buyers in consuming territories. These dealers are known as shippers in most of the markets. Some commission men are shippers as well as receivers and many receivers are also shippers.

Shippers in central and other distributing markets are an essential part of the marketing machinery for the reason that they create the demand for the surplus hay which is shipped to such markets. They buy the hay on the open market and obtain offers from dealers and consumers in nonproducing sections through brokers, traveling representatives, or by wire or letter. Their business is, therefore, largely that of distribution and their principal efforts are put forth to obtain orders for the amount of hay which they can buy on their market. They do not make a fixed charge for handling the hay as do the commission merchants but depend upon the profits which they may make for compensation. Shippers usually try to make a profit of $1 to $2 per ton and because of the service rendered become a considerable factor in the disposition of the hay shipped to large markets. Many shippers succeed in working up a fairly large business, often amounting to ten or twenty cars per day, and hold it by furnishing their customers with hay of satisfactory quality at current market prices. Competition, however, is sometimes keen, and has caused some shippers to practice unfair methods.

Probably the most common unfair practice is that of shipping hay of a lower grade than that sold but invoicing it at the price of the higher grade. This practice is most common when there is an active demand or when the market is advancing. Under such conditions the buyer takes the hay even when he knows it is not of the grade bought because of one or two reasons. First, he may be out of hay and unable to wait for another car to be shipped; second, the market may have advanced so that the hay he has received is worth what he agreed to pay for the higher quality. The buyer usually remembers an unfair transaction and "gets even" with the shipper by refusing to accept shipments when the market has declined, thus leaving them on track for the shipper to dispose of as best he can.

These practices cause enormous losses from time to time and help to increase the spread in prices between those paid to the producer and those paid by the consumer. Many losses could be prevented by trade organizations if regulations for outshipments of hay were made similar to those now in effect for inshipments. Too many markets seem to be pursuing the short-sighted policy of making regulations which do not give proper consideration to those shipping to the market and those buying from it, with the result that both producers and consumers are now greatly interested in perfecting some marketing agency that will eliminate the large central markets which allow unfair practices.

MOVEMENT TO MARKET.

By far the greatest part of the hay which moves to large markets is by rail. However, the amount being transported by auto trucks is constantly increasing. At several of the large eastern markets, including Baltimore and Philadelphia, the amount of hay received by truck is almost, if not equal, to that received by rail. This condition is subject to change because only hay from neighboring sections can be marketed by truck and the supply of this hay may be very limited some seasons. Hay is also shipped by boat on inland rivers, but in small lots making up a very small percentage of the total amount shipped. The difficulty and expense of getting the hay to or from the boat, and of finding warehouse space to store the hay until sold, are the principal disadvantages of shipping hay by water. There are practically no facilities for loading hay from the boat to cars and hence but little reshipping can be done.

At practically all markets shipments arriving are placed in outside or hold yards and the consignee is notified. At some terminal markets, however, the various railroads have designated certain tracks or yards as hay tracks or hay yards and place all hay arriving over their lines at these locations. Where special hay tracks have been provided, arrangements are made in some markets whereby the cars are placed immediately on the special tracks. At others the consignee must surrender the bill of lading and order the cars to the destination desired.

At Cincinnati a special yard has been leased by the grain and hay exchange and arrangements have been made by which cars from all roads are placed in this yard for sale. A joint railroad agent is stationed at the yards and bills of lading need not be surrendered until the cars are sold and ready to be reconsigned. A switching charge of $3 is made by the road placing the cars in this special yard, but this charge is borne by the inbound carrier if the revenue is $10 or more per car. At most other markets no charge is made for placing cars on sales tracks but such tracks are only specially designated tracks in the regular yards of the carrier.

If dealers desire to have cars placed at their warehouses, railroads switch them direct from the holding yards, generally without charge. but if the cars have been placed on the sales tracks there is usually a switching charge. The surrender of the original bill of lading is generally required before cars will be switched to warehouse or unloading tracks.

Railroads usually furnish the inspection department of the local trade association with lists showing the initial and number of the cars together with their location. The name of the consignee is also generally shown but in some markets consignees are assigned numbers and the numbers only are shown on the bulletin. The lists are sometimes posted only in the local yard offices and those interested call these offices by telephone or visit them in person in order to obtain the information.

METHODS OF SALE.

There are several methods by which hay is sold at terminal markets. Some of the more important are on the exchange floor, at the car door, on plug tracks, at warehouses, and in offices.

Sales on the Exchange Floor.

In several markets all or a part of the sales are made during the session of the exchange. An exchange, as understood by the trade, is a place at which members of the trade organizations meet for a few hours each week day and buy and sell the commodities which they handle. Some of the markets using this method are Memphis, Indianapolis, St. Paul, and Pittsburgh. The methods of sale on the exchanges vary somewhat in the different markets.

Small samples of hay representing the carloads from which they have been taken by the inspector or sampler may be exhibited on the sample tables. The grade designation as assigned by the inspector is shown on a tag attached to the sample. The buyer inspects the various samples and, if the quality as shown by the sample is satisfactory, endeavors to purchase the car from the receiver or commission merchant having it for sale. The terms of sale usually specify that the entire car must be of a grade equal to the sample and a rate of discount for any low grade is agreed upon at the time of sale.

In other instances no samples are submitted but the cars of hay are offered for sale by grade and description. An official of the exchange conducts the "call" and asks for offers of the various kinds and grades of hay. A member having a car, say of No. 1 timothy, for sale offers one car No. 1 timothy at $26. Bids are then called for.

The first bids made are usually below the price asked and are then raised (unless the market is very weak) to meet the offer of the seller, which is frequently reduced slightly to effect a sale. If the bids and offers do not reach the same amount no sale is effected. Buyers in most cases do not depend entirely upon the grade certificate as to the character of the hay but visit the receiving yards and inspect the hay before the market opens.

The advantage of this method is that it establishes a cash market price for each day upon which bids to country shippers and offers for shipment may be based. It also assures the country shipper that his hay has been offered in an open market and sold to the highest bidder. The principal difficulty arises when the buyer maintains that

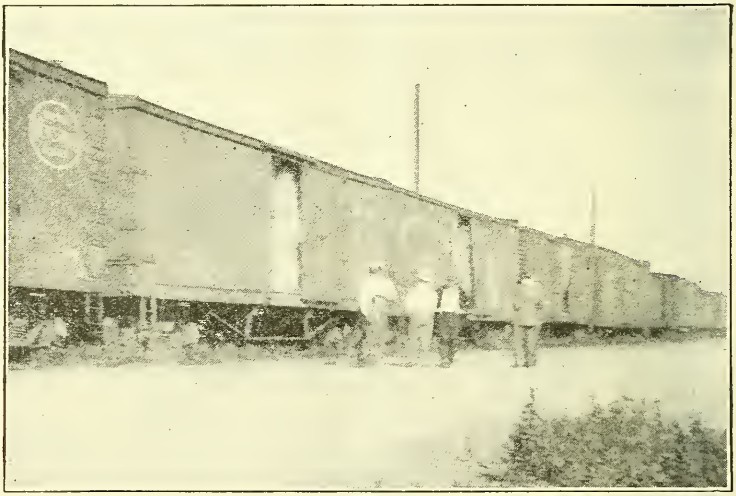

FIG. 4.—Selling hay at the car door.

the hay is not all of the same quality and demands a reduction or elects to take it at the price of the lower grade.

SALES AT THE CAR DOOR.

In a number of markets, including Chicago, St. Louis, and Minneapolis, trading is done in the railroad yards where the cars have been placed for sale. The doors of the car are opened and seller and buyer conclude the sale of the hay at the car door. Since only the bales at the door of the car can be seen, the buyer usually makes the purchase on the condition that all the hay is of the grade showing at the door. If the shipper has loaded the car uniformly and the buyer is fair, this method of sale is satisfactory, although it is sometimes difficult to determine the actual quality of the hay by examining only the ends of a few bales (fig. 4).

Cars loaded with two or more kinds of hay, or with hay varying in quality, can not be marketed satisfactorily by the car-door method. Naturally if hay of more than one grade is shipped in one car, the better grade is placed in the doorway. Buyers, therefore, unless they know the shipper personally or by reputation and know his cars are all of uniform quality and invoiced correctly, usually offer a price sufficiently below the market to protect themselves against any inferior hay. If the full market price is paid for the hay a differential is agreed upon for any lower grade hay which may be found.

The fact that only a very small portion of the hay may be inspected at the time of sale has led to unfair practices on the part of both the country shipper and the buyer. The unscrupulous shipper, knowing the manner in which the hay is sold, frequently loads a certain amount of poor hay in the car where it can not readily be detected. It is possible to load all but about 50 bales with poor hay and still make the car appear as if it were loaded with good quality hay. If such a car is sold to a shipper in the terminal market and is reconsigned, the poor hay is frequently not detected, and the country shipper receives the price of good hay. If the car is unloaded in the terminal market, however, his dishonesty is discovered, and he probably receives less than the hay is really worth.

Some buyers engage in the unfair practice of claiming that the hay is partly off grade when it is not. The claim is always made after the car has been partly unloaded. This practice is carried on somewhat as follows: The buyer having purchased the car at the sales tracks orders it switched to his warehouse for unloading. After two or three tons have been unloaded the buyer pretends that the hay back from the door is of poorer quality than that at the door, which was the basis of the purchase. He therefore calls up the receiver or commission merchant and informs him that the hay in the ends of the car is of inferior quality and that he will reject the remainder of the car. Under the present methods of inspection and marketing the seller can do little else than accept whatever terms the buyer is willing to offer for the remainder of the hay. It has been noted that such rejections occur more frequently on a declining market than on an advancing market, and that the discounts demanded bear a close relation to the amount of the decline in the market.

When hay is hauled direct from the sales tracks, as is frequently the case where the sales tracks are also the unloading tracks, a part of a car can be rejected if the buyer chooses to do so. The remainder of the hay must then be resold. At Chicago a special yard is provided to which these rejected cars can be switched for resale. The expense of switching, etc., is so great that it is a better policy to allow a liberal discount to the original buyer than to attempt to switch and resell or even to resell on unloading tracks and pay demurrage.

It is thought that these unfair practices on the part of both the shipper and the buyer can be greatly reduced by an impartial inspection and grading system, based upon uniform standards that are understood alike by both buyer and seller.

Plug Track Sales.

In order to overcome some of the difficulties of other methods of sales several large markets, including Kansas City, Cincinnati, and Omaha, have established "plug" yards. They have been termed "plug" yards because the cars offered for sale there are "plugged,"

Fig. 5.—Selling hay at Plug Yards by the auction method. The hay piled outside the car is called the "plug." The man on the hay is acting as auctioneer.

i. e., a plug consisting of 15 to 50 bales is taken out of the car and placed outside so that the buyer can determine better the character of the hay in the car.

The methods of selling hay at the plug yards differ somewhat at the various markets. At most places, except Cincinnati, the actual selling is carried on in practically the same manner as sales at the car door. The method is considered more satisfactory than sales at the car door, however, for the reason that the buyer can see a good representative sample of the hay he is buying. When 30 to 50 bales are removed from the car there is a good opportunity to see whether the hay runs uniform or not (fig. 5).

Each day the buyers and sellers meet at the plug tracks and consummate sales. The buyers examine the different cars offered, and when some are found that meet their requirements they inquire the prices; or, it may be that the sellers request offers. In either event the sales are made privately, but in several markets the seller is required by the rules of the commercial organization of which he may be a member to report all sales made, together with the prices received for each car.

At Cincinnati sales at the plug tracks are made by auction, i. e., each car is sold at public auction to the highest bidder. The dealer to whom the car is consigned or who owns the car usually acts as auctioneer; or he may request a member of the board of governors of the plug yards to sell the car for him. If a receiver or commission merchant desires to buy a car consigned to himself, the rules require that a member of the board of governors shall auction the car. This eliminates the practice, which in some instances is unfair to the shipper, of taking a car for the receiver's account without making an effort to sell it. When auctioning cars at Cincinnati, the seller has the privilege of rejecting all offers and selling after the close of the market at a private sale or of carrying them over for the next day's market. A trackage charge of $1 per day per car is charged for cars carried over and the same rules as to demurrage apply as in any other city.

At a few markets where there are no proper facilities for plugging in the manner aready described, cars are sometimes "wagon plugged." The hay in part of the doorway and in one end of the car is loaded onto wagons. That left in the car is transferred into the space made vacant by the removal of the hay onto wagons, and the hay from the wagons is then loaded back into the car in the opposite end from which it was taken. By this method practically every bale may be seen and graded if desired. When hay is handled in this manner buyers usually conclude the sale after the hay has been graded either at the railroad yards or on the floor of the exchange.

The terms of plug track sales differ somewhat from those applying to other methods. The hay is not sold by grade and in most markets plug sales are final. The buyer has had an opportunity to examine the hay and he, therefore, is not allowed any discount if it is not of the quality it appeared to be when examined at the plug track. The seller frequently guarantees the hay to be of uniform quality and the buyer may request that the car be plugged deeper if he is doubtful about the uniformity of the loading, but otherwise no claims are allowed after the car has been sold.

This system of marketing at terminal markets is quite satisfactory to country shippers and commission merchants, but because of the fact that unscrupulous shippers are able to place from 50 to 75 bales of poor quality hay in the cars with but little danger of detection, the buyers frequently experience considerable loss and some will buy only such cars as the seller guarantees to be uniformly loaded with hay of the quality shown by the plug (fig. 6).

The practicability of the plug method depends to a great extent upon the facilities available for plugging the cars. The plug yards must be located so as to be convenient to the trade and so that the railroads may place cars in them with the minimum amount of expense. At Chicago, for example, it has been found impracticable to establish plug yards for the reason that no place is available that can be reached economically by all the principal roads bringing hay into that market. At Memphis, cars are plugged and inspected and the hay is loaded back into the cars immediately because the yards do not afford a desirable place for selling. The cost of selling by the plug method is greater than the others commonly used and varies from 75 cents to $3 per car according to the services performed.

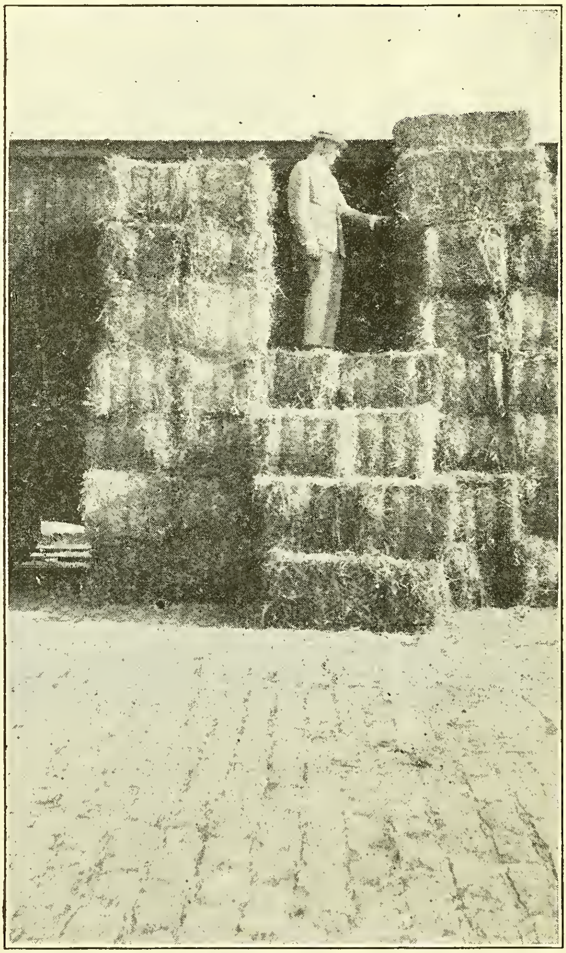

FIG. 6.—Showing quantity of hay usually taken from the car as a plug.

SALES AT WAREHOUSES.

At New York, Boston, Baltimore, and other eastern markets, as well as at several southern markets, the railroads maintain warehouses into which all hay is unloaded upon arrival and from which practically all sales are made. The hay from each car is stored separately so that its identiy is not lost. The dealers visit these warehouses each day, and the hay is disposed of at private sales between buyers and sellers. So far as the transactions between the dealers at the warehouses are concerned the hay is not sold by grade, but the buyer determines whether or not it is of the grade desired. Grades are usually applied only to hay which has been bought to "arrive" as of a certain grade specified.

There are three advantages in selling from warehouses. Sales may be conducted regardless of weather conditions, dealers may see the exact character of the hay offered, and when receipts are in excess of the demand the hay may be left in storage at a reasonable cost and not forced upon a market already overloaded. This method is confined almost entirely to places where practically all the hay is consumed in the market, and is not considered economical in markets where most of the hay is reshipped and reconsigned to consuming sections, because the costs of unloading and reloading outweigh the advantages.

There is no question but that the possession of large storage space stabilizes a market. Some shippers maintain that terminal dealers are opposed to warehouses because they tend to eliminate the wide fluctuations in hay prices whereby speculation at the expense of the country shipper becomes possible. It is thought, however, that the cost of operation under present trade practices is the principal reason that they are not maintained in distributing markets.

Office Sales.

When for any reason hay offered for sale by any of the methods already described is not sold during the trading period, it is frequently sold later. The dealer having the hay for sale may know of some buyer who was not at the market and may visit him at his place of business or call him by telephone and sell the car to him. If no local buyer can be found, the seller may wire several out-of-town buyers and sell the hay to one of them. The terms of such sales are usually the same as those applied to sales on the open market except that when the buyer has not seen the hay its character is fully described during the transaction.

Merits of Various Methods of Sales.

It is impossible to designate any one of the methods named as the best. Some have decided advantages over others but each one has been adopted in the particular market in which it is used because dealers think it is best suited to the facilities of that market.

Under present conditions and practices it seems that the warehouse method is best in those markets where practically all the hay is used locally and can be hauled by wagon or motor truck direct from the warehouse. In large distributing markets the plug method seems most satisfactory when the proper facilities are available.

TIME OF SETTLEMENT.

Most large markets have fixed rules governing settlement for hay sold in the open market. Cash settlements are usually made within 24 or 48 hours after the time of sale. When the hay is to be unloaded or weighed in the market in which it is sold, an advance of about 80 per cent of the value is required in lieu of the full cash settlement. When hay is reshipped or reconsigned an advance is usually required of the buyer if destination weights or grades are to govern settlement, but if market weights and grades guaranteed are to be accepted a full settlement is required within the customary time limit. Time sales are generally made only by local dealers in a market to other dealers or consumers who are outside of the membership of the commercial exchanges.

SHIPMENTS AND RECONSIGNMENTS.

The amount of hay shipped or reconsigned from the different markets varies considerably but the percentage is much larger in the central western markets than in those of any other section. The following table gives the estimated percentage of the hay received that is reconsigned from the principal distributing markets:

Market.	Receipts.	Reconsignments.
	Cars.[1]	*Per cent.*
Kansas City	46,000	80
Chicago	17,500	17
St. Louis	13,500	50
Cincinnati	10,000	90
Pittsburgh	7,000	85
Memphis	4,750	75

[1] Approximate number for year 1920.

A large part of the hay reconsigned from the central western markets moves to the large consuming sections in the South and Southeast. A considerable part of the alfalfa reshipped from Kansas City goes east and northeast into sections in which the production of alfalfa is small and is used for dairy and mixed feeds.

Most of the shipping and reconsigning is done by the shippers in the terminal markets and is a phase of hay marketing which is distinct from the other methods already described.

SALES BY SHIPPERS.

When hay is sold in the terminal markets at car door or plug tracks a large percentage is bought by the shippers located in that market. A small amount is bought by local dealers. The rules of most of the local hay trade organizations prohibit other than members from trading on the various markets, therefore outside buyers or shippers seldom become a factor in the markets.

Shippers depend upon orders from consuming sections for their business. When many orders are received the shippers are active buyers in the market, and when no orders are received they remain out of the market unless they buy to store or in anticipation of orders. Shippers frequently buy hay when they have no orders for it, if in their opinion it is good business to do so, and then offer the hay for sale by wire or letter. If the orders received are not equal to the hay bought it frequently is resold upon the market on the succeeding days.

Obtaining Orders.

The shipper at the terminal market obtains his orders by the same methods and through the same agencies as does the country shipper, namely, by wire, by letter, through brokers, and through traveling salesmen. These agencies have already been fully described.

Terms of Sale.

The acceptance of an order by a shipper constitutes a sale for him, and the terms are almost always included in the confirmation of sale, which is usually sent by wire or mail immediately upon receipt of an order if it is accepted.

The items usually included in the terms of sale are: Quantity, kind of hay, time of shipment, and terms of settlement.

QUANTITY SOLD.

The quantity sold is usually expressed only in carloads, but the number of tons is sometimes also mentioned. Certain trade rules provide that the number of bales shall also be stated, but this is seldom done because it is usually impossible for a shipper to tell how many bales will be contained in the car he buys. It is also frequently impracticable to state the number of tons.

CHARACTER OF HAY SOLD.

The most difficult thing to state satisfactorily in the confirmation of sale is the character of hay sold. Numerical grades for hay have been adopted in practically all hay markets, and generally there is a fairly good understanding in the terminal markets as to the character of the hay represented by the grade designation. In the consuming sections, however, local conditions seem to be a factor influencing the interpretation of the grades, so that the ideas of buyers as to the quality represented by certain grades vary in the different sections. For example, mining sections seem willing to accept a much lower grade of hay for No. 1 timothy than small markets with a retail trade. The price is also given consideration, and buyers frequently specify No. 1 hay and then refuse to pay more than the price of No. 2. Shippers in the various markets in competition for business have made use of these conditions to such an extent that quotations and sales by grade have come to have but little meaning.

These conditions have also led to the substitution of certain terms for the numerical grades, such as "Choice timothy hay," "Good feeding hay," etc. The need for the term "Choice timothy hay" has developed because of the tendency on the part of the shippers to lower the quality of No. 1 hay to agree with the ideas of the least exacting purchasers, and in some instances the grade represented by "Choice timothy hay" has also been lowered, as is evidenced by a number of samples examined by representatives of the Bureau of Markets, which were found to be lower than the recognized standards for No. 1 timothy.

Many shippers who desire to build up a permanent trade with their customers are supplementing the numerical grade designation with descriptive phrases in order to make clear the character of the hay offered or sold. This, it is claimed, eliminates many of the difficulties encountered when hay is sold by grade only.

The greatest care should be used in describing the character of the hay when confirming the sale, in order that as little difficulty as possible may be experienced when the hay is received by the buyer.

The fact that descriptive terms are needed indicates that present grade terms are inadequate or are at least not sufficiently clear. The Bureau of Markets is at present engaged in the study of market grades for the purpose of determining wherein they are deficient, and, if possible, of constructing grades or standards that will be adequate for the use of the whole trade in the purchase and sale of hay.

TIME OF SHIPMENT.

The trade terms used to denote the time within which a shipment may be made have been defined by trade associations, and their use is fairly uniform throughout the country. These terms are: Immediate shipment, which has been interpreted as three calendar days; quick shipment, five calendar days; and prompt shipment, ten calendar days (Sundays and holidays excluded). For shipments which are to be made within a period longer than 10 days the time is usually stated. Sales are frequently for "scattered shipment." This means that the hay is to be shipped a car or two at a time at a rate as uniform as possible over a given period. The advantage of this method is that it assures the buyer of a constant supply at a uniform price. The shipper, however, hesitates to sell on such terms unless the market is fairly steady or he is certain of a sufficient amount of hay to fill the order. When the time is not stated in the terms of sale it is generally understood that prompt shipment will be made.

TERMS OF SETTLEMENT.

On hay shipped from terminal markets the terms of settlement are almost always either "sight" or "arrival" draft, but the arrival draft is used much more extensively because buyers generally refuse to pay for the hay until they have inspected it. The number of instances in which the hay is shipped on open billing is few.

Because much of the hay sold by shippers in terminal markets is bought by them on track in their respective markets and is reconsigned directly from the track the terms of sale relative to the weights and the grades that govern settlement vary a great deal. Unless the hay has been loaded from a warehouse at a terminal market it is almost impossible for shippers to give official weights.[1]

The term most used is "shipper's[2] weights guaranteed within 2 per cent."[3] Outturn weights, however, are frequently specified, and, in fact, "shipper's weights guaranteed" are practically outturn weights, for the guarantee can not be enforced unless the hay is weighed at destination to determine the correctness of the shipper's weights.

Considerable difficulty is experienced with weights when hay is sold on the terms just mentioned. The weighing facilities of both the country shipper and the buyer at interior points in consuming territories are frequently very poor and their weighing methods are inefficient. The country shipper, therefore, is often not sure that his weights are correct; nevertheless he bases his invoice upon them and sells or consigns his hay to the terminal market.

The receiver or commission merchant there offers and sells the hay on the open market and offers the shipper's weights or invoice as evidence of the amount of hay in the car. The shipper buys the hay and reconsigns it to his customer, using the country shipper's weights as the basis of his invoice. The buyer, if he has scales, usually weighs the hay as he unloads it. If the outturn weight, considering the 2 per cent tolerance allowed, is less than the invoice weight, he makes an affidavit as to the correctness of his weight and attaches it to a

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[1] "Official" weights are those obtained by the official weighing bureaus which are maintained by the trade organizations at most terminal markets. A full description of methods of official weighing is given in Bulletin No. 978; The Weighing of Market Hay, by G. A. Collier and H. B. McClure. 1921.

[2] "Shippers" in this instance refers to country shippers.

[3] In some markets the tolerance allowed is only 1 per cent, while in others as much as 3 per cent is sometimes allowed.

claim for the loss in weight, which he forwards to the shipper from whom he bought the hay. The shipper having practically guaranteed the weight usually pays the claim and in turn makes a claim upon the receiver or commission merchant from whom he bought the hay. If full settlement has not been made with the country shipper, the claim is generally allowed, and the returns made to the country shipper are upon the basis of the outturn weights.

If full returns have been made by the commission merchant upon the sale of the car at the terminal market, as is frequently the case under the present methods of sale especially on plug tracks, the country shipper may not pay the claim presented to him; he may think that his weights are just as accurate as those of the ultimate buyer and he may have good reasons to think so. If he will not allow the claim, he is requested to furnish an affidavit as to the correctness of his weights. The commission merchant or receiver then presents this affidavit to the terminal market shipper, who, with an affidavit as to the correctness of the weights of both the country shipper and buyer, has no other recourse than to present a claim to the railroad for loss in transit. Since a physical loss frequently can not be shown, the terminal market shipper usually stands the loss. This loss must be added to the cost of doing business.

One large shipper in northern Indiana estimates that the average shortage on hay shipped direct to consuming sections is 800 pounds per car. This loss, which at present seems to be unavoidable, has led to questionable practices on the part of some shippers from terminal markets. One of the most common of these is the raising of the country shippers's weights 500 to 1,000 pounds and trusting to the buyer's neglect to weigh the hay. The amount gained in this way is used to offset the loss which may be occasioned when the hay is weighed.

The country shipper and buyer both contend that their weights are correct. The middlemen must, therefore, stand the loss unless by some means, fair or otherwise, he can shift it to some of the other interested parties. If some means could be found for having all hay weighed by a competent disinterested agency, preferably at the terminal market, so that a certificate of weight could be furnished both the shipper and buyer, most of the difficulty as to weights could be eliminated.

At the present time the grades which are to govern transactions between shippers and buyers cause more controversies and disputes than any other item in the terms of sale.[4] Grades have been made the excuse for rejections, excessive discounts, and other claims on the part of buyers. The present market practices seem to be the prin-

[4] The matter of grading is fully discussed in Bulletin No. 980, Inspection and Grading of Hay, by H. B. McClure and G. A. Collier. 1921.

cipal cause of a great many of these misunderstandings. The character of the grades, as has already been mentioned, is also a contributing factor.

In the first place, official grade certificates for outbound shipments are seldom furnished by shippers from terminal markets. A number of reasons have been advanced for this practice. It is claimed to be impracticable to issue certificates for cars that have been only "plug" or car-door inspected. However, such certificates are issued and used in settlements for hay in inbound shipments. Grade certificates for hay loaded out of warehouses at terminal markets are issued in only a few instances; in some markets, it is stated, $1 or $2 per ton more is charged for hay with which a grade certificate is furnished. It appears, therefore, that the grade stated by shippers in their quotations and terms of sale are personal grades and not official market grades. Many shippers claim that the grades given the hay are those desired by the buyer, but since the buyer would hardly reject hay which conformed to his own ideas as to grade it is doubted whether this is the reason for the use of such grade terms by shippers.

It has been noted also that more No. 1 hay is shipped out of the various terminal markets than the official records show has been shipped into them during a stated period, or, in other words, the grades seem to have been raised on outshipments. This practice is never satisfactory to the buyers and they usually show their disapproval whenever they have an opportunity to do so.

One of the remedies for the difficulties now experienced in connection with grades in the terms of sale is to state definitely what grades are to be used, i. e., whether they are individual or personal grades, market grades, or association grades. Another remedy is to leave the interpretation and application of the grades to a competent and disinterested party whenever possible.

OTHER MARKET PRACTICES.

In an apparent effort to overcome some of the difficulties experienced in shipping hay from terminal markets under present conditions, dealers in some of the western distributing markets have engaged in a marketing practice which is a combination of the activities of both a commission merchant and a shipper. Such dealers solicit orders from buyers in the same manner as shippers do and also solicit consignments from country shippers. When orders are received they are filled from the consignments which have been made by country shippers to these dealers. The advantage claimed is that the shipper consigning the hay receives more than if it were sold on the market because he obtains the whole amount paid by the buyer or consumer less only one commission. If only one commission is charged, the country shipper may receive more for his hay than if it is sold upon arrival at the terminal market.

There are so many other factors entering into the transaction, however, that it is doubtful whether it can be considered fair to the shipper unless his consent has been obtained to handle the sale in this manner. In the first place, the country shipper usually consigns to a terminal market for definite reasons. Lower prices may seem imminent and in order to market his hay before they occur he may rush his hay on consignment to a neighboring market. In this case it would certainly be unfair to the shipper for the commission merchant to reconsign his hay upon a previous sale to some distant point at which it may not arrive until the market has declined. If the shipment should be refused and heavy charges should be incurred, it would be clearly unfair to the shipper to have to stand a discount to cover them, yet such would probably be the case under these conditions. Again, the country shipper may have consigned his hay because of an expected advance in the market and he may desire to have his hay sold to the highest bidder upon arrival. In that case it would be unfair to him to have his shipment of hay applied upon a sale made at an earlier date and probably at a lower price. These practices are unfair to shippers to terminal markets, and should be eliminated by the regulations prescribed for those markets. If a market does not have such regulations, shippers should ascertain whether their consignments are handled fairly or not.

ADJUSTMENTS.

It is generally very difficult to adjust satisfactorily disputes and controversies that arise relative to terms of sale. Trade organizations have arbitration committees to which controversies which principals are unable to settle between themselves may be referred, and as a last recourse the civil courts may be called upon to decide the issue. But few cases get into the courts, however, and only a small number are referred to arbitration committees.

In most cases the parties in a dispute relative to the terms of sale, weights and grades, etc., present their claims and counterclaims to each other by letter and the matter is finally settled by one or the other, or probably both, making some concessions. When considerable money is involved the one making the claim frequently calls upon the other party, or sends a representative to call, and makes a personal effort to adjust the matter. The state of the market frequently has a great deal to do with the adjustment of a claim. Misunderstandings or misinterpretations of the terms of sale and nonfulfillment of them are the principal causes of disputes and all persons interested in the marketing of hay should strive to use clear, distinct terms, that can not be misinterpreted and that cover the transaction thoroughly.

KINDS OF HAY RECEIVED AT PRINCIPAL MARKETS.

The kinds of hay received at the various markets and the size of bales preferred are shown in the tables, pages 46 to 49, inclusive.

Generally speaking, timothy is the principal hay handled in the markets east of the Mississippi. Clover and clover mixed are also handled, with some alfalfa. In the markets in the Southeastern States other hays, such as peanut hay, Bermuda, Johnson grass, and lespedeza, are handled to a small extent. West of the Mississippi alfalfa and prairie are the principal hays. On the west coast the division seems to be about equal between alfalfa and grain hay.

Eastern markets pay a premium for the large box-press bale. Central western markets prefer the 16 by 18 inch or 17 by 22 inch bale. In the southwestern markets, where considerable hay is baled from the windrow, a small two-wire bale not larger than 16 by 18 inches, weighing about 70 pounds, is given preference.

The preferences of the different markets for certain sizes of bales have never been explained, but from a survey recently made by the Federal Bureau of Markets it seems that precedent is the most important factor. Dealers who prefer the large bales assert that the hay comes out of the bale in better condition and does not have the "life" pressed out of it. From the meager data available, however, recompressed hay seems to be as nourishing as ligthly pressed hay. In this light it would seem that the appearance of the hay is the important factor since hay taken from a box-press bale appears better than that taken from bales from other kinds of presses. In southern markets where the hay is sold to retailers and consumers the smaller bales are prefererd because they are lighter to handle. Where hay is baled from the windrow, as is the case in the Southwest, the smaller bale is preferred because it is not so likely to spoil as a larger, more tightly pressed bale.

Considerable expense would be eliminated in baling if a standard size of bale could be adopted because only one size of press and one length of wire would then be necessary. Some of the difficulty of loading minimum weight into cars would also be overcome.

WHOLESALERS AND RETAILERS IN CONSUMING TERRITORIES.

Many of the important factors which should be considered in a discussion of the marketing of hay in consuming territories have already been described in detail in the discussions of marketing by the country shipper and at the termial markets. Since purchases by

Requirements of the various eastern, western, and southern hay markets, showing kinds of hay received, types of bales, methods of inspection, weights, and the most common faults that affect the selling price.

EASTERN MARKETS.

Markets.	Kinds of hay received.[1]	Types of bales in demand (weights in pounds).	Inspection.	Kinds of market weights used.	Methods of receiving and selling.	Common faults that affect the selling price of market hay.
Baltimore, Md	Tim, cl, cl-mx	Small 3-wire[2] (100), large (200–230).	Warehouse	Car, loaded and unloaded, at terminal warehouse.	Warehouse, each carload separated into grades.	Presence of fine grasses, weeds, daisies, and plantain; meadows kept in hay too long.
Boston, Mass	Tim, cl-mx, cl, some al.	Large upright[2] (190–220), small.	None	Official[3]	Terminal warehouses	Late cutting, mow burn, and presence of weeds and daisies.
Chicago, Ill	Tim, cl, cl-mx, pr	14 by 18 inches (100), 16 by 18 inches (125).	Door, bale	Railroad, official	Holding yard, private warehouses.	Presence of other grasses; cut too late.
Cincinnati, Ohio	Tim, cl-mx, cl, alsike cl.	Small[2] (100–125), large (200–230).	Plug	Official, on hand-truck scales at warehouses.	Private warehouses; sold plug track.	Clover cut too late; presence of white mold, weeds, and stubble; "white top" very common; bales often "sandwiched."
Cleveland, Ohio	Tim, cl-mx, cl	Medium	Door		On track	
Columbus, Ohio	Tim, cl-mx	Medium, small	do	Shippers, with guarantee attached.		
Duluth, Minn	Tim, upland pr, mx	Small (100)	Door, bale	Railroad, shipper's, consignee's.	On track, private warehouses.	Streaked bales, caused by improper curing; considerable wet hay received.
Indianapolis, Ind	Tim, cl-mx	Small, large	Door		Private and sample on exchange.	
Minneapolis, Minn	Tim, cl-mx, pr	Medium	do	Railroad track scales	Private warehouses	
New York, N. Y	Tim, cl-mx, cl, some al.	Large upright[2] (190–220), small (100–125).	Door, warehouse.	Tag, corrected by averaging actual bale weights.	Terminal warehouses	Late cutting, mow burn, and presence of weeds and daisies.
Philadelphia, Pa	Tim, cl-mx, some al	Medium[4] (100–125)	do	Railroad track scales; wagon scales at private warehouses.	Holding yards; sold at yards or in warehouses.	Most of the low-grade hay caused by late cutting and improper methods of curing.
St. Louis, Mo	Tim, cl-mx, al, pr, cl	Small[2] (80–100), large	Door	City wagon scales	On track, private warehouses.	Cut too late; "sandwiched," as most of the product has been stacked and carelessly baled.
Washington, D. C	Tim, cl-mx, cl	Medium, large	do		Private warehouses	Cut too late; reddish color; presence of fine grasses.

WESTERN MARKETS.

Markets.	Kinds of hay received.[1]	Types of bales in demand (weights in pounds).	Inspection.	Kinds of market weights used.	Methods of receiving and selling.	Common faults that affect the selling price of market hay.
Boise, Idaho	Tim, al, tim-mx	Small	None	City wagon scale, shipper's, consignee's.	Private warehouses	Timothy and mixed hay often cut too late.
Butte, Mont	Tim, al, bluejoint	do	do	do	do	Meadows are allowed to become too old, resulting in a mixed hay not in demand.

Denver, Colo	S. Park wire-gr, al, Colo. upland.	Small[2] (80), 16 by 18 inches.	do	Railroad, shipper's, consignee's.	do	Streaked bales caused by improper curing; prairie hay not uniform in quality.
Los Angeles, Calif	Bar, wh, oat, al, tim	Medium (150)	do	Railroad, city	do	Grain hay often cut too late; presence of dirt and weeds; hay sometimes contains too much moisture.
Ogden, Utah	Al, tim	Small	do	City wagon scale, shipper's, consignee's.	do	Low-grade timothy caused by other grasses in meadows used too long for hay.
Phoenix, Ariz	Al, wh, oat, bar	Small (70-90)	do	Railroad, city	do	Irrigated hay too coarse; first crop of alfalfa often badly infested with foxtail and other grasses.
Pocatello, Idaho	Al, tim	Small	do	City wagon scale, shipper's, consignee's.	do	Alfalfa often baled before being thoroughly cured, causing it to heat and spoil.
Portland, Oreg	Tim, cl, wh, al, nat, vet-mx.	Medium[2] (100-150), large (200).	do	Railroad, city	do	Clover hay often moldy or dusty; meadows used for hay too long.
Pueblo, Colo	Pr, nat, al	Small[2] (80)	do	City wagon scale, shipper's, consignee's.	do	Timothy often contains foxtail; prairie hay of poor quality, due to cutting too late.
Salt Lake City, Utah	Tim, al	Small[2] (80-100)	do	do	do	Timothy often improperly cured in wet weather; timothy from old meadows contains too much redtop and wild grasses; rain spoils hay in partly baled stacks.
San Antonio, Tex	Jn, N. Tex pr, al, cane, C.	Small (70-80)	Door	City	do	Cane hay cut too late, too coarse; prairie hay has too much "red" late-cut grass; Johnson grass often too coarse.
San Francisco, Calif	Wh, oat, w-oat, bar, rye, grain-mx.	Large (200-220)	None	Railroad, city	Holding yards, sold by auction system.[5]	Grain hay often cut too late; presence of dirt and weeds; hay sometimes contains too much moisture.
Seattle, Wash	Tim, al, wh, redtop-mx, Sound hay.	Medium[6] (100-150), large (200).	do	City wagon scale, shipper's, consignee's.	Private warehouses	Hay often heats on account of improper curing or storing.
Spokane, Wash	Tim, al, wh, bluejoint.	Small (100-120)	(7)	do	do	Timothy meadows used too long; grain hay cut too late; considerable hay heats after being baled.

[1] The several kinds of hay are shown in the order of importance of demand. The meanings of the symbols are as follows: al=alfalfa, bar=barley, Ber=Bermuda grass, C="coast" hay, cl=clover, corn=baled corn shucks, cr=crab grass, gr=grass, Jn=Johnson grass, lt=light, mil=millet, mx=mixed hay, N=north, nat=native, pr=prairie hay, S=south, Tex=Texas, tim=timothy, vet=vetch, w=wild, wh=wheat.
[2] Kind preferred.
[3] The official market weights referred to are those certified by inspectors officially appointed by the various hay markets.
[4] Medium or three-quarter bales, 17 by 22 inches, preferred.
[5] Private warehouses used for storing hay for city trade and export.
[6] Medium preferred, compressed for export.
[7] Consignee has privilege of inspection.

Requirements of the various eastern, western, and southern hay markets, showing kinds of hay received, types of bales, methods of inspection, weights, and the most common faults that affect the selling price—Continued.

SOUTHERN MARKETS.

Markets.	Kinds of hay received.[1]	Types of bales in demand (weights in pounds).	Inspection.	Kinds of market weights used.	Methods of receiving and selling.	Common faults that affect the selling price of market hay.
Atlanta, Ga.	Tim, al, Ber, Jn, mil, corn.	Small [2] (70–100), medium 3-wire (150).	Door, bale.	Official, shipper's, consignee's.		
Augusta, Ga.	Tim, Jn, Ber, nat-mx.	Small [2] (80–100), large 5-wire (200).	None.	Shipper's, consignee's.	Private warehouses.	Johnson grass very often cut too late.
Birmingham, Ala.	Tim, al, Jn, lt-mx-tim.	Small [2] (80).	Door.	Railroad, shipper's.	do.	Local-grown alfalfa often improperly cured.
Charleston, S. C.	Tim, tim and gr-mx.	Small.	None.	Railroad, city.	do.	Timothy often cut too late, has reddish color, and is mixed with briars and grasses.
Columbia, S. C.	Tim, Ber, Jn.	Small[2] (16 by 18 inches), large (18 by 22 inches).	do.	do.	do.	Timothy often cut too late, has red color, and contains trash and weeds.
Fort Worth, Tex.	Jn, pr, al, C.	Small [2] (60–80).	Door.	City.	do.	First crop of Johnson grass often cut too late and improperly cured.
Galveston, Tex.	Tex. pr, Jn, al, C, tim.	do.[2]	None.	do.	do.	Cane and Johnson grass cut too late; prairie has reddish color caused by being cut too late.
Houston, Tex.	Jn, pr, al, C.	do.[2]	Door.	do.	do.	Do.
Jackson, Miss.	Tim, al, lt-cl-mx.	Small.	None.	Shipper's.	do.	Local-grown alfalfa off color and improperly cured.
Jacksonville, Fla.	Tim, lt-cl-mx, some cl.	Medium [1] (100–125), small (70–90).	Door, warehouse.	Consignee's, shipper's.	do.	Medium bales should have three wires; little demand for the lower grades of hay.
Little Rock, Ark.	Pr, al.	Small [2] (60–80).	Door,[4] plug.	City.	do.	Red color in prairie hay is most common fault found with hay in this market.
Macon, Ga.	Tim, cr.	Small [2] (80–100), large 5-wire.	None.	Shipper's, consignee's.	do.	Local-grown hay often of poor color.
Memphis, Tenn.	Tim cl-mx, pr, al.	Small [2] (60–100).	Door, bale.	Official [3].	do.	Sandwiched cars and bales often received; considerable hay off color; demand for timothy of better grades only.
Mobile, Ala.	Tim, al.	Small (80–100).	(5)	Shipper's, city.	do.	
Montgomery, Ala.	Jn, tim, al, Ber.	Small [2] (80–100), 14 by 18 inches.	None.	do.	do.	Large amount of lower grades of timothy received in the past has caused this kind of hay to cease to be in very great demand.
New Orleans, La.	Tim, pr, al, cl-mx, cl.	Small,[2] large.	Bale.	Platform scale at warehouse.	Terminal warehouse.	A large percentage of hay grades low on account of being too mature and improperly cured.

Norfolk, Va	Tim, lt-cl-mx, cl	Small, medium [2] (100-125).	Door	City	Private warehouses	Timothy often cut too late, has reddish color, and is mixed with briars and grasses.
Pensacola, Fla	Tim, al	Small (80)	(6)	Shipper's, city	do	More low-grade hay received than in demand.
Raleigh, N. C	Tim, nat	Small [2] (125), large	None	City	Private warehouses	Timothy often cut too late, has reddish color, and is mixed with briars and grasses.
Savannah, Ga	Tim, pr, al	Small (90), large	Warehouse, bale.	Platform scale at warehouse.	Terminal warehouse	Timothy often mixed with redtop, other grasses, and weeds.
Shreveport, La	Tim, al, pr, Ber	Small [2] (60-70), 14 by 18 inches.	None	Shipper's	Private warehouses	Local-grown alfalfa off color and improperly cured.
Tampa, Fla	Tim, pr, cl	Small [2] (90-100), medium (120-150).	do	Consignee's, shipper's	do	Medium bales should have three wires.
Wilmington, N. C	Tim, some cl	Small [2] (125), large	(6)	Tag	do	Timothy often cut too late, has reddish color, and is mixed with briars and grasses.

[1] The several kinds of hay are shown in the order of importance of demand. The meanings of the symbols are as follows: al=alfalfa, bar=barley, Ber=Bermuda grass, C=" coast " hay, cl=clover, corn=baled corn shucks, cr=crab grass, gr=grass, Jn=Johnson grass, lt=light, mil=millet, mx=mixed hay, N=north, nat=native, pr=prairie hay, S=south, Tex=Texas, tim=timothy, vet=vetch, w=wild, wh=wheat.
[2] Kind preferred.
[3] The official market weights referred to are those certified by inspectors officially appointed by the various hay markets.
[4] Inspection under Little Rock Exchange rules.
[5] Chamber of commerce sometimes inspects hay.
[6] Buyer has privilege of door inspection.

wholesalers and retailers in consuming sections are coincident with sales by shippers in the producing sections and at the various markets, no further explanations will be needed concerning these transactions.

LOCATION AND PREFERENCES OF CONSUMING TERRITORIES.

Taking the country as a whole, only a small percentage of the hay produced, estimated at from 15 to 20 per cent, is shipped out of the county in which it is raised, thus leaving 80 to 85 per cent to be consumed locally. Certain well-defined areas, however, do not produce sufficient hay for their requirements and these are known as consuming territories. Roughly defined they are as follows: The New England dairying sections; the mining sections of Pennsylvania, Michigan, and Wisconsin; the section south of the Ohio and Potomac Rivers and east of the Mississippi; certain sections of Louisiana, Texas, and New Mexico; and nonproducing sections west of the Rocky Mountains.

Timothy and light clover mixed hay are preferred and constitute the bulk of the hay handled east of the Mississippi River. Alfalfa and prairie are most extensively used west of the river. A good deal of alfalfa is beginning to be used in southern and southeastern sections also.

Timothy hay in general is preferred in markets where the demand is from draymen, horse liveries, etc. Clover and alfalfa meet the demand from dairymen; prairie, while used in place of timothy to some extent, is most extensively used for feeding stock which is being carried through the winter. While timothy, clover, alfalfa, and prairie are considered the principal commercial hays, native hays are marketed to some extent in the territories in which they are grown. In the South, peanut hay, peavine hay, Johnson grass, Bermuda, and lespedeza hay are grown and marketed locally, but are not shipped to any very distant markets.

DISTRIBUTION.

The bulk of the hay marketed in consuming sections is bought from the country shipper or shipper in terminal markets, direct or through a broker, by wholesalers or retailers located in the consuming sections. Wholesalers usually have storage for several cars of hay and unload most of it upon arrival. It is then sold in whole or split carloads to consumers and retailers in the same or surrounding markets. Carload orders to wholesalers are usually filled if possible by diverting or reconsigning hay which is en route or which has been ordered by the wholesaler while the hay unloaded in the warehouse is generally used for filling split-car orders, i. e., orders for one carload composed possibly of grain, feed, and hay. Split-car orders constitute an important part of the business of most wholesalers in southern markets. Retailers sell mostly in small quantities to consumers.

WEIGHTS.

In those sections where tagged weights are used the hay is sold on the weights indicated on the tags. The advantage to the dealers of using these weights is that it eliminates any loss from shrinkage or handling because they sell the hay by the same weight by which they buy it and any loss is thus passed to the consumer.

In many distributing markets all hay is weighed as it is sold. By this method the consumer gets what he pays for but the dealer, to cover the loss caused by handling, etc., must charge slightly more for his hay. In a few places hay is still retailed by the bale, the dealer basing the price per bale on the average weight of the bales as indicated by his invoice for the car. Unless the weight of the bales is uniform this method is an unsatisfactory one to the purchaser.

GRADES.

In retailing only a few grade terms are used. Hay is almost always sold as No. 1 or good hay. If the dealer has some mixed hay the amount of the mixture is usually stated. In some instances the use for which the hay is best suited is stated when describing the character, for example, "Good rabbit hay," "Choice dairy alfalfa," or "Good sheep hay." When the hay offered is not considered first class it is usually not given a grade designation but the dealers describe it as "good feeding hay, just a little ripe," or "No. 1 hay containing just a few weeds," or possibly "good hay that is a little dark," etc. In general very few consumers have any conception of the quality represented by any grade terms other than Choice and No. 1 hay and these terms are, therefore, used with such modifications as have been mentioned.

TERMS OF SETTLEMENT.

No sight or arrival drafts are used by retailers and the time of settlement depends on the character of business done. Some dealers sell for cash only, others allow 30 days' credit, and still others allow accounts to run as long as a year. In dairy sections the time of settlement is frequently made to coincide with the date upon which the dairymen receive pay for their products, which may be once a month. In the South settlement for the whole season is commonly made when farmers market their cotton. It will be seen that no single method of settlement is used throughout consuming sections, but that that method is used which is best suited to local conditions.

SUGGESTIONS.

While a good many unfair methods are at present practiced by those concerned in the marketing of hay it appears that most of them are related to loose methods of business on the part of various agencies engaged in the handling of hay. On the basis of careful observations made throughout the hay producing and consuming sections, and at the principal markets, it is thought that some improvement in the methods of marketing hay can be affected by observing the following suggestions:

On the part of the country shipper: (1) More care in grading, weighing, and loading the hay; (2) better forms for use in confirming sales, tabulating and stating weights, and for invoicing hay; and (3) more care and accuracy in stating terms of sale.

On the part of dealers in terminal markets: (1) The elimination of the practice of allowing the state of the market to influence the fulfillment of contracts with country shippers; (2) more uniform methods of handling in terminal markets; (3) better weighing methods and more consideration of contents of weight certificates; (4) more uniform grading practices; (5) grading inbound and outbound hay on the same basis when hay is bought and sold on grade designations; and (6) the elimination of the practice of "boosting" grades on outshipments.

On the part of dealers in consuming sections: (1) More careful weighing of purchases; (2) elimination of rejections when price decline is the only factor; and (3) better records relative to contents and weight of a car when unloading.

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BULLETIN No. 980

Contribution from the Bureau of Markets and Crop Estimates
H. C. TAYLOR, Chief

Washington, D. C. ▼ November 16, 1921

INSPECTION AND GRADING OF HAY.

By H. B. McClure, *Specialist in Hay Marketing*, and G. A. Collier, *Investigator in Hay Marketing*.

CONTENTS.

In theory, hay is inspected for the purpose of promoting better business relationship between the various agencies engaged in handling or marketing hay, especially those which do not come into personal contact with each other, such as the country shipper and the distributor. In actual practice the inspection often proves highly satisfactory to one of the interested parties and quite the reverse to the other.

The necessity for inspection of hay arose with the advent of the trunk-line railroads and the invention of the baling press. These factors greatly widened the heretofore rather unimportant local market by making it possible and often very profitable to ship baled hay many hundreds of miles. As soon as baled hay was shipped in appreciable quantities difficulties between shipper and receiver arose because they did not have the same ideas as to what constituted certain qualities or grades, or they were unable to describe such qualities accurately.

Considerable progress has been made in the inspection of hay during the last 30 years, as is evidenced by the large volume of business done in the marketing of hay, but the inspection has not yet reached a really satisfactory stage.

It is the purpose of this bulletin to describe methods of inspection in vogue to-day, indicate the relative merits of each kind, and give information obtained by a comprehensive study of the subject recently made in the leading hay markets of the country for the bene-

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fit of all agencies engaged in the production and marketing of hay. These agencies are (1) the producer, (2) the producer shipper, (3) the country shipper, (4) the track buyer, (5) the commission man, (6) the terminal wholesaler and shipper, (7) the broker, (8) the distributor (wholesale and retail), and (9) the consumer of market hay. The endeavor is to present this important marketing factor in such a light that each agency engaged in the hay business will understand some of the problems that confront other agencies. Such an understanding should reveal the necessity for a better and more uniform inspection of hay and should induce all agencies to do their part in bringing about this much-needed change, to the benefit of all.

GRADES AND INSPECTION SERVICE.

HOW GRADES WERE FORMED.

The first grades formulated for hay were what might be termed "local" grades; that is, they were used by a few men in one market and were perhaps very different from the "local" grades used in other markets to which the same kinds of hay were shipped. Later, terminal-market hay dealers formed business associations such as city hay dealers' associations, exchanges, and boards of trade, which had trade rules governing the method of inspecting, buying, and selling of hay by its members. The grades used were formulated by the members or were grades used by other organizations in other markets.

The grades in most general use are those of the National Hay Association. Several of the States have what are known as State grades for hay, and in a few instances the grades of the National Hay Association have been adopted by the States.

"Local" grades still exist in many markets. Sometimes they are used as "official" grades for a specified market and sometimes they are used personally by members of the association to which the hay dealers belong in spite of the fact that such members are expected to adhere strictly to the rules of their association and use the "official" grades only.

It is very significant that in the formulation of grades the producer, who has all of the responsibility, the work and the worry of seeding, growing, and making of succulent forage into marketable hay is scarcely considered, much less consulted, when grades for hay are being formulated, although the value of his total crop stands second among agricultural crops and is outranked only by the great corn crop.

The requirements of grades can not be thoroughly understood unless the desires of the principal agencies be known. There are at least three agencies engaged in the marketing of hay whose motives or wishes, respecting grades, are opposed to one another.

The desires of (1) the country shipper are opposed to those of (2) the terminal receiver and shipper, whose desires are opposed somewhat to those of the (3) distributor in a consuming territory.

It is a well-known fact that the country shipper wants rather "loose" grades, that is, grades which will permit wide latitude with respect to the quality demanded. He naturally wants grades which allow considerable variation within each grade, for then it becomes rather easy for him to deliver any specified kind, especially of the better grades of hay.

The terminal-market dealer wants very rigid or "tight" grades, each of which will permit but one quality of hay to fit the grade. Such grades would be of incalculable advantage to him, especially when prices have dropped and he wants to reject hay arriving upon a poor market. Another advantage to the terminal dealer would occur if he were allowed to reconsign hay without having to furnish an "out" inspection certificate, because he could place his own grade on such outbound hay. In other words, the principle of this terminal-market practice is to buy as cheaply as possible from the country shipper by use of "rigid" grades or inspection and sell at as high a price as possible to the distributor by means of grading the hay up.

The large distributor in the consuming territory wants one thing more than any other, namely, to bring about some system whereby he will be able to get actually the kind of hay he has bought. This is true because, in many instances, he sells hay to those who are desirous of buying only the better grades. At present the best way for the southern hay dealer to get good No. 1 hay is to deal through large terminal market dealers who keep traveling representatives on the road for the purpose of visiting the southern dealers once or twice a year in order to "keep together" on the matter of grades. The smaller southern dealer who buys from terminal dealers who do not send "outbound" certificates with the invoice is likely to grade hay high. He will often accept No. 2 and No. 3 hay as being No. 1 because he can resell it to customers who do not know good hay as judged by present grade requirements. The result of the difference of opinion regarding grade requirements is that one type of dealer pays for real No. 1 hay and gets it while the other type of dealer pays the market price for No. 1 hay and often does not get it. It is quite probable that the distributor's desires regarding grade requirements would coincide with those of the country shipper if the use of official outbound inspection certificates accompanied all hay reconsigned from terminal markets.

The formation and occasional revising of market grades for hay are largely under the control of the terminal-market members of organizations composed of the various agencies engaged in the marketing of hay. Attempts of country shippers to revise grades so that they will be suitable to the producers' ideas usually fail. This is evidenced by the attempt in 1920 on the part of country shippers to do away with "Standard" timothy, a grade which was very seldom used by country shippers. This grade has caused considerable confusion in the hay business and was eliminated in August, 1921.

VARIATION IN ESTABLISHED GRADES.

Almost a score of sets of grades have been in existence for several years and they show considerable variation in the requirements for certain grades.[1] "Prime" timothy is a grade used in only two terminal markets, Buffalo and New York City. This grade calls for "straight" timothy, a product which now is seldom grown.

"Choice" timothy is found in the grades of Buffalo, Galveston, Little Rock, Fort Worth, Denver, and in the Washington and Oregon State grades. Little Rock grades require that "choice" timothy be "straight" timothy. The Denver grade allows 12.5 per cent of "other" grasses, and the other sets allow 5 per cent of "other" grasses.

No. 1 timothy grades also show some variation. As regards mixture, the New York City grade is the strictest, while the requirements of the Washington and Oregon grades are the most lenient. No. 1 New York City timothy allows for other grasses, with the exception of clover, while the Washington and Oregon State grades allow 15 per cent of redtop, or clover or wild grasses, or 25 per cent of alfalfa.

The Pennsylvania State grades allow 20 per cent of "other" grasses in No. 1 timothy, and most of the other sets of grades allow only 12.5 per cent of "other" grasses. Standard timothy is found in only two sets of grades, namely, those of the National Hay Association and of Little Rock, Ark. The grade requirements for Nos. 2 and 3 timothy also show considerable variation, which tends to confuse the shipper who ships hay to different markets not using the same set of grades.

The variation in the different sets of grades is not greater than the variation of interpretation of grades in different markets using the same set of grades.

PRESENT STATUS OF INSPECTION SERVICE.

With but few exceptions, inspection of hay is made only at terminal and distributing markets. The exceptions are in Washington State in the Yakima Valley, where National Hay Association grades are used by inspectors under the directions of the Seattle Merchants' Exchange, and at several points in Idaho, where State inspectors employ the State grades.

[1] For detailed information regarding grade requirements used by various markets, see grades used by National Hay Association, New York City, Little Rock, Denver, and Galveston, and Washington, Oregon and Pennsylvania State grades.

In general, the hay producer or the country shipper is utterly unable to have an official inspection made. It is a strange state of affairs that makes it impossible for a country member of a national hay association to demand and get an inspection of his hay in a terminal market from an inspector who has been approved by his own association. In other words, these approved hay inspectors[2] are to be found almost entirely in the large city markets working entirely for the interests of the receiving end of the hay business. It would seem to be for the best interests of the hay trade in general that all agencies engaged in the business should have an equal chance to call for an official inspection to settle questions regarding the quality or grade of their hay.

One of the chief reasons why the inspectors in half of the markets using National Hay Association grades have not been approved is because of the persistent use of special or "local" grades in those markets.

APPOINTMENT AND SUPERVISION OF INSPECTORS.

Hay inspectors receive their appointments in one of three ways: (1) From exchanges, boards of trade, etc.; (2) from the city council or mayor; (3) from State authorities. State and city administration inspectors are subject only to the administration appointing them, and the tenure of their office as a rule is not subject to the wishes of the terminal hay dealers.

By the first method of appointing inspectors the hay dealers have direct control of the tenure of office of the inspector. The inspector is employed by and works for the hay dealers, and it is obvious that his tenure of office would depend upon the degree of satisfaction he gives his employers in inspecting and grading hay in a manner to satisfy the dealers in that market. It is a matter of common knowledge that there is a wide variation in the manner in which inspectors, using the same rules for grading, interpret grades

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[2] National Hay Association inspectors were located in the following places in 1921:

Indianapolis, Ind.	San Antonio, Tex.	Savannah, Ga.
Sioux City, Iowa.	Atlanta, Ga.	New Orleans, La.
Richmond, Va.	St. Joseph, Mo.	St. Louis, Mo.
Denver, Colo.	Birmingham, Ala.	Omaha, Nebr.
Chattanooga, Tenn.	Baltimore, Md.	Winchester, Ind.
Houston, Tex.	Jacksonville, Fla.	

The following places are using National Hay Association grades entirely or in part, but their inspectors have not been approved:

Buffalo, N. Y.	St. Paul, Minn.	Chicago, Ill.
New York City.	Cleveland, Ohio.	Pittsburgh, Pa.
Huntington, W. Va.	Detroit, Mich.	Toledo, Ohio.
Minneapolis, Minn.	Dallas, Tex.	Memphis, Tenn.
Meridian, Miss.	Duluth, Minn.	Fort Worth, Tex.
Jersey City, N. J.	Cincinnati, Ohio.	Brooklyn, N. Y.
Norfolk, Va.	Nashville, Tenn.	Louisville, Ky.
Columbus, Ohio.	Philadelphia, Pa.	Kansas City, Mo.

in certain markets. A careful investigation has shown that this variation is not due usually to a lack of knowledge on the part of the inspectors but is often accounted for by the general quality of hay received in the market and the demand for certain grades. Inspection is likely to be more strict in a market receiving a large percentage of high-grade hay than in one where the bulk of hay received is of the poorer grades. The trade realizes this and before one purchases hay from a strange market he should familiarize himself with the way in which the rules for grading are interpreted.

Experience in the hay business and a good character are the chief qualifications for a hay inspector. Inspectors are not allowed to be financially interested directly or indirectly in the hay business, for they must be free from all temptation to commit unfair practices in buying and selling hay.

The successful inspector, at present, is one whose work satisfies the majority of his employers at least half the time. No efforts have ever been made to train inspectors so that they will know positively that their work is correctly done. At present the only way of testing an inspector's ability is to appoint a committee of hay dealers to see if the inspector grades hay the way they would grade it. Both inspector and committee might judge hay far from accurately, but would have no way to ascertain each other's inefficiency. Studies in hay standardization have opened up a rather large field regarding possibilities of training men to become proficient inspectors and of aiding inspectors to correct a tendency to overestimate or underestimate factors used in judging certain kinds and qualities of hay.

METHOD OF PAYMENT OF INSPECTORS.

There are two general methods of paying inspectors, namely, by the fee system and by a specified salary per year. Taking all things into consideration, the straight salary method is probably the most satisfactory. The inspector is certain of a stipulated salary every month, and if the hours of work are not too long, and if the salary is commensurate with the duties required, the inspector should be satisfied and willing to perform his duties accurately.

The fee system may be objectionable for two reasons: (1) If the inspector's work is heavy there may be a temptation to slight his work in his eagerness to inspect too many cars a day and thus increase his earnings; (2) if an inspector working under the fee system has comparatively little to do, his earnings become inadequate to support him. Then he is obliged to do other work in connection with his inspection duties to earn an adequate amount.

PERCENTAGE OF HAY INSPECTED IN TERMINAL MARKETS.

The percentage of hay inspected in terminal markets varies considerably. In a few markets all hay is inspected on arrival. This is usually a car-door inspection subject to a bale inspection later if the hay is sold in or near the city. In a few markets the inspection service is made a source of revenue for the exchange, and but little attention is paid to the grades given the hay by the car-door inspection method. In one market having the car-door inspection system 90 per cent of the hay received is reconsigned without unloading or transferring the hay to another car, yet no provision is made to issue "outbound" certificates of inspection.

The general rule is for inspection only at the request of the dealer interested in the sale of the hay. It is usually requested when the shipper has graded the hay too high or when the market has slumped and the city dealer thinks that an official inspection might lower the grade claimed by the shipper, which would in turn lessen his losses.

Experienced hay dealers say that there is no need of an official inspection if buyer and seller have an opportunity to inspect the hay thoroughly. If the buyer is present he buys "on sight" and uses his own judgment as to grade. If after a sale of this kind has been made and the purchaser upon unloading the car finds it not to be of the grade shown by the plug hay, he usually has no redress.

HOW HAY IS INSPECTED AND GRADED.

CAR-DOOR INSPECTION.

The most common method of inspection is to inspect the hay in the car doors. This kind of inspection, under present conditions, is of comparatively little value to the hay trade in general. The most serious objection to car-door inspection is that the hay in the doors may not represent truly the average grade of the entire car. There is a feeling among receivers that the placing of good hay in the doors and poorer hay away from the doors is not always due to chance. It can be readily seen that if door inspection were final, that there might be a temptation for some to load the best hay in the doors. However, there is a large and growing class of country shippers who have found that, all things considered, fair or uniform loading pays best in the long run. With uniform loading, car-door inspection becomes more valuable.

At present the only conditions under which a car-door inspection will be accepted by receivers is when the receiver knows from past dealings with a particular shipper that the shipper loads his car uniformly. In case such a shipper is unable to load hay of a uniform grade he notifies the receiver in the invoice as to the amount of each grade. If shippers in general would be honest in loading cars, car-door inspection would be valuable. A large percentage of the hay trade is in favor of the enactment of either State or Federal laws making the nonuniform loading of cars subject to car-door inspection a misdemeanor subject to a fine of such proportions that it would tend to discourage quickly this unfair practice.

The easiest and quickest way of making a car-door inspection is for the inspector to stand on the ground in front of the open door and form his opinion regarding grades after looking at the exposed bales. If no grade variation is shown by any of the bales he may be able to grade the hay fairly well from the ground. Many inspectors, however, are more painstaking than this in making car-door inspections. They carry a short light ladder about 6 feet long, which enables them to get a close view of the hay even at the top of the car. When cars are not loaded to the roof in the doorway they get into the car, so as to see as many bales as possible. Some thorough inspectors examine the hay in the opposite doorway if they are in doubt regarding grade after viewing the hay in the first doorway.

FIG. 1.—Inspecting hay by car-door method.

There are factors which sometimes make car-door inspection very difficult. Closeness of the car tracks is one. Crowded cars make a poor light for inspection. Sometimes a newly painted red car will reflect light in such a way that it is practically impossible for an inspector to judge the true color of the hay. Some inspectors under such conditions pull out samples from several bales and carry them to a place where the light is good. When the sky is overcast it is sometimes impossible to distinguish the very slight difference in color that differentiates the two grades. Again, at times car doors are not opened to their full extent. Under such conditions the inspector may be unable to open the door and may be obliged to put a grade on the hay from the little portion he can see, making his work very unsatisfactory even to himself. Some inspectors carry a short crowbar for opening difficult doors.

Car-door inspection is more or less unsatisfactory when several grades are shown in the doors. Sometimes the inspector is able to "average" the grade, while at other times he does not feel justified in doing so. To avoid unjust criticism it is customary in some markets to make out the certificate as showing, for example, No. 1 Timothy and "some" No Grade hay, etc. Of course such an inspection is of little, if any, value to the receiver.

Hay in transit is often damaged by rain entering a partly closed doorway. The inspector has no way of knowing how much hay has been wet or damaged, and he is obliged to grade the hay as low as it can possibly be, which may cause a loss to the shipper if the settlement is made as per the inspection certificate.

Some shippers of alfalfa in the irrigated sections of the West complain bitterly against car-door inspection because of the bleaching of the hay at the doors. They claim that the entire car is graded as bleached, when as a matter of fact the only bleached bales are the few that the inspector sees in the doorways. If this is true, car-door inspection should not be used for alfalfa shipped from points so distant that bleaching takes place in transit.

CAR-DOOR INSPECTION CERTIFICATES.

As might be supposed, car-door inspection certificates can not be depended upon to tell all of the truth concerning a carload of hay. If the car contains only one grade it is so stated on the certificate. If more than one grade is showing in the doorway, however, the certificate is of little or no value to the shipper, for it does not state how much of each grade the car contains.

Inspection certificates are sometimes made out with respect to the contents of the car as follows: No. 1 Timothy and No. 2 Timothy; No. 1 Timothy and No. 3 Timothy; No. 1 Timothy and some No Grade, etc. Since the shipper has no practical way of proving how much of each grade he loaded into the car, he is obliged to allow the receiver to make the returns as he sees fit. Unless the shipper knows personally that the receiver is considered honest he is likely to be dissatisfied with the returns from hay shipped to terminal markets using car-door inspection.

SAMPLE INSPECTION.

Sample inspection is used but little in terminal hay markets. It is somewhat similar to car-door inspection, but is less dependable except under ideal conditions. Sample inspection is made by opening one or two bales and taking or selecting a few handfuls of hay, which are then brought to the inspector's office and there graded. It is taken for granted that these small samples are truly representative of the entire car, since the carload is graded as being of the grade shown by the samples. In making sample inspection it is customary to select one or two of the bales in the doorway, usually at the top, since they are the most accessible bales in the car. Under these circumstances there is not much chance of securing representative samples unless the car has been loaded with hay of uniform grade, which does not occur in a large percentage of cases.

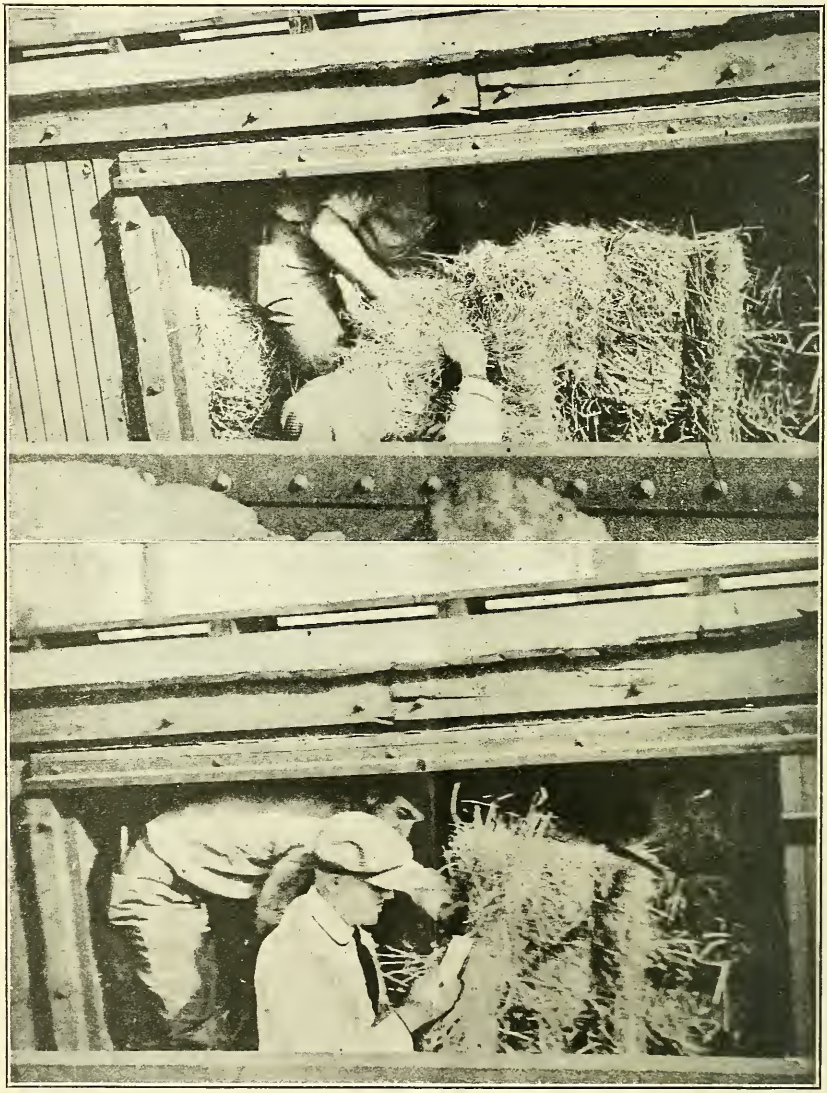

FIG. 2.—Obtaining a sample from a car of hay for use in grading and selling the hay on one of the exchanges.

Sample inspection is in favor where the samples are taken on the floor of the exchange and are used in selling. It also saves time when the inspector's work is very heavy. By having the samples brought to his office the inspector can do more inspection work per day than if he had to visit personally all the cars located in several holding yards in different parts of the city.

Reinspection in or near the terminal market usually consists of bale inspection at the warehouse of the buyer, which will be discussed in detail under bale inspection. Appeals from the inspector's decision are usually settled by a committee of hay men appointed by the local hay dealers' association or exchange. This committee inspects the hay, but it is seldom necessary to overrule the inspector. Reinspection is usually caused by improper loading, that is, by putting the best hay in the doorways and poorer hay where the inspector can not see it. This is a pernicious practice that should be stopped.

PLUG INSPECTION.

Plug inspection is the newest method of inspection and has been in vogue only a few years. This method is used in a few of the terminal markets and would be used more extensively if proper facilities could be secured. Plugging is usually made under the supervision of the inspector. Men are hired by him to handle the hay as he inspects the cars. The plugging consists in taking out a number of bales from the doorway and toward each end of the car until the inspector thinks he can see enough of the bales to determine the grade of the hay in the car. In some instances only about 30 bales are removed, while in others the larger portion of the hay is moved, but the inspector seldom actually sees all the hay in the car. In one market hay from the doors and one end of the car is loaded on wagons and the hay from the other end is moved along the car. Sometimes a section is taken out along one side of the car to the end, in which case less than one-half of the hay in the car is seen by the inspector. In some markets the hay is put back into the car immediately after the inspector has finished. In such instances the owner must be on hand when the car is plugged if he wishes to see the hay inspected and graded. In other markets the plug is left outside the car until after the car has been sold, which usually occurs within a few hours after the car has been plugged. Plug inspectors' fees ranging from 75 cents to $3 per car are charged in the various markets. These charges are almost always assessed against the shipper, although he is not allowed in most markets to call for an official inspection of his own hay.

Markets have changed to the plug method of inspection for several reasons. In one large market plug tracks were established primarily to eliminate bale inspection. Shippers from this market do not want an official grade placed upon the hay which they ship out, as they wish to use their own grades. They claim that the dealers in the southern territory to which they ship have different ideas as to what constitutes the various grades of hay, and they must know what their buyers want. When a car of hay reaches the plug tracks it is opened and 30 or more bales are placed on the ground in front of the car. It is officially inspected only when it has been bought "to arrive" and does not seem to be of the grade bought, or when the market has declined and the receiver hopes that by having it officially inspected he can refuse the shipment. Many unfair practices have grown from this situation, the most common of which is the double standard of grades, one for inbound shipments and the other for outbound shipments.

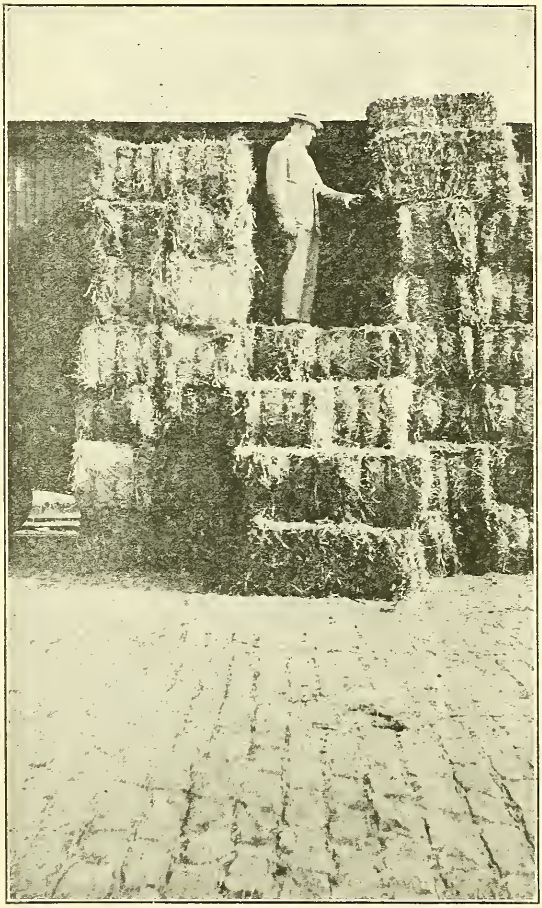

FIG. 3.—Inspecting hay by plug method.

While the plug method is much better than the car-door method, most dealers are of the opinion that it still does not really give the grade of all of the hay in the car. Consequently, inspection certificates based on plug inspection are not entirely satisfactory, since they do not furnish complete information regarding the amounts of different grades upon which to base accurately the returns to the shipper.

WAREHOUSE INSPECTION.

Warehouse inspection usually consists of inspecting hay after it has been placed in the warehouse. The value of this method depends directly upon how the hay is piled. It is obvious that the longer and narrower the pile the more hay will be exposed for inspection. When a carload of hay is piled high in a square pile the inspector will be able to see only the outside of the stack, and if the hay from other cars touches the sides of the pile then only the ends of the carload are exposed for inspection.

The lighting in the warehouse is a very important factor in the successful use of this method. In some warehouses the hay on one side has a much better light than the hay on the other side. Sometimes it is comparatively easy to inspect hay on a bright day, but when cloudy it is nearly impossible to make a fair inspection.

There are two general methods of making out warehouse inspection certificates. One is to state the grades of hay found in the pile, with no attempt to state definitely the number of bales of each kind; the other is to estimate the percentage of each kind of hay showing on the outside of the pile. Neither method of filling out certificates is entirely satisfactory, especially when the shipper and receiver do not have much confidence in each other.

BALE INSPECTION.

Bale inspection is not now used in any of the important markets, except in case of reinspection. A real bale inspection consists of the careful examination of each bale. Bale inspection is rarely called for until the car is partly unloaded and hay, other than the grade purchased, is discovered. When this happens unloading is stopped and the inspector is called in. Upon his arrival he inspects only the hay remaining in the car, because bale inspection usually occurs at the warehouse of the buyer and the inspector has no way of ascertaining what hay came out of the car.

With a badly mixed car the careful inspector usually catches each bale with his hay hook as it comes out of the car and by keeping it on end he can easily turn it so that all four sides can be seen. A careful record of the weight and number of bales of each grade is made and a certificate is filled out showing just what the inspector finds.

REINSPECTION.

In some markets reinspection consists of bale inspection, but in many other markets reinspection differs materially from bale inspection. In such cases the hay remaining in the car is not inspected bale by bale, but the quality of the hay is estimated in bulk as it appears in the car. With this method of reinspection the certificate does not state just how many "off-grade" bales were found, but leaves this rather important matter to the buyer. This is very unfair to the shipper, but as he sells hay on the terms of the terminal market, he is obliged to abide by the rules, grades, and practices of that market. The charge for reinspection ranges from 75 cents to $3 per car.

CERTIFICATES OF GRADE AND THEIR USES.

USE OF "IN" CERTIFICATES.

The principal use of "in" inspection certificates, when terminal inspection was instituted, was to furnish official evidence regarding the quality of hay whereby an honest settlement could be made between receiver and shipper. With a strictly unbiased inspection service the universal use of certificates of grade would obviously tend to place the marketing of hay on a good business foundation.

However, in many markets "in" certificates are used only occasionally at the present time. Some markets allow the inspection of hay only upon the request of the receiver, and under certain conditions inspection certificates are used unfairly. When a market has a good demand for hay and the prices are advancing from day to day the hay bought "to arrive" is accepted as invoiced without giving attention to the grade, unless it is obviously of such a quality that notwithstanding the advancing market it will show a loss.

For example, hay bought to be No. 2 timothy or better will often be accepted on contract at contract price, even if it actually grades No. 3. Since with the advancing market the dealer has a profit anyway, he does not have the hay graded but accepts it as of the grade bought. But if the market has declined it is customary to have an official inspection made and if the hay is not of the grade bought it is rejected or the shipper is notified of the discount at which it will be accepted. Receivers say that they are obliged to call for inspection on a declining market because they are obliged to protect themselves and accept only the grade contracted for. They claim that when the market is advancing they pay the shipper more than the hay is really worth and therefore the shipper should not complain against inspection on a declining market.

USE OF "OUT" CERTIFICATES.

Except in rare instances, outbound shipments are not now graded. It is claimed by some dealers who do a shipping business from the distributing markets that there is at present such a difference of opinion among consumers and dealers located in consuming territories as to what constitutes the qualifications for the different grades that it would be impossible to sell hay on the same grades on which it is bought in these distributing markets. In other words, this means that dealers will not use an outbound inspection certificate, especially for hay shipped into the South. If the dealers will not reconsign hay according to an official inspection it is evidently because they are not willing to use the grade as determined by their own inspector. There is evidence that grades are sometimes raised on hay shipped into consuming territories, especially on shipments into the South. This is one reason why outbound inspection certificates are not in general use to-day.

It has been found that in some instances if the southern receiver insists on an outbound certificate, the price first quoted will be raised at least $2 or more per ton over the price quoted when no certificate was to be sent. Many dealers in consuming territories know present grades of hay, but are not able to obtain the kind of hay they want because they can get no official outbound certificates and must take the hay on the grade of the various shippers.

At one large market in 11 months during the year 1919 over 12,000 cars of hay were inspected on arrival and official certificates of grade were issued. At least 50 per cent of this hay was reshipped or sold to points south or east, but no outbound certificates were furnished, and from interviews with dealers and consumers in the territory to which this hay was shipped it appears that in some instances the hay was sold on a higher grade designation than the inbound certificates showed the grade to be.

At another terminal market during the same period nearly 3,000 cars were inspected upon arrival and official certificates as to grade were issued. Nine certificates on "out" inspection were issued, yet it was estimated that more than 50 per cent of all of the hay in this market was reshipped and sold to points farther south.

Conditions are similar in many other markets which have the same practices, for it has been noted that at present very few certificates of grade are officially issued for outbound shipments, even in markets which provide for "in" inspection on all hay arriving on these markets.

UNIFORM GRADES AND INSPECTION.

There will be no improvement in hay marketing until uniform grades are adopted and strictly adhered to in all of the markets. The need for more uniform grades is strikingly shown by the rather general use of special grades to describe a kind of hay not covered by any present grade designation. Those using these special grades are country shippers, distributors, and consumers. They are not used to a noticeable extent in the large terminal markets. Country shippers have found that they are obliged to market a large amount of hay for which present grades are not suited. By using special descriptive grades they are able to sell these kinds of hay more easily and more profitably than if they attempted to classify the hay under existing inadequate terminal-market rules or grades. At present very few hay dealers use the official rules to any great extent, and they use them very carelessly.

Uniform grades, to be of equal value to all marketing agencies, should be of such a nature that each would describe a definite kind of hay in regard to (1) color of leaves, stems, and heads; (2) texture; (3) stage of maturity when cut; (4) approximate amount of other grasses, weeds, stubble, etc.; (5) region where grown in some instances. By using grades containing these factors the buyer and seller could get a very clear word picture which would enable him to know fairly accurately what he is selling or buying. Under the authority conferred by the food products inspection law the Bureau of Markets is conducting extensive investigations with a view to formulating grades which will be fair and just to all and which will be simple in form, readily understood, and easily applied by all marketing agencies.

ADVANTAGE TO THE TRADE.

To the producer.—The uniform application of standard hay grades will be of the utmost value to the producer, for with them he can, if he so desires, learn the true grade of his product. He will realize that his old, grassy, wornout meadow should be plowed up and reseeded to proper kinds and mixtures that will sell to advantage on the market. The producer who knows grades will be able to market intelligently when selling to the country shipper or when shipping his own hay. Uniform grades will encourage selling hay by grade on the farm.

To the shipper.—The shipper will be relieved of a vast amount of trouble by the uniform application of standard grades, because great variation in the interpretation of grades by different receivers or in different sections or markets will not occur. They will be of great help in his dealings with the intelligent producer and will probably result in more profit to the producer because of the lessened chances of loss now sustained when an average price per ton is made for the producer's entire crop or surplus. With uniform grades it is believed that country shippers as a rule will encourage as much as possible the buying of hay by grade on the farm.

To the consumer.—The consumer will be greatly benefited by uniform grades after he has thoroughly learned them. He may find that the kind of hay he has been buying for "Choice" and No. 1 is only of medium quality. Uniform grades should tend to save the consumer considerable money, for by their use he will know, first, just what kind of hay to purchase; and second, just what kind or grade of hay is to be delivered on his order.

Effect on certain trade practices.—The uniform application of standard grades will make a change in the method of reconsigning hay from terminal markets. Instead of invoicing the hay according to his own judgment the shipper will invoice it according to the inspection certificate issued by the inspector. This method will result in the shipper making less money than formerly when shipping to certain receivers in the distributing territory if the distributor's ideas as to grade requirements have been lower than those of the shipper who has been invoicing hay a little high as regards grades.

It is obvious that the only way to insure the uniform application of grades in all parts of the country is by the maintenance of an effective and unbiased inspection service open to all agencies engaged in marketing. The time when one agency only has the entire benefit of inspection to the detriment of other interested agencies must be passed if any progress is to be made in the hay business.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 981

Contribution from the Bureau of Plant Industry
WM. A. TAYLOR, Chief

Washington, D. C. PROFESSIONAL PAPER December 21, 1921

SUDAN GRASS AND RELATED PLANTS.

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CONTENTS.

INTRODUCTION INTO THE UNITED STATES.

Sudan grass was introduced into the United States from Africa in 1909, through the efforts of C. V. Piper, Agrostologist in Charge of the Office of Forage-Crop Investigations, Bureau of Plant Industry, United States Department of Agriculture. Eight ounces of seed were obtained in the original importation (fig. 1), and a portion of this was planted that year at the forage-crop field station at Chillicothe, Tex.[2] From this small beginning has come practically all of the

[1] Many of the data here recorded were contributed by the following members of the staff of the Office of Forage-Crop Investigations, who personally conducted the experiments at the points indicated: R. W. Edwards, at Chillicothe, Tex. (resigned Feb. 25, 1918); A. B. Cron, at Amarillo, Tex.; Roland McKee, at Chico, Calif.; Samuel Garver, at Redfield, S. Dak.; and H. R. Reed, at Bard, Calif. Acknowledgment is made of their assistance and of the cooperation of the agronomists of the State Agricultural Experiment Stations and the superintendents of the field stations of the United States Department of Agriculture.

[2] The field station at Chillicothe, Tex., is maintained as a cooperative project in conjunction with the Texas Agricultural Experiment Station. From its inception, in 1905, up to 1916 the expenses were borne largely by the United States Department of Agriculture. In 1915, 100 acres of land 5 miles southwest of Chillicothe were purchased by the State of Texas and designated "Texas Substation No. 12." The cooperation between the Office of Forage-Crop Investigations of the United States Department of Agriculture and the Texas Agricultural Experiment Station has been continued at the new location. The administration of the station since January 1, 1916, has been in the hands of the Texas station, and the State of Texas has made liberal financial contributions to support the work.

Sudan grass now being grown in the United States. The value of this crop in 1918 was estimated at $10,500,000.

The first importation of Sudan grass seed, which was received in the United States on March 16, 1909, was presented to the United States Department of Agriculture by R. Hewison, then Director of Agriculture and Lands, Sudan Government, Khartum, Sudan. This shipment was assigned S. P. I. No. 25017. A second importation was received on July 12, 1912, from W. A. Davie, Inspector of Agriculture, Khartum, Sudan, and assigned S. P. I. No. 34114. A third lot was re-

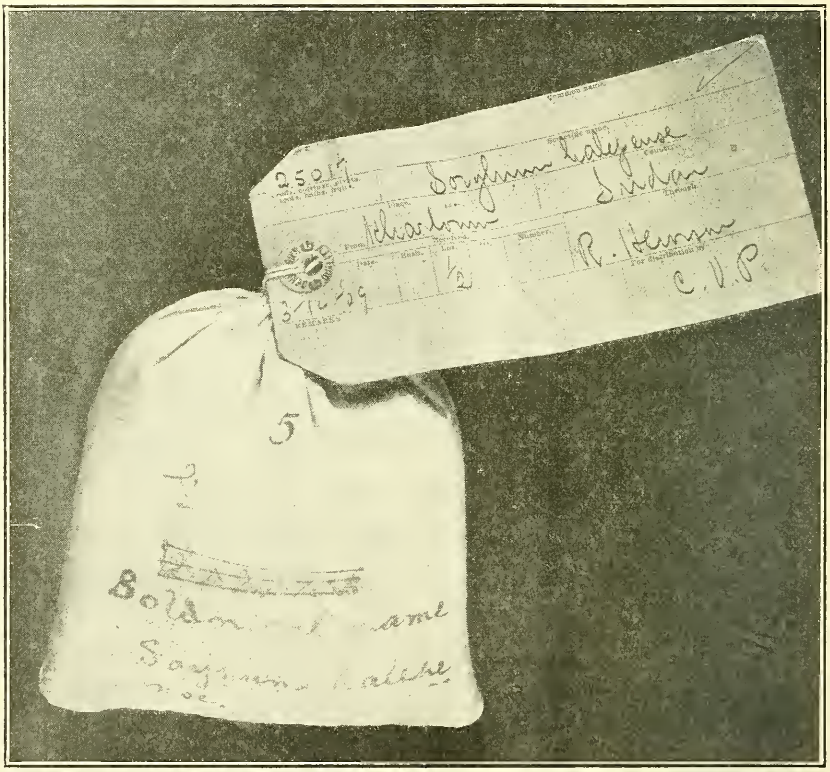

FIG. 1.—The original package of Sudan grass seed just as it came from Mr. R. Hewison, Khartum, except for the attached inventory tag of the Office of Foreign Seed and Plant Introduction.

ceived on January 24, 1918, from W. Carl McQuiston, Cairo, Egypt, and numbered 45773 in the Seed and Plant Introduction Inventory. The first two importations, Nos. 25017 and 34114, were to all appearances identical in value, but No. 45773 was less vigorous and was therefore not used in growing seed for experimentation or distribution.

In addition to the shipments received by the United States Department of Agriculture, there were at least two known importations of Sudan grass seed from Africa by private parties, one by L. T. Shoemaker, Camden, Ohio, in 1914, and the other by W. E. Mountain, Pilot Point, Tex., in the same year. None of these later importations had any appreciable effect on the spread of Sudan grass in the United States, because practically all of the seed distributed by the United States Department of Agriculture to State agricultural experiment stations in 1912 and to farmers in 1913 originated in the importation of 1909 grown in the increase plats at the Chillicothe (Tex.) Field Station in that and the following years (fig. 2). The Texas Agricultural Experiment Station obtained a considerable quantity of the seed from the Department of Agriculture in 1913 and distributed it to farmers in the State, enthusiastically urging its propagation.

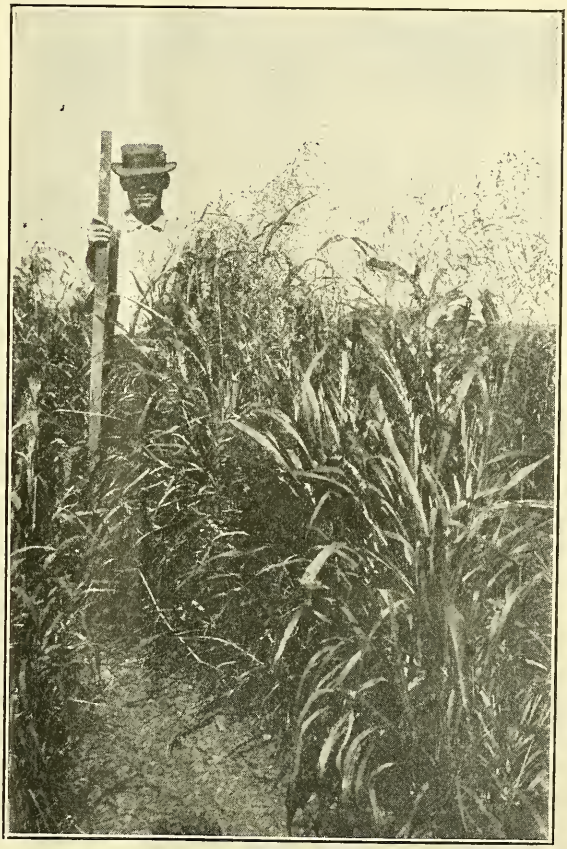

FIG. 2.—The first row of Sudan grass grown in the United States. Photographed at the Chillicothe (Tex.) Field Station, July 17, 1909.

The success of the Sudan grass was immediate and phenomenal, and in order to encourage its propagation the Office of Forage-Crop Investigations has carried on a great many tests in cooperation with the State agricultural experiment stations. It is the purpose of this bulletin to describe the results of these tests more fully than was possible in the former publication, Farmers' Bulletin 1126, in order to establish definitely the status of Sudan grass in different sections of the United States and to furnish a more complete basis for the recommendations given in the bulletin mentioned. Other grass sorghums closely related to Sudan grass are considered also and their probable value indicated.

DESCRIPTION AND BOTANICAL RELATIONSHIPS.

Sudan grass is an annual hay plant belonging to the sorghum family, with slender stems 4 to 6 feet high, numerous, rather soft leaves, a loose, open panicle, numerous tillers, only occasional branches, and no rootstocks. Johnson grass (*Andropogon halepensis*), on the other hand, is a perennial under favorable conditions, with stems more slender than those of Sudan grass, 3 to 4 feet high, few, narrow, rather harsh leaves which have thick white midribs, loose, open, often drooping panicles, few to many tillers, branching somewhat after maturity, and with numerous aggressive rootstocks which make it difficult to eradicate from cultivated fields. The seed characters of the two grasses will be considered in detail under "Seed production."

According to the classification of Piper in his "Forage Plants and Their Culture," Sudan grass belongs to his proposed new agronomic group called "grass sorghums," and its technical name is *Andropogon sorghum sudanensis* (19, pp. 33–34)[3] and not *Andropogon halepensis*, under which name it was obtained from Africa.[4] The dividing line botanically between *Andropogon sorghum* and *Andropogon halepensis* has been determined by Piper as the presence or absence of rhizomes, or rootstocks. This characteristic provides a very definite line of demarcation, and a study of the map of Africa and the Mediterranean region of Europe and Asia (fig. 3) leaves little doubt that the range of natural distribution conforms with this indicated classification. The halepensis, or rootstock, forms are confined to Asia Minor, Turkey, Greece, Italy, southern France, and the northern parts of Africa, the distribution extending eastward through southern Asia to the Himalayas, while farther south in the interior of Africa all the wild forms of Andropogon seem to lack rootstocks and to be more closely related to the true sorghums.

Rather strong evidence of a specific difference between Johnson grass and the sorghums is the difficulty attending their cross-pollination. It has long been known that Johnson grass crosses very rarely with the sorghums, even though the two species have been intermingled in the same fields for the last 30 years. A letter of inquiry was sent in 1912 to each agronomist of the agricultural experiment stations of our Southeastern States where Johnson grass was known to be abundant, asking him if he had ever personally observed an undoubted hybrid of Johnson grass and sorghum. The replies revealed the astonishing fact that only one of these men so intimately in touch with agricultural conditions in these States was willing to say that he had observed even what he suspected might be a cross between these two crop plants. Since that time a definite search for such hybrids has resulted in the discovery of three or four undoubted natural crosses between sorghum and Johnson grass, one of which is

[3] The serial numbers in parentheses refer to "Literature cited," at the end of this bulletin.

[4] The technical name of Sudan grass used in Department Bulletin No. 772, entitled "The Genera of Grasses of the United States," by A. S. Hitchcock, p. 267, is *Holcus sorghum sudanensis* (Piper) Hitchc., while its allies are known as *Holcus sorghum drummondii* (Nees) Hitchc., and *Holcus sorghum exiguus* (Forsk.) Hitchc.

shown in figure 4. Attempts to cross these two species artificially in the greenhouse have been successful in only a very small percentage of the trials, most of the attempts resulting in failure even under fa-

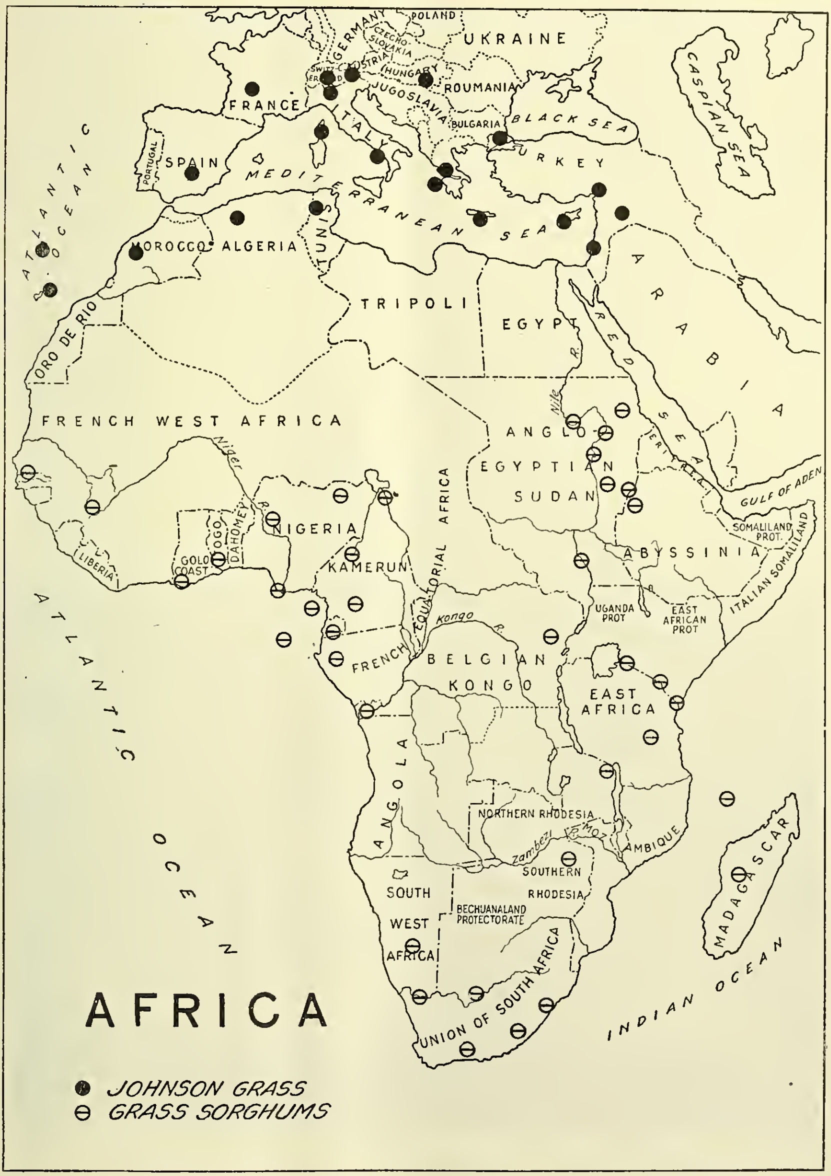

FIG. 3.—The natural distribution of Johnson grass and the grass sorghums.

vorable conditions. There is apparently an antagonism or unfavorable reaction between the reproductive organs of these two plants, which is rather decided evidence of their specific differences.

Several other grass sorghums discovered in Africa and near-by islands since the introduction of Sudan grass into the United States indicate the possibilities which exist in this comparatively unexplored

FIG. 4.—A typical plant of the Sumac sorgo-Johnson grass hybrid, F. C. I. No. 5846. Photographed at the Arlington Experimental Farm, Va., October 12, 1913.

continent. Among these introductions are Tunis grass, toura, Kamerun grass, and tabucki grass.

A discussion of these different grass sorghums has been introduced in order to show the very easy and natural gradations in forms already known to exist between Sudan grass and the cultivated varieties of sorghum. Others, no doubt, will be found in Africa when that continent is more carefully explored. No one can foretell the possibilities of improvement through the careful hybridization of these new forms with our cultivated sorghums.

TUNIS GRASS.

There have been at least two distinct importations of Tunis grass (*Andropogon sorghum virgatus* (Hack.) Piper) through the Office of Foreign Seed and Plant Introduction of the Bureau of Plant Industry. The first, S. P. I. No. 26301, was received from Dr. L. Trabut, Algiers, Algeria, December 2, 1909. In a letter received at a subsequent date from Doctor Trabut he says regarding Tunis grass: "This grass has been accidentally introduced at the botanic station with seeds from Egypt, berseem, sorghum, cereals, etc. It has meanwhile become naturalized here." The second importation, S. P. I. No. 38108, was received May 4, 1914, from Alfred Bircher, of the Middle-Egypt Botanic Station, Matania el Saff, Egypt, who described it as "a fodder grass growing spontaneously in Egypt."

Evidently Tunis grass, like Sudan grass, has been introduced into Egypt and no doubt is found growing spontaneously where it has escaped from cultivation. It is native, however, in Anglo-Egyptian Sudan, where it is found growing wild. The Kew and Berlin herbaria contain specimens of Tunis grass from Kordofan, Khartum, El Egeda, between Old Dongola and Merowat, between Khartum and Berber, and at Matama in northern Abyssinia. Hackel cites a specimen from Senegal also.

Tunis grass has never been tested so extensively as Sudan grass, because it has always appeared less desirable. It is not as leafy as Sudan grass (fig. 5), and its seeds shatter so easily that a great deal of care is required to obtain a sufficient quantity for field plantings. Scar tissue forms at the base of the seed, and it breaks from the rachis branch clean, like Johnson grass. Much of the seed falls from the top of the panicle before that at the bottom is ripe and while the leaves and stem of the plant are yet green.

At the Fort Hays Experiment Station, Hays, Kans., in 1914 and 1915 Tunis grass made an average yield of 8,360 pounds and Sudan grass 8,840 pounds of cured hay to the acre. The difference in yield is not very large, but the quality of the Tunis grass hay was so inferior to that of the Sudan grass hay that further tests were not considered necessary. R. E. Karper, superintendent of substation No. 8, Lubbock, Tex., says in Bulletin No. 219 of the Texas Agricultural Experiment Station: "Comparisons of Sudan grass and Tunis grass for forage in 1914 resulted in Sudan grass outyielding the latter in every case, showing a total average increase of yield of 0.85 ton per acre." Tests at the field stations at Chillicothe and Amarillo, Tex., have always shown that Sudan grass is superior to Tunis grass in those localities.

Tunis grass seems best adapted to a region where the period of heaviest rainfall coincides with that of the higher temperatures. It is possible that it might have some value in a locality having wet and dry seasons. If the temperatures were high enough during the wet part of the year Tunis grass might make a good pasture grass and reseed itself indefinitely.

Tunis grass crosses freely with the sorghums, and some of these natural crosses appear more valuable than the pure strain. This

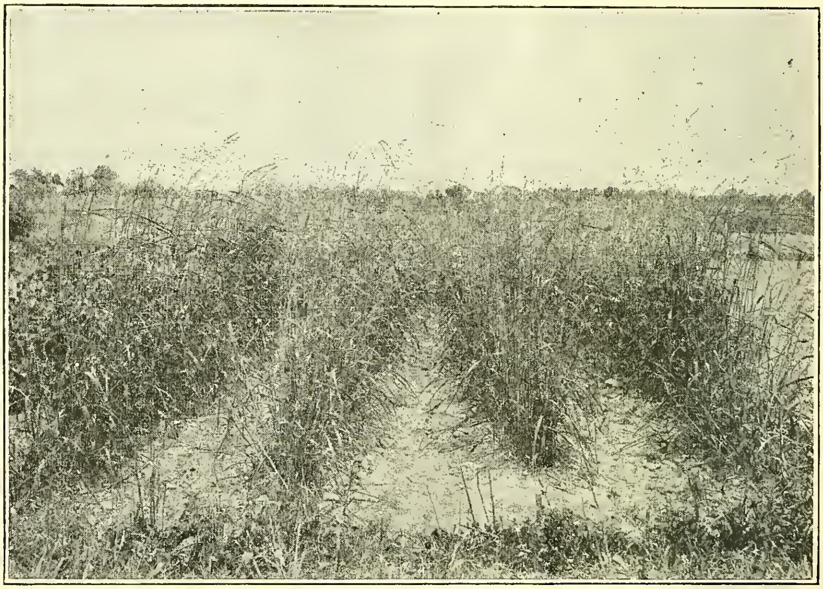

FIG. 5.—Tunis grass grown in rows 40 inches apart at the Arlington Experimental Farm, Va. Photographed August 26, 1915.

grass apparently has only two points of superiority over Sudan grass; it is a few days earlier in reaching maturity and is less subject to the attacks of red-spot, or sorghum blight. These two characters if they are transmitted to the hybrids with sorghum may give to such hybrids a superiority over the Sudan-sorghum crosses.

KAMERUN GRASS.

The first introduction into the United States of Kamerun grass (*Andropogon sorghum effusus* Hackel) was S. P. I. No. 38005, received April 13, 1914. This was obtained by P. H. Dorsett, near Bahia, Brazil, in which country it is rather widely distributed. A second shipment of seed, S. P. I. No. 38670, was received on July 1, 1914, from Dr. T. A. Argolla Ferrão, Bahia, Brazil. In Brazil this grass bears the vernacular name "capim de boi," which means grass of the ox or cattle. Kamerun grass is undoubtedly a native of the Kongo and Guinea coast regions of Africa, where numerous travelers have found it growing wild, usually along watercourses. It was no doubt introduced into Brazil by the slave trade and by the same agency into Cuba, another place where it is now found.

Besides the importations obtained by P. H. Dorsett, of the Office of Foreign Seed and Plant Introduction, several other collectors, including Burchell, Blanchet, and Gardner, found Kamerun grass in Brazil (18). The Kew and Berlin herbaria contain specimens from the islands of St. Thomas and Fernando Po, from Kamerun, the Spanish Guinea Hinterland, Togo, and Boma on the Kongo River and Nupe on the Niger River. Most of the specimens, it will be noted, are from the Guinea coast region, but Shantz[5] found Kamerun grass in abundance along the Lualaba River and in other parts of eastern Belgian Kongo. It would therefore seem to be widely distributed in the interior of equatorial Africa, as well as along the Guinea coast.

FIG. 6.—Kamerun grass, S. P. I. No. 38005. Planted April 22. Photographed October 19. Plants ripening at a height of 7 feet. Chula Vista, Calif., 1916.

Under cultivation in the United States, Kamerun grass reaches a height of 6 to 9 feet, with erect stems somewhat larger than a lead pencil; narrow, rather harsh leaves with thick midribs; and a large, loose, drooping panicle. (Fig. 6.) The individual spikelet is about the same shape as that of Sudan grass, but smaller and pubescent,

[5] Dr. H. L. Shantz, of the Bureau of Plant Industry, United States Department of Agriculture, spent about 14 months, from July, 1919, to September, 1920, on a collecting trip in eastern Africa for the Office of Foreign Seed and Plant Introduction.

whereas that of Sudan grass is nearly glabrous. The seed shatters easily, but not so readily as seed of Tunis grass or tabucki grass. A study of Kamerun grass in row plantings at various field stations has indicated that it can not compete successfully with Sudan grass in the United States. It may have some value, however, for crossing with Sudan grass or the sorghums.

TABUCKI GRASS.

Seed of tabucki grass (*Andropogon sorghum verticilliflorus* (Steudel) Piper) was obtained as S. P. I. No. 38866 from I. B. Pole Evans, Pretoria, South Africa, in 1915. It is a variable grass which appears indigenous to southeastern Africa from Mount Kilimanjaro to the Cape. Numerous specimens are also recorded from adjacent islands in the Indian Ocean.

Later importations of tabucki grass were received as follows: S. P. I. No. 39377, from H. G. Mundy, Department of Agriculture, Salisbury, southern Rhodesia, November 9, 1914 (the seed of this lot was immature and none of it germinated); S. P. I. No. 40773, from P. R. Dupont, curator of the Botanic Gardens, Seychelles Islands, May 19, 1915; S. P. I. No. 40832, from I. B. Pole Evans, Department of Agriculture, Pretoria, South Africa, June 7, 1915 (the seed of this lot was collected at Tzaneen in northern Transvaal); and S. P. I. No. 40897, from F. A. Stockdale, Director of Agriculture, Reduit, Mauritius, July 6, 1915. The seeds from Mauritius produced plants which resembled toura more than they did tabucki grass.

Under cultivation in the United States tabucki grass resembles Kamerun grass very closely. The stems are erect or slightly spreading, 6 to 9 feet high, somewhat larger than a lead pencil, with 9 or 10 leaves which are rather narrow and harsh. The panicle is large and spreading, like that of Kamerun grass, but the spikelets are a little smaller, more turgid at the base, and shatter from the stem almost as freely as the seed of Tunis grass.

Another form of *Andropogon sorghum verticilliflorus* is the toura, of Tahiti. A small sample of this was obtained by the United States Department of Agriculture in 1903 from William F. Doty, United States consul, Tahiti, Society Islands, but it was identified as Johnson grass (*Andropogon halepensis*), and no attempt apparently was made to test the seed at that time. Later, when trials of Sudan grass had indicated the possible differences which might exist in these so-called halepensis forms, the seed was brought out and tested. These tests showed that it was not halepensis, being entirely without rootstocks. The description of tabucki grass answers for toura except that toura is somewhat earlier and smaller than tabucki grass and the stems ascend at a trifle wider angle. (Fig. 7.)

Mr. Edouard Ahnne, president of the Chamber of Agriculture, Tahiti, Society Islands, who presented an additional supply of toura seed to the United States Department of Agriculture under S. P. I. No. 42278, sends the following information about it: "This grass grows in Tahiti in a wild state, all along the creeks, on the roadside, and on the uncultivated lands. The horses and cattle seek for it willingly when it is young; later, the stem becomes woody and hard."

Tests of the different forms of *Andropogon sorghum verticilliflorus* indicate that they are of little value in the United States.

FIG. 7.—Two rows of toura grass (on the left) and a row of Sudan grass (on the right)Chillicothe, Tex., September 16, 1915.

HEWISON GRASS.

Seed of a wild sorghum (*Andropogon sorghum hewisoni* Piper) was obtained as S. P. I. No. 33739 from Sennaar Province, Sudan, through R. Hewison, Esq., in 1912. It has stout, rather pithy, slightly sweet stems five-eighths of an inch in diameter and 8 to 10 feet high; many rather broad leaves; a compact panicle, the base of which is inclosed in the sheath; and spikelets which are decidedly pubescent and usually reddish in color. This wild sorghum is more limited in distribution than the others mentioned and is more nearly like the cultivated varieties. (Fig. 8.) It is quite possible that a more complete knowledge of this form will show it to be a cross between some other wild sorghum and durra.

In the United States *Andropogon sorghum hewisoni* is found to require a very long season in which to mature and it seems to be of little value.

FIG. 8.—Panicle of *Andropogon sorghum hewisonii*, S. P. I. No. 33739, from a plant grown in the greenhouse of the Department of Agriculture.

CHICKEN CORN.

Seed of this sorghum (*Andropogon sorghum drummondii* (Nees) Hackel) was first collected by Drummond at New Orleans in 1832. It is widely distributed in Louisiana and Mississippi, being known locally as "chicken corn," and occurs as far north as Kentucky, growing spontaneously in cultivated ground. This wild sorghum was undoubtedly introduced from Africa by Negro slaves, as it has been found in northern Nigeria and at other points along the Niger River. Specimens have been collected from the Carolinas, Mexico, Yucatan, and Guatemala. This sorghum apparently has been modified by cultivation, and in its present form it resembles the cultivated varieties much more closely than does any other wild-grass sorghum. At one time it appeared to have been abundant and rather highly prized in the Southern States, but it is now somewhat scarce, owing probably to the attacks of the sorghum midge.

In cultivated plantings at the Arlington Experimental Farm and other field stations of the United States Department of Agriculture *Andropogon sorghum drummondii* grew to a height of 8 to 10 feet, with pithy stems five-eighths to three-fourths of an inch in diameter; rather broad, fairly abundant leaves; panicle barely exserted from the last leaf sheath, open and spreading like that of Amber sorgo (fig. 9); and spikelets about the same size as those of Black Amber, with smooth black or reddish brown glumes. A careful comparison with other sorghums indicates that this form, though interesting historically, adds little of value to the crop plants of the United States.

SORGHUM-JOHNSON GRASS HYBRIDS.

Consideration of some of the natural and artificial hybrids of sorghum and Johnson grass indicates the wide possibilities in this comparatively untouched field. The first natural hybrids to be studied

FIG. 9.—Typical panicle of chicken corn (*Andropogon sorghum drummondii*). Grown at the Arlington Experimental Farm, Va., 1914.

by the Office of Forage-Crop Investigations were found in September, 1912, in a field of Sumac sorgo on the farm of Mrs. Flynn, near Chillicothe, Tex. This field was badly infested with Johnson grass, and a number of plants were discovered which showed evidences of hybrid origin. Seed was gathered from these plants, and two of them were dug up and transplanted at the field station. One of these plants had elementary rootstocks, and the other, though it lacked any well-developed rootstocks, had a panicle that clearly showed a relationship with Johnson grass.

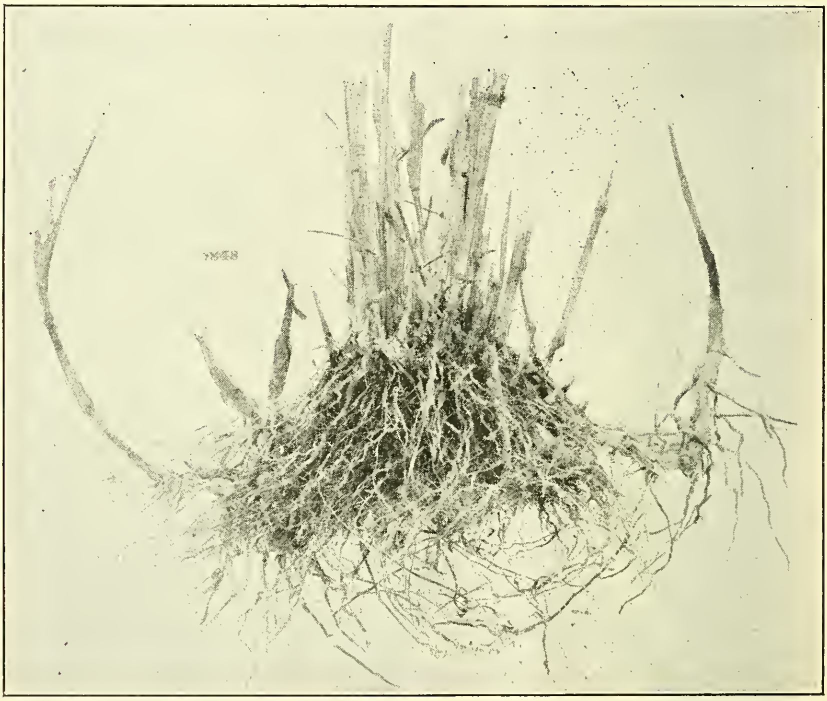

FIG. 10.—Root of a hybrid between Sumac sorgo and Johnson grass, F. C. I. No. 5848, showing the development of rhizomes.

Neither of the plants which had been reset at the field station lived over winter, but the seed from these and other hybrid plants was sown at the Chillicothe Field Station and at the Arlington Experimental Farm, Va., in the spring of 1913. In the resulting crop there were at least four distinct forms. Some had well-developed rootstocks (fig. 10), while others, even though they resembled Johnson grass more closely in stem and leaf characters, had no rootstocks at all. There was also a wide variation in the juiciness and sweetness of the stems, one form being quite as juicy and sweet as Sumac sorgo, while other forms had pithy stems.

A second natural cross between sorghum and Johnson grass was discovered on September 16, 1913, on the farm of J. W. Austin, Pilot Point, Tex. This was located in a field of Honey sorgo, and is quite surely a cross between Honey sorgo and Johnson grass. Mr. Austin has applied to this cross the name "Johnsorgo." This hybrid has abundant and very large rootstocks and will probably not become popular in the South except as a hay and pasture crop on fields already

Fig. 11.—A row of "Johnsorgo," F. C. I. No. 8557, 8 feet tall, at the Arlington Experimental Farm, Va., October 11, 1915.

infested with Johnson grass. Johnsorgo is remarkably like Sudan grass in appearance (fig. 11), but is much less subject to the attacks of the red-spot, or sorghum blight, a disease which is very destructive to Sudan grass in warm, moist climates. Johnsorgo is the most promising of all the hybrids between sorghum and Johnson grass yet tested.

In order to provide material for a more definite study of these hybrids several artificial crosses of sorghum and Johnson grass were made. The first of these, F. C. I. No. 6573, a cross between Black Amber sorgo and Johnson grass, was made at the Arlington Experimental Farm, Va., in September, 1912. The first-generation plant, which was grown in the greenhouse that winter from a hybrid seed which developed on the Black Amber sorgo, looked more like Johnson grass than sorgo, but had no rootstocks. Seed from this F_1 plant was sown at Arlington on June 3, 1913, and the F_2 proved to be quite vigorous, about 90 inches tall, and almost as coarse as its sorgo ancestor. The panicles, however, were intermediate in character, and a few plants in the row developed rudimentary rootstocks. Trials of the progeny of this cross were continued, and several promising selections were made. One of these selections growing in a row at Biloxi, Miss., in 1917 was cut twice, first on July 17 and the second time on October 2. Each time the plants were about 7 feet tall.

Other artificial crosses between sorghum and Johnson grass have been made, but their history is very similar to that of F. C. I. No. 6573 and will not be given here.

Selections from the different sorghum-Johnson grass hybrids have been grown each year in the tests at Chillicothe, Tex., and at other points, but nothing superior to Sudan grass has been obtained. Some of the selections resemble Sudan grass very much, however, (see figs. 4 and 11), and if this valuable grass sorghum had not been discovered previously a fairly good substitute for it could have been developed in this way.

DISTRIBUTION AND IMPORTANCE OF SUDAN GRASS IN AFRICA.

Sudan grass is being cultivated sparingly under the name "garawi" along the Nile in lower Egypt, mostly on military hay farms. It has not, however, gained any great popularity there such as it has attained in the United States. That this grass originated farther south in Africa is now fairly well established. Botanical specimens of it are on file from upper Egypt; also from Senegambia, a British possession on the west coast of Africa, and from a point near the northern end of Lake Nyasa in northern Rhodesia. Besides these more or less authentic specimens, a plant very similar to Sudan grass has been collected in the Katagum district of northern Nigeria.

The fact that Sudan grass is found only under cultivation in lower Egypt and that it is known to be growing spontaneously along the upper Nile and in the Sudan farther west indicates that the grass must be native in that region of comparatively low rainfall just south of the Sahara Desert. (See the map, fig. 3.) It is more difficult to understand just how the grass came to be found south of the equator on the shore of Lake Nyasa. British colonial troops may have carried the seed with them in hay shipments from Egypt to their more southern possessions, or it may have been carried south by natives from the headwaters of the Nile along the chain of interior lakes which form an almost continuous waterway from Lake Albert Nyanza on the north to Lake Nyasa on the south. These, however, are only speculations. We are sure that Sudan grass is found growing wild in a part of Africa having a rainfall of 20 to 40 inches and a mean temperature during the growing season of 80° to 90° F., climatic conditions very similar to those in our southern Great Plains, where Sudan grass has done so well.

SUDAN GRASS IN OTHER COUNTRIES.

Since its introduction by the United States Department of Agriculture, Sudan grass has been tested in many parts of the world. It has, perhaps, been most successful in Australia, where it is being grown at the different experiment stations, and is recommended highly, especially in New South Wales (3). It has done well where tested in Brazil and Argentina (fig. 12), and no doubt will become a valued forage crop in the stock-producing sections of South America.

Fig. 12.—Sudan grass on the Estado do Maranhão, 2 degrees south of the Equator in Brazil. Planted February 26 and photographed on May 3 by Edward C. Green, Superintendente, Servico do Algodão, Brazil.

The Philippine Islands, Hawaii, and Porto Rico all report success with Sudan grass, and in Cuba it is highly prized as forage (12). Although it is not adapted to the climate of Canada, good crops of it have been grown in southern Alberta. Sudan grass is sure to prove valuable in all semitropical regions and in the warmer parts of the temperate zones.

SOIL RELATIONS.

FERTILITY.

Sudan grass thrives best, of course, in a good soil. Rich clay loams produce the best growth, but it makes better yields on poor soils than most hay crops. A good many farmers are now using it as a supplementary pasture on poor hill lands in the dry summer season, and not a few have reported success with it on sandy lands. On sandy land at Valentine, Nebr., it made the following yields of hay to the acre: In rows 42 inches apart, 0.61 ton; in rows 21 inches apart, 0.83 ton; and in drilled seedings, 0.87 ton.

At Grand Rapids. Mich., it grew to a height of 5 feet on sandy soil and made a better yield than any other annual hay plant on trial.

DRAINAGE.

A wet, muggy, or seepy soil is disastrous to Sudan grass, and thorough drainage must be provided for such soils before one can hope to succeed with this grass. Soils not naturally well drained should be tile-drained at least one year previous to seeding, so that the ground will have an opportunity to become warm. Cold, wet soils are particularly unsuited to Sudan grass, and this is the chief reason why early seedings are so often failures.

ACIDITY AND ALKALI.

Sudan grass is not as susceptible to injury from acid soils as the legumes. Applications of lime are required only when the soil is too acid for the ordinary cereals.

Several tests of Sudan grass on alkali soils have been made, and its behavior under such conditions is about the same as that of the sorghums. A number of other crops are far more resistant to alkali than is Sudan grass.

CLIMATIC ADAPTATIONS.

TEMPERATURE REQUIREMENTS.

Sudan grass grows best in a warm climate with a comparatively good rainfall. During germination and early growth it will endure as much cold as other sorghums, but not quite as much as corn. Numerous reports from the Northwestern States show that Sudan grass a few inches high withstood late spring frosts which killed other tender plants. In many of these instances the grass remained practically dormant during the period of low temperatures, but made a vigorous growth when warm weather arrived. In other cases frost killed the young Sudan grass. Still other reports have been common from cold regions to the effect that the crop lived through the season but was of a yellowish color and did not grow more than 6 to 18 inches high even after warm weather came.

Because of the untimely frosts and the cold growing season Sudan grass does poorly at the higher altitudes. The farther south, the higher the altitude limit. The profitable limit for hay production seems to be from 6,000 to 8,000 feet in New Mexico, Arizona, California, Nevada, Colorado, and Utah, and 4,000 to 5,000 feet in Wyoming, Montana, Idaho, Oregon, and Washington. In several tests reported from Apache County, Ariz., in 1915, this grass produced a hay crop 4 to 5 feet high and sometimes matured seed without irrigation at an altitude of 6,000 to 6,800 feet, and in 1916 it grew 5 to 6 feet high and yielded 2 tons to the acre under irrigation at Eagar, Apache County (7,600 feet). At Currie, Elko County, Nev. (7,380 feet), 1 ton per acre without irrigation was reported in 1916. At Santa Fe, N. Mex. (7,000 feet), one satisfactory cutting was secured on dry land, but two or three farmers in that State report entire failure at 8,000 feet. In southwestern Colorado at altitudes of 6,500 to 7,000 feet, Sudan grass grew 3 to 5 feet high and made satisfactory hay cuttings. It attained a height of 2 feet at Placerville, San Miguel County (9,000 feet), and did equally well at Grand Valley, Garfield County, which is over 8,000 feet high. Many failures, however, have been reported from Colorado, especially in 1915, at altitudes above 6,000 feet. In Wyoming Sudan grass has been a failure at Laramie (7,000 feet), has sometimes grown 3 to 5 feet high at Cheyenne and other points at 6,000 feet, but has appeared to be valuable only in the northeastern part of the State at the lower altitudes (4,000 to 5,000 feet). In Utah in 1916 Sudan grass grew but 2½ feet high at 6,500 feet in Grand County, made 1¼ tons per acre at 7,000 feet in San Juan County, but froze at 8,300 feet in Carbon County when 4 inches high. In Montana under irrigation Sudan grass produced 4 tons of hay per acre in 1914 and 3 tons in 1916 at Bozeman (4,887 feet), but has been satisfactory in less than half the dry-land tests in Fergus County (4,000 feet). In Idaho and Oregon the crop has been successful only in the lower altitudes, frost having killed or injured many plats on the dry lands of those States above 3,000 or 4,000 feet high. In both Oregon and Washington Sudan grass has been found valuable only at the lower altitudes. It can be planted with a reasonable chance of success in the valleys, both to the east and to the west of the Cascade Range. In the Willamette Valley, Oreg., and along the coastal plain in Washington other forage crops, such as alfalfa and the small grains, which will outyield Sudan grass, are available, but even in these localities it can be profitably used for soiling and as an emergency hay crop.

The limit of altitude for seed production is at least 1,000 feet lower than for hay, because under cool conditions it takes a month or more to mature seed after the crop has reached the proper stage of maturity to cut for hay.

MOISTURE REQUIREMENTS.

The drought endurance of Sudan grass is equal but not superior to that of the best sorghums. Its extensive fibrous root system enables the crop to grow as long as there is any available moisture in the soil. It has repeatedly shown ability to discontinue growth but continue alive during a period of drought and then revive quickly and grow vigorously when rain comes. It must have moisture, however, and crops reported to have grown without rain are usually found to have used soil moisture previously stored or to have been favored by the natural run-off from adjoining areas.

Sudan grass has sometimes given good returns under dry farming in the Southwest at places where the normal annual rainfall is but 8 to 15 inches. It yields much more, however, in the southern Great Plains area, where the annual rainfall is between 20 and 30 inches. Growth is abundant in the Southeast, where the rainfall is 40 to 60 inches, but this humidity permits the sorghum midge to thrive, which, as explained elsewhere, prevents seed production. Where the rainfall is about 60 inches and the altitude mostly below 100 feet, as in Florida and other Gulf and Atlantic coast points, Sudan grass production is usually not profitable, owing to the disease known as red-spot, or sorghum blight. Heavy rainfall, in addition to cold, accounts for the failure of Sudan grass reported within 10 or 20 miles of the Pacific coast in northern California and Oregon. The crop has shown ability, however, to survive inundation for several days as well as corn or any of the sorghums if the soil is drained well.

TABLE I.—*The water requirements of Sudan grass and other staple crops, as determined by experiments at Garden City, Kans., and Akron, Colo.*

[The data under "Ratio" show the number of pounds of water required to produce 1 pound of dry matter.]

Crop plant.	At Garden City, Kans., 1915 (16, pp. 483–484).			At Akron, Colo., 1912 (4, pp. 50–51).	
	Varieties.	Period of growth.	Ratio.	Varieties.	Ratio.
Corn	Pride of Saline	May 22 to Aug. 25	267± 2	Average of 8	286
Kafir	Dwarf Blackhull	May 22 to Sept. 11	221± 2	Blackhull	259±5
Milo	Dwarf	May 22 to Sept. 3	244± 3	Dwarf	273±4
Sorgo				Minnesota Amber	239±2
				Red Amber	237±4
Millet				German	248±7
				Kursk	187±2
Feterita		May 22 to Sept. 6	249± 2		
Sudan grass		May 22 to Sept. 14	306±15		359±2

The water requirements of Sudan grass and several other crops were determined on the basis of the total dry matter, exclusive of that in the roots, by Briggs and Shantz in 1912 at Akron, Colo., and by Miller in 1915 at Garden City, Kans., as shown in Table I. These results indicate in a general way that Sudan grass uses more water in the production of a pound of dry matter when the supply of soil moisture is abundant than the other sorghums, the millets, or corn. In the tests at Garden City, Kans., and Akron, Colo., the plants were grown under optimum soil-moisture conditions; that is, the soil was supplied regularly with all the water the plant could use. This condition, of course, did not simulate in the least degree the soil conditions ordinarily found in a semiarid region, where drought endurance is an important factor in crop production. It is impossible to predict what the results would be if the plants were grown in soil with a limited or suboptimum soil-moisture content. The careful work of these investigators can not be used, therefore, as a basis for estimating the value of Sudan grass under dry conditions.

RELATIVE IMPORTANCE OF THE CROP.

Texas, Oklahoma, and Kansas are now the leading States, respectively, in Sudan grass acreage, and will be likely to remain so. Statistics are available for Kansas only, where, according to reports of the State board of agriculture, 79,166 acres were grown in 1918. So far, the leading locality is in northwestern Texas, around Lubbock (29), where the crop has been grown in large acreages for seed and forage since 1913. The acreage in other States is still small,

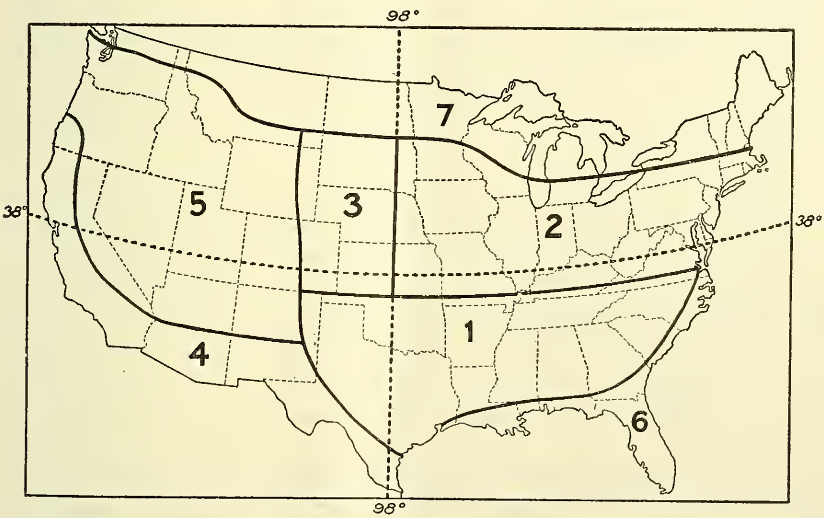

FIG. 13.—Outline map showing the forage value of Sudan grass in different parts of the United States.

but the crop has been widely grown experimentally all over the United States since 1912, and its use is increasing.

The principal regions of production in the United States are shown on the map (fig. 13) as follows:

Region 1.—Two or three good cuttings of hay are obtained without irrigation in this region, the yields varying from 2 to 4 tons to the acre. This is the region of its greatest importance because of the need for a better hay grass in these States. Profitable seed yields are obtained west of the ninety-eighth meridian only, the sorghum midge usually preventing seed formation in the more humid district east of this meridian.

Region 2.—Sudan grass thrives here almost as well as in region 1, making good yields both of hay and of seed. Timothy, clover, and alfalfa, however, meet the hay requirements of this region so fully that Sudan grass is valued chiefly as a catch crop or for limited culture on soils not suited to these forage crops.

Region 3.—This comprises the region west of region 2, where the rainfall is too low for the successful cultivation of timothy and clover. Sudan grass commonly makes one cutting under such conditions, and in favorable seasons two, yielding 1 to 3 tons of hay to the acre. Its chief competitors in this region are alfalfa, sorghum, and millet. Alfalfa is preferred to Sudan grass only in the more favored locations, such as river and creek valleys or where irrigation is possible. The better varieties of sorghum, such as Red Amber and Orange, will outyield Sudan grass, but the latter is better suited for pasture purposes, produces a better quality of hay, and is easier to handle with haying machinery. Seed production, though possible in most of this region, is profitable only in the southern part.

Region 4.—Sudan grass yields abundantly both in hay and in seed in all irrigated localities in this region; yields of 4 tons of hay to the acre are not uncommon on good soils. It is used chiefly to supplement alfalfa in the rations of horses and dairy cattle, as a pure alfalfa hay ration seems to result in digestive disturbances, especially in dairy cows.

Region 5.—In this part of the United States Sudan grass is successful only in limited areas. Its failure except in these localities is due either to low temperatures caused by high altitudes or to insufficient rainfall.

Region 6.—In this region, including Florida and the Coastal Plain along both the Atlantic and Gulf coasts, Sudan grass is usually a failure, largely on account of the injury to the foliage caused by red-spot, or sorghum blight.

Region 7.—This is a region 100 to 200 miles wide along the northern border of the United States. Sudan grass is not profitable here, because of the cool summers and the short growing season.

The Office of Forage-Crop Investigations of the Bureau of Plant Industry, United States Department of Agriculture, sent seed to numerous State agricultural experiment stations in 1912 and succeeding years. In 1914 the Office of Congressional Seed Distribution sent out 1-pound packets of Sudan grass seed to 2,800 farmers, in 1915 to 75,751, and in 1916 to 97,392. Reports as to the success of Sudan grass and its probable value, as compared with other forage crops, were called for from several thousand of these farmers in 1915 and 1916. Their answers have been examined and their opinion of the crop, expressed in the percentage of favorable reports for each section of the United States, is shown on the map, figure 14, which indicates in more detail than figure 13, the relation of Sudan grass to climatic factors.

This map (fig. 14) is based upon Weather Bureau Bulletin W and shows for each section of the United States (1) the average length of the growing season, i. e., the time elapsing between the last killing frost in spring and the first killing frost in the fall; (2) the mean temperature for the growing season; (3) the normal rainfall for the entire year; and (4) the adaptation of Sudan grass to these conditions, as shown by the percentage of favorable reports from farmers who received seed through the Office of Congressional Seed Distribution.

The rather complete agreement between this map and the outline map, which was prepared largely from reports secured through State agricultural experiment stations, is worthy of note. There are several slight inconsistencies in the results, but on the whole the maps show that the successful production of Sudan grass is correlated with high temperatures during the growing season and to a less extent with rainfall.

USE AS A CATCH CROP.

Sudan grass will be widely grown as an emergency hay crop in much the same manner as millet. As a means of overcoming a threatened shortage in the supply of hay required to carry the farmer's live stock through the winter, Sudan grass is fully as good as millet. (Fig. 15.) The growing season is short, the quality of the hay is very good, and the yields of Sudan grass are usually higher than millet yields. Millet in the North and sorgo (sweet

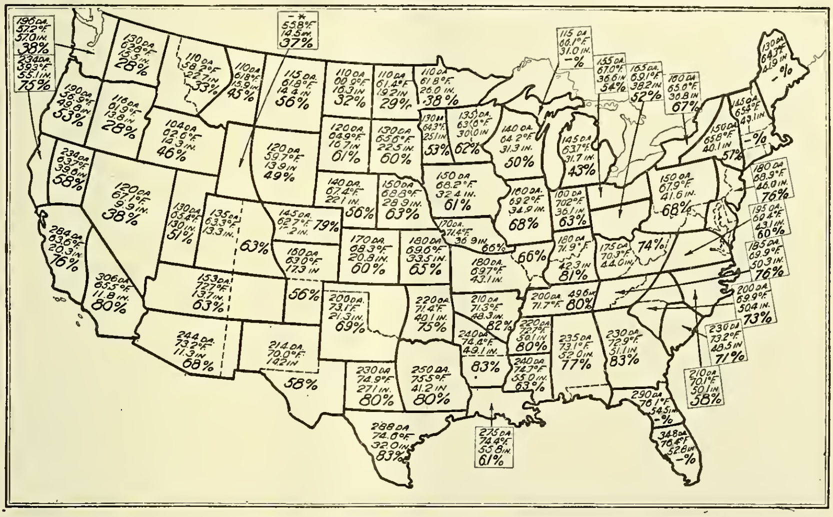

FIG. 14.—Outline map, showing by States and other indicated geographic divisions (1) the average length (in days) of the growing season or frost-free period, (2) the mean temperature (in degrees F.) of the growing season, (3) the normal annual rainfall (in inches), and (4) the percentage of success with Sudan grass grown in different sections, as reported by several thousand farmers who received trial packages of seed from the United States Department of Agriculture in 1915 and 1916. Frost is likely to occur any month of the year in the western section of Wyoming (marked with an asterisk).

sorghum) in the South have been the most popular catch crops. A comparison of these two crops with Sudan grass is presented in Table II.

Table II shows that millet is equal or superior to Sudan grass in the northern Great Plains and that it yields about the same in the timothy and clover belt if only one cutting is considered in the yield of both crops. In the southern Great Plains Sudan grass yields much more than millet. Sweet sorghum grown in cultivated rows or in drilled or broadcasted seedings outyields both Sudan grass and millet, but the hay is coarse and unsuitable to handle with a fork. The aftermath or second growth of sorghum is not as safe to pasture as that of Sudan grass, and none of the millets make sufficient second growth to afford appreciable pasturage. These facts indicate a wider utilization of Sudan grass as a catch crop in the future.

TABLE II.—*Comparative yields of Sudan grass, millet, and sorgo, seeded broadcast or in close drills.*

Location of test.	Years of test.	Plats.		Yields of cured hay per acre (tons).		
		Size (acres).	Replications.	Sudan grass.	Millet.	Sorgo.
Southern Great Plains:						
Big Spring, Tex	1916 to 1919	0.10 to 3.0	1 to 4	2.54	1.23	4.85
San Antonio, Tex	1912 to 1916		2	5.86		6.35
Chillicothe, Tex	1913 to 1918	.05	2	2.04	.94	3.00
Lubbock, Tex	1914 and 1915			3.81	3.33	4.88
Lawton, Okla	1917 to 1919	.10	1 to 2	2.40		4.14
Average				3.33	1.83	4.64
Central Great Plains:						
Amarillo, Tex	1912 to 1917	.05	2	1.65	1.44	2.70
Dalhart, Tex	1917 to 1919	.10	1 to 2	1.66	.46	2.08
Tucumcari, N. Mex	1913 to 1917	.10	1	1.33	.93	2.70
Woodward, Okla	1914, 1917 to 1919.	.04 to .10	1 to 2	1.70	1.34	3.77
Garden City, Kans	1912	.05	2	1.69	2.23	3.25
Hays, Kans	1914 to 1919	.05	2	2.72	2.18	3.66
Akron, Colo	1915 to 1919	.05	3	1.69	2.01	2.10
Average				1.78	1.51	2.89
Northern Great Plains:						
Archer, Wyo	1914 to 1915	.10	1	.82	1.61	1.41
Sheridan, Wyo	1917 to 1919	.05	3	.67	.57	1.37
Ardmore, S. Dak	1915 to 1916, 1918, 1919	.10	3	2.04	2.04	3.05
Newell, S. Dak	1915 to 1918	.05	3	1.40	2.09	2.33
Redfield, S. Dak	1915 to 1919	.04	2	3.34	3.18	4.15
Mandan, N. Dak	1915 to 1919	.05	3	1.40	2.09	2.33
Moccasin, Mont	1915, 1916	.05	2	.74	1.62	1.05
Average				1.49	1.89	2.24
Timothy and clover region:						
Manhattan, Kans	1914, 1915			4.02	2.81	3.99
Lincoln, Nebr	1915 to 1917	.05	2	3.60	3.40	5.50
Madison, Wis	1916	.025	2	2.79	3.08	
Jackson, Tenn	1914		2	2.21	.77	
Knoxville, Tenn	1914, 1915, and 1917.	.02	2	3.08	2.31	
Wooster, Ohio	1912 to 1918			3.70	3.70	8.30
New London, Ohio	1912, 1913	.05	2	1.29	2.52	
Ithaca, N. Y	1913	.012	3	.73	1.65	
State College, Pa	1913, 1915			2.64	2.13	
Blacksburg, Va	1912	.02	2	5.00		6.43
Do	1917	.02	8	1.69	2.85	
Average				2.80	2.52	6.06

The acreage of millet has been on the decline since 1899 (24, p. 5), and except in the irrigated regions of the Southwest any increase in the acreage of Sudan grass will mean a further decrease in the millet acreage. On the other hand, there has been a steady growth in the acreage of forage sorghums, which are likely to continue to be the chief competitors of Sudan grass as emergency hay crops.

USE IN ROTATIONS.

Although Sudan grass is an annual and therefore can be introduced easily into any rotation, its extensive use as a staple crop in regular rotations is not to be expected. To fill such a position, the crop must be either a money crop or a soil improver. In certain Southern States where good prices are to be obtained for hay, Sudan grass may be used like the corn or wheat of our Northern States as one of the money crops, but in other States it is not likely to supplant the well-known plants of our common rotations. It probably exhausts the fertility of the soil as rapidly as corn or cotton. Sorghums are popularly supposed to be "hard on the soil," and this reputed deleterious effect on fertility is frequently mentioned by farmers in the timothy and red clover region as their reason for not growing Sudan grass.

FIG. 15.—Growth of Sudan grass (at left) compared with that of millet, 48 days from planting.

A 4-year rotation for the cotton belt which has been suggested by the Texas Agricultural Experiment Station (29, p. 9) is, for the first and second years, cotton; third year, corn or grain sorghum, with cowpeas interplanted, to be pastured or plowed under for green manure; fourth year, Sudan grass. In such a rotation the grain sorghums should be used only in those regions where they are not subject to attacks of the sorghum midge. It is quite likely that such a rotation would require the application of some fertilizer, preferably barnyard manure, at least once in four years, since the small quantity of humus added by the legume would hardly be sufficient to maintain fertility.

HAY PRODUCTION.

PREPARATION OF THE SEED BED.

On account of its small seed and slow early growth, Sudan grass requires a seed bed that is well prepared, warm, moist, and free from weeds. For surface planting either in rows or with a grain drill, soil prepared as for wheat or oats is usually satisfactory. It is best to plow the ground in the spring, about two or three weeks before it is intended to sow the Sudan grass. Plowing at this time warms and aerates the soil and turns under the early crop of weeds. After plowing, the field should be harrowed to pulverize the clods and settle the soil. After two or three weeks the second crop of weeds will have started, and these can be killed with the disk or drag harrow.

In the dry regions row plantings are sometimes made with a lister. Where this method of seeding is practiced, it usually pays to blank list the ground in the fall or early spring and follow this with sufficient spring tillage to destroy the weeds at seeding time. Disking or some other form of cultivation should precede listing whenever it is planned to list and plant in the same operation.

USE OF FERTILIZERS.

In the Central and Western States fertilizers for Sudan grass are not necessary, but in the Southeastern States, on the poorer soils, moderate applications of some fertilizer, chiefly combinations of phosphorus and nitrogen, will be found profitable. Sudan grass is not adapted to infertile soils, and profitable crops of hay should not be expected unless a reasonably good soil is chosen for growing it. A legume of some kind, such as vetch, cowpea, or clover, should be used on worn-out soils which need building up.

Tests of acid phosphate applied at the rate of 200 pounds to the acre were made in Kentucky, and in only two cases out of ten did it fail to give profitable increases in the hay yields. The average increase attributable to the fertilizer was 68 per cent. In experiments on gray sandy soil at Calhoun, La., in 1915 Sudan grass yielded 0.75 ton of dry hay per acre on unfertilized plats. With an application of 315 pounds of cottonseed meal per acre the yield was 1.66 tons per acre, an increase of 121 per cent due to the fertilizer. An application of cottonseed meal and acid phosphate in equal parts at the rate of 315 pounds per acre resulted in a yield of 2.13 tons per acre, an increase of 184 per cent over the check plats. These plats were planted in rows 3 feet apart. In broadcasted plats on the same soil the yield was considerably larger. These experiments, though limited in number, indicate the wisdom of using fertilizers in the Southeastern States.

Barnyard manure nearly always increases the yields of Sudan grass. It is generally more profitable, however, to apply the manure to some money crop, such as corn, and allow the Sudan grass to benefit by the residual effect, which is usually noticeable for two or three years after the manure has been applied.

DATE OF SEEDING.

Like other plants of the sorghum family, Sudan grass must not be seeded until the soil is warm. A large number of the failures with this grass can be attributed directly to early planting, especially in the northern part of the Sudan grass region. In South Dakota the spring is usually cold and backward and seedings made by farmers in the early part of May have often been unsuccessful. During the same years, however, good crops have been grown at the experiment station at Redfield, S. Dak., by planting about June 1 (fig. 16).

FIG. 16.—Sudan grass 4 feet tall and not yet headed at the Redfield (S. Dak.) Field Station, August 10, 1915.

Sudan grass has frequently withstood light frosts, but a frost of any severity is likely to injure the young plants materially. A good rule is to sow this grass from two to four weeks after the normal date for planting corn. Experimental data on this subject are presented in Table III.

Table III shows that in regions from 30° to 35° north latitude the earlier dates are best, but that good yields may be expected from seedings made at any time between April 1 and June 15. The maximum hay yields were obtained from seedings on April 1.

In the middle section of the United States, approximately between 35° and 40° north latitude, it is usually safe to sow at any time bebetween May 1 and July 1. There is no decided optimum date, although June 1 gave a slightly higher average yield at the eight stations where tests were made.

In the Northern States, above 40° north latitude, the safest rule is to withhold planting until the ground is thoroughly warm and the weather settled. Not enough data were obtained from northern stations to decide the question of the best date for planting. Unfavorable weather conditions prevented seeding on the earlier dates in most years. It is worth mentioning, however, that seedings on June 1 have been uniformly successful at Redfield, S. Dak.

TABLE III.—*Yields of Sudan grass hay from different dates of seeding in various parts of the United States.*

Location of test.	Plats.		Seasons under test.	Yields of cured hay (per acre) from plantings made on—							
	Size.	Replications.		Apr. 1.	Apr. 15.	May 1.	May 15.	June 1.	June 15.	July 1.	July 15.
Southern section:	*Acres.*			*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Bard, Calif.	0.05	2	2	3.82	3.84	4.15	3.80	3.55	2.91		
Chillicothe, Tex.	.05	2	7	2.07	1.95	1.97	2.05	1.55	1.67	1.58	
Baton Rouge, La.			1	4.70	3.85	3.60	3.15	3.00			
Agricultural College, Miss.	.05	1	1	5.38	5.58	3.60	3.45	3.05	2.63	2.58	
Athens, Ga.		1 or 2	5	1.98	2.05	2.11	2.05	2.29	2.05	1.32	1.33
Gainesville, Fla.	.05	2	1	1.31	1.81	1.54	2.04				
Average				3.21	3.18	2.83	2.76	2.69	2.32	1.83	1.33
Middle section:											
Davis, Calif.[1]	.05	2	2	5.66	6.80	4.87	5.02	3.98			
Do.	.05	2	2	4.96	7.02	4.70	4.98	3.20			
Hays, Kans.	.05	2	6		.37	1.51	1.84	1.84	1.87	1.61	1.30
Tribune, Kans.	.02	2	2	.65	1.10	2.06	2.80	3.76	2.98	2.40	1.27
Stillwater, Okla.	.10	1	1		2.23	2.94	2.70	.68	1.18	.43	.88
Amarillo, Tex.	.05	2	5		1.52	1.68	1.71	1.70	1.81	1.99	1.37
Knoxville, Tenn.	.02	1	1	1.10	1.25	1.05	1.10	1.70	1.05	1.05	1.37
Jackson, Tenn.			2	1.66	2.23	2.28	2.55	2.48	2.58	2.28	1.02
Blacksburg, Va.	.05	2	3			3.52	2.73	2.74	2.30	1.85	
College Park, Md.	.05	2	1			2.17	2.69	3.32	3.85		2.25
Average[2]				1.14	1.45	2.15	2.27	2.28	2.20	1.66	1.35
Northern section:											
St. Paul, Minn.	.015	2	1			4.74	4.54	4.59	4.49		
Redfield, S. Dak.	.05	2	5			2.75	2.87	3.05	2.77		
Average						3.75	3.71	3.82	3.63		

[1] Irrigated. [2] The data for Davis are excluded from the averages.

The latest date at which it is advisable to sow Sudan grass may be considered roughly as 70 to 90 days before the normal date of the first killing frost in the fall. The high price of seed makes it advisable to postpone seeding several weeks rather than sow in dry, cold, or weedy soil. If conditions for planting continue bad during the season, it may be found practicable to substitute for Sudan grass a forage crop the seed of which is cheaper, such as sorghum or millet.

METHOD OF SEEDING.

The method of seeding found best for sweet-sorghum hay production in any region should be followed in seeding Sudan grass. This means that it may be sown broadcast, in close drills, or in any convenient width of cultivated rows. Moisture, seed, and cultur equipment are the chief factors to be considered in deciding upo the exact method.

Because of its smaller size Sudan grass seed should be plante shallower than sorghum; usually from half an inch to $1\frac{1}{2}$ inches deep best on moist or heavy soils, while from 1 to 3 inches is better on dı or lighter land. Planting deep in loose or dry soil often secures bett conditions for germination, but does not seem to have any appr ciable effect on the depth at which the Sudan grass plant forms i root system. In some tests at the Arlington Experimental Farm, Va

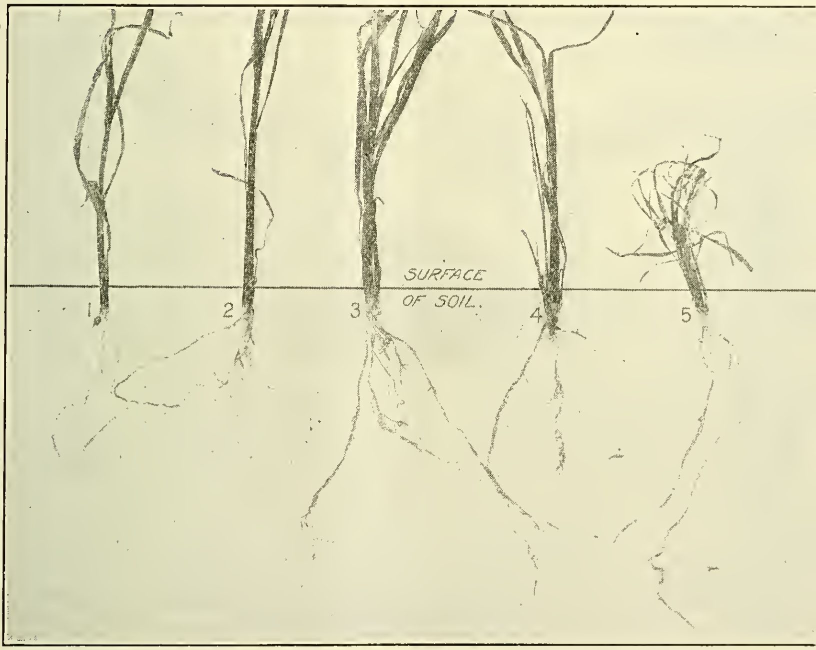

FIG. 17.—The effect on the seedling of planting Sudan grass seed at different depths. From left to rig (1) half an inch, (2) 1 inch, (3) $1\frac{1}{2}$ inches, (4) 2 inches, (5) 3 inches.

seeds planted from half an inch to 3 inches deep all produced plan with the crown just beneath the surface of the ground. (Fig. 17.)

Experiments to permit exact comparisons of results from differe planting methods under widely varying conditions were begun i 1913. Data for work extending over one to four years at each 23 agricultural experiment stations are presented in Table IV.

Table IV shows that no one method has given uniformly superio yields in any region. The plant's vigorous root system exhausts s completely the available plant food and moisture in rows of an width here reported that yields usually bear a definite relation only t factors of climate, soil, and culture.

TABLE IV.—*Yields of cured Sudan grass hay from different methods of seeding.*

Location of test.	Years of test.	Plats.		Number of cuttings.	Yields per acre.		
		Size.	Replications.		Close-drilled or broadcasted.	18 to 24 inch rows.	34 to 44 inch rows.
Humid regions:		*Acres.*			*Tons.*	*Tons.*	*Tons.*
Angleton, Tex	1913 to 1916		1	2–3	2.39	3.29	2.05
Beeville, Tex	1913		2		4.70	5.21	5.63
Nacogdoches, Tex	1914				1.52	1.80	1.51
Temple, Tex	1913		2			1.48	1.03
Stillwater, Okla	1914	0.10	2		.60	.35	2.29
Lincoln, Nebr	1915 to 1917	.05	2	2	3.80		3.70
Lexington, Ky	1915			2	7.95	9.39	6.96
Nine farms in Kentucky	1915	.05	18		1.77		1.18
Wooster, Ohio	1916 to 1918				3.04	2.86	2.74
State College, Pa	1915	.065	1	1	2.59		2.55
St. Paul, Minn	1913	.015	2	1	3.76	3.69	4.10
Average [1]					3.42	3.80	3.61
Dry regions (not irrigated):							
Davis, Calif	1913 to 1915	.05	1	3	3.79	4.49	3.65
Chillicothe, Tex	1913 to 1919	.05	2	2–3	1.99	1.98	2.19
Amarillo, Tex	1913 to 1917	.05	1 or 2	1–3	1.68	2.04	1.88
Lubbock, Tex	1913		3 or 4			3.00	2.14
Woodward, Okla	1917 and 1918				1.58		2.08
Hays, Kans	1913 to 1919	.05	2	1–2	2.40	2.74	2.55
Garden City, Kans	1914		1	1	.43	2.41	1.36
Tribune, Kans	1914		1	1	1.95	1.66	1.00
Dodge City, Kans	1914			2	3.57		1.15
Colby, Kans	1914			1	0	0	1.00
Akron, Colo	1914 to 1919	.05	3	1	1.77		1.70
Valentine, Nebr	1913	.10	1	1	1.19	.83	.61
Archer, Wyo	1914 to 1915	.10	1	1	1.35	.78	.82
Sheridan, Wyo	1917 to 1919	.05	3	1	.67		.61
Ardmore, S. Dak	1914, 1916, 1918, 1919.	.10	3	1	1.26		1.40
Redfield, S. Dak	1915 to 1919	.05	2	1	3.34	2.54	2.15
Newell, S. Dak	1914 to 1918	.05	3	1	1.91		1.64
Mandan, N. Dak	1914 to 1919	.05	3	1	1.43		1.52
Huntley, Mont	1914	10	1	1	.60	.42	
Average [1]					1.81	1.95	1.72
Dry regions (irrigated):							
Bard, Calif	1914, 1915	.05	2	3	3.12	3.99	2.77
Davis, Calif	1913, 1914, and 1916.	.05	1	2–3	6.15	6.23	5.99
Chico, Calif	1913 to 1915	.05	1 to 4	2–3	5.52	5.50	5.17
Bozeman, Mont	1914	.10	1	1	4.35		3.60
Average [1]					4.93	5.24	4.64

[1] Averages include only the stations where data for all three methods are presented.

CLOSE DRILLS AND BROADCASTING.

In humid regions and under irrigation, drilling with a grain drill is the most satisfactory method of seeding Sudan grass for hay except when seed is very expensive. Even in the dry regions this method gives nearly as good results as the cultivated-row plan. Sudan grass seeded in close drills requires no cultivation, the plants mature more uniformly and have finer stems, the roots are less troublesome later on, and the hay is not as dusty as that grown in cultivated rows.

The ordinary wheat drill is the best machine for this work. It distributes clean Sudan grass seed uniformly and covers it evenly. Most wheat drills sow this seed at about the same speed as wheat; for example, when set for 2 pecks of wheat per acre the drill may be expected to sow 2 pecks of Sudan grass seed (15 to 20 pounds). If the drill feed can not be set to sow thinly enough, bran or some other inert substance may be mixed with the Sudan grass seed. Alfalfa and grass seed drills or attachments have been used by some farmers for sowing Sudan grass. Although such machines work in some cases, their general use is not recommended because the seed of Sudan grass is so much larger than that of alfalfa, clover, and timothy that it stops up the feeds frequently, and as a result the seed may be sown too thinly and not covered deeply enough.

Broadcasting is recommended only when the area to be sown is small, the seed not well cleaned, or no suitable drill is available. About 25 per cent more seed should be used in broadcasting than in drilling, and it should be harrowed in well at once. The objections to broadcasting are that it distributes and covers the seed so unevenly that more seed is required, and a good stand is not as certain as when the crop is drilled.

CULTIVATED ROWS.

In the dry regions west of the 98th meridian, cultivated rows frequently show a greater superiority over drilled seedings than is indicated by the comparative yields of hay. During drought periods, as at Hays, Kans., in 1916, intertilled plats produced nearly normal plants, while adjoining close-drilled Sudan grass failed to head out and produced an inferior quality of hay, though the yield per acre was nearly equal to that from the rows. When seed is very scarce and expensive, wide rows are preferable, because they require much less seed per acre.

On the other hand, as the row width increases the hay becomes enough coarser to lower its market value somewhat. The actual feeding value, however, is not reduced much, if any; for when row plantings are harvested at the proper stage of maturity and fed intelligently the stems as well as the leaves are practically all consumed.

Hay from cultivated rows mowed and raked in the usual way is sometimes objectionable because of the clods and dust gathered up with it. This condition is seldom troublesome except in seasons of drought or in fields cultivated deeper or later than usual. Cutting row plantings with a binder solves the dust problem.

The bunchy root system developed by Sudan grass in wide rows sometimes makes soil preparation for the next crop expensive and difficult. Fields, after being in 40-inch rows at the Fort Hays Experiment Station, Hays, Kans., in 1915, were placed in condition for cropping the next year with great difficulty. (Fig. 18.) After plowing, it required two double diskings and several harrowings to fit the land for 1916 crops. Close-drilled fields at the same station that year and 24-inch row plantings the preceding year left roots so much finer and more evenly distributed that later tillage was not difficult, and in some cases the soil seemed lighter and more mellow than before.

Sudan grass may be surface planted in rows with either a grain drill or corn planter. It may be planted in furrows directly with a lister, or, more safely but less economically, with the corn planter following blank listing. Surface planting is more likely to give a good stand and rapid early growth, because the soil is warmer and the plants are not exposed to being washed out, covered up, or drowned, as in listed furrows. Listing has the advantage in dry regions of putting the seed down into moist soil, often resulting in good stands where the surface soil is too dry for seed to sprout. Listed fields may be cultivated easily and rapidly with the special

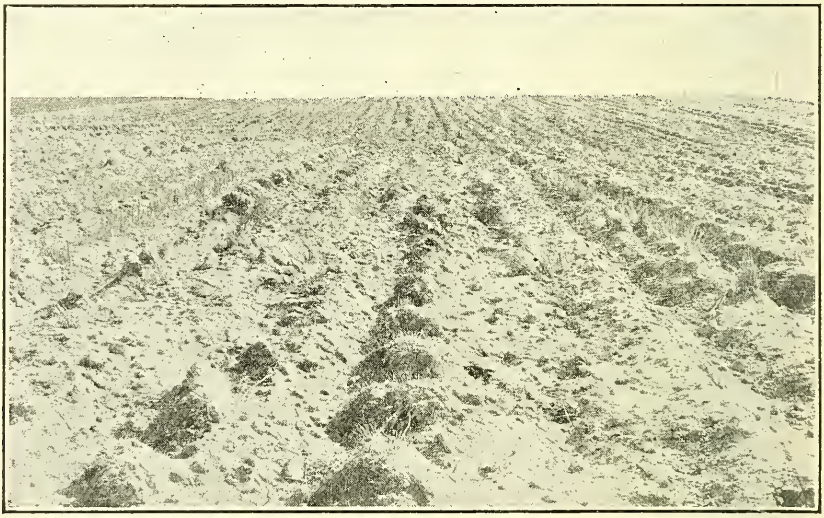

FIG. 18.—The difficulty of putting a field in condition for cropping the year following a crop of Sudan grass seeded in 40-inch rows is shown in this illustration.

2-row machine commonly used for listed corn and sorghums in the Great Plains area. It is much easier to cover up weeds in cultivating listed fields, but, on the other hand, surface-planted Sudan grass properly handled grows so rapidly that weeds give very little trouble and are soon overcome by the shade.

Rows may be spaced any distance desired with a grain drill by stopping up the holes not needed. In drills with the vertical disk feed, rags tightly inserted serve this purpose, but in drills with the horizontal corrugated-cylinder feed it is usually necessary to tack a material like tin or wood over the holes. The grain drill used in this way is especially useful for rows less than 3 feet apart. For example, a drill with 10 holes 7 inches apart sows four 21-inch rows at once by seeding through the first, fourth, seventh, and tenth holes; or the first, fifth, and ninth holes may be used to sow three 28-inch rows. Rows 36 to 48 inches apart are better suited to the corn planter. The planter may also be used to sow 18-inch to 24-inch rows by straddling, but this is slower and does not space the rows as uniformly as the drill. The lister is best adapted to rows 40 or 42 inches apart. One may use either a single-row lister, requiring three or four horses, or a 2-row lister with six or eight horses.

RATE OF SEEDING.

IN DRILLED OR BROADCASTED SEEDINGS.

Rates varying from 10 to 40 pounds per acre have been tested for from one to four years at 24 widely distributed points. Table V presents the yield reported to the Office of Forage-Crop Investigations from these stations.

TABLE V.—*Yields of cured hay from different rates of seeding broadcast or in close drills.*

Location of test.	Years of test.	Plats.		Hay yields when seeded at following rates per acre.				
		Size.	Replications.	10 pounds.	15 pounds.	20 pounds.	25 to 30 pounds.	35 to 40 pounds.
Humid regions:		*Acres.*		*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Athens, Ga	1914		1		0.42	0.91	1.63	
Agricultural College, Miss	1913	0.05	1		1.93	2.06	2.45	2.50
Do	1915	.10	2	3.12	4.09	4.34	4.22	3.56
Baton Rouge, La	1913	.05	2		2.05	1.73	2.20	
Beeville, Tex	1913		2		4.84	4.84	5.03	5.01
Blacksburg, Va	1913 to 1917	.05	2		1.46	1.62	1.58	2.00
College Park, Md	1913 to 1915	.05	2		3.32	3.33	3.41	3.62
Fayetteville, Ark	1913	.10	1		1.12	.87	.95	.88
Jackson, Tenn	1913 to 1915		1	2.32	1.90	2.14	1.97	2.01
Knoxville, Tenn	1913	.025	2		2.94	3.26	3.29	2.69
Lexington, Ky	1915		1	6.72		7.95	8.85	
Lincoln, Nebr	1915 to 1917	.05	2		3.40		3.30	3.60
Madison, Wis	1915	.025	2	3.37	3.24	3.11	3.06	2.42
St. Paul, Minn	1913	.015	2		4.25	3.97	4.28	4.05
Average [1]					2.91	2.95	3.02	2.87
Dry regions (not irrigated):								
Davis, Calif	1913 to 1915	.05	1 or 2	5.04	4.99	4.31	3.91	4.37
Amarillo, Tex	1914 to 1917	.05	2	2.30	2.51	2.18	2.49	
Chillicothe, Tex	1913 to 1919	.05	2	1.94	2.28	2.24	2.23	2.13
Lubbock, Tex	1913 to 1916				3.18	3.43	3.30	3.18
Pecos, Tex	1913		2		1.25	1.89	2.20	2.58
Spur, Tex	1914		2		5.14	5.02	5.02	5.04
Hays, Kans	1913 to 1918	.05	2	2.48	2.50	2.43	2.40	2.45
Tribune, Kans	1914 and 1915	.02	2	3.62	4.22	3.95	3.28	2.81
Redfield, S. Dak	1916 to 1919	.04	2	2.53	2.58	2.49	2.71	
Average [1]					3.37	3.32	3.19	3.22
Dry regions (irrigated):								
Bard, Calif	1914 and 1915	.05	2	2.66	3.02	2.68	3.02	2.76
Davis, Calif	1914 to 1916	.05	1	8.02	6.74	7.28	5.90	6.16
Average				5.34	4.88	4.98	4.46	4.46

[1] Only the stations where data are presented for all rates of seeding of 15 pounds or more are included in the averages.

The yields reported in Table V, as in the width-of-row tests, show no decided superiority for any rate of seeding. Sudan grass tillers so freely in thin stands that the final number of stems per square foot has been about the same for all the rates in these experiments. In general, 20 pounds per acre under favorable seeding conditions has been just as satisfactory as thicker rates. In several cases, 10 to 15 pounds have given maximum returns. A farmer near Goodland, Kans., obtained an excellent yield in 1915 on a 4-acre field by broadcasting only 5 pounds of seed per acre. The stand averaged one plant to each square foot, but each plant tillered profusely and grew to a height of 6 to 8 feet.

A pound of the average Sudan grass seed contains 50,000 seeds. As there are 43,560 square feet in an acre, it follows that a Sudan grass field would have as many plants per square foot as there were pounds sown per acre if 87 per cent of the seeds grew. But one can not expect more than 40 or 50 per cent of the seeds to produce plants.

Taking all factors into consideration, 20 to 25 pounds per acre are recommended for close-drilled seedings in humid regions and 15 to 20 pounds in dry sections. Owing to the more favorable conditions for germination under irrigation, 15 to 20 pounds are sufficient. These quantities should be proportionately increased if the seed is poor, the soil in poor physical condition, or if broadcasting is practiced.

CULTIVATED-ROW PLANTING.

Few tests of different rates of seeding in row plantings have been made. These trials show that it makes little difference in the forage yield whether 3 or 6 pounds of seed per acre are used in the 36-inch to 44-inch rows. The plants in the thinner seedings tiller so abundantly that the lack of original plants is usually overcome. Thin seeding results in coarser stems, however, and unless seed is scarce or very expensive it is advisable to sow 4 pounds per acre in the dry regions and 6 pounds in the more humid areas.

A grain drill, a corn planter, or a lister may be used in planting these rows, as described under "Methods of seeding." If the planter or lister is not equipped with suitable plates, blank ones may be bought and fitted with holes as desired. The ordinary milo plate works well. In any case, the holes should be well reamed out on the under side and large enough to let three or four seeds through at once. About 15 seeds per foot of row space should be dropped; this requires 3 to 4 pounds per acre in 40-inch rows and correspondingly more for closer widths.

HARVESTING.

TIME OF CUTTING.

Like timothy, Sudan grass allows considerable latitude in the time of cutting. It makes good hay if cut at any time from the appearance of the first heads until past full bloom. If mowed before heading, the plant is quite succulent and more cuttings during the season can be made, but usually no appreciable increase in yield of hay results. (Fig. 19.)

Sorghum when very young is 90 per cent water; just before heading, 87 per cent; when first heads are appearing, 85 per cent; in full bloom, 80 per cent; and when ripe, 75 per cent. Sudan grass is so nearly like sorghum that it is safe to estimate the percentage of moisture in Sudan grass by that found in sorghum at like stages of maturity. It is apparent, therefore, that if the crop is cut quite young, practically 90 per cent of the total weight will be made up of water. This means that only 10 per cent of the crop is dry matter and effective as feeding material. Where

FIG. 19.—Sudan grass in drilled seedings at the Fort Hays Experiment Station, Hays, Kans. Both plats were seeded on June 14; the plat on the left shows the second growth after a first cutting made on August 3 before the grass headed. Photographed September 4, 1915.

the crop is cut when in full bloom or with the seeds in the soft-dough stage, approximately 20 per cent of the total weight is dry matter and possesses feeding value.

The percentages of protein, ash, and fat are highest in young plants and lowest in mature ones. The yield of these elements in pounds per acre is larger, however, when the grass has been allowed to head. Early cutting is not justified, therefore, either from the standpoint of total yield or food value. The wisdom of allowing Sudan grass to grow at least until it has headed is indicated by the results presented in Table VI.

The question of palatability affects the decision regarding the time of cutting. Sudan grass leaves remain green and new shoots keep coming until the seed ripens. The stems, however, become woody after seed has set; therefore the hay from cuttings made about the time the grass heads is somewhat more palatable than later cuttings.

TABLE VI.—*Composition and yield per acre of the principal food elements in Sudan grass when cut at different stages of maturity.*

Stage of maturity.	Number of samples.	Total dry matter.	Ash.	Ether extract.	Protein.	Crude fiber.	Nitrogen-free extract.
Computed on the basis of actual dry matter:							
Very young, 18 to 24 inches tall	24	*Per cent.* 100	*Per cent.* 10.77	*Per cent.* 1.52	*Per cent.* 13.58	*Per cent.* 25.54	*Per cent.* 48.59
Just before heading	19	100	9.26	1.98	12.89	27.05	48.82
First heads appearing	12	100	8.74	1.72	11.54	28.38	49.62
Beginning to bloom	10	100	8.19	1.68	9.82	31.15	49.16
Seed in milk or soft-dough stage	8	100	7.20	1.64	8.73	29.26	53.17
Seed fully mature	2	100	7.35	1.38	6.03	36.71	48.53
Yields per acre at Hays, Kans., 1915 to 1918:							
Just before heading, two cuttings		*Pounds.* 3,235	*Pounds.* 355	*Pounds.* 62	*Pounds.* 471	*Pounds.* 923	*Pounds.* 1,424
Cut as first heads appeared and again at frost		3,952	422	65	506	1,173	1,786
Cut when beginning to bloom and again at frost, in 1915 and 1916		3,802	373	60	421	1,196	1,752
Seed in soft-dough stage; only one cutting		4,093	361	62	352	1,336	1,982

Local conditions should largely govern the time of cutting. When insect pests threaten or drought or frost checks growth, it frequently pays to mow Sudan grass if it is 2 or 3 feet high whether it is headed or not. Scarcity of hay or the approach of a very busy season may also justify such early cutting. Rush of work and the desire to harvest seed are valid reasons for late cutting, for even thrashed Sudan grass is a fairly good roughage.

MACHINERY.

The mowing machine is usually employed in harvesting Sudan grass hay, especially that less than 4 to 5 feet high. If the crop is fed green, a little at a time, an ordinary scythe may well be used

Grain binders work well on both rows and broadcast Sudan grass 3 to 6 feet high. Cultivated rows more than 5 feet high are best handled with a corn binder. (Fig. 20.) In 1915 some Kansas growers cut very tall broadcasted Sudan grass and sweet sorghums with a corn binder by attaching an extension arm on one side to make it gather in and cut a swath 2 to 3 feet wide. Though loose Sudan grass hay is much easier to pitch than the coarser sorghums, many farmers consider that the added cost in binding tall grass is more than offset by the convenience of handling. In humid regions the hay may spoil in the bundle if bound green.

CURING AND STORING.

In dry windy regions the crop, if bound, may be set up at once in substantial shocks. If mowed, the hay usually should be raked within two or three days, for the leaves dry very rapidly. It may then be cured in windrows or cocks until the stems are dry and it becomes safe to bale or stack the hay. On account of the slow drying of the stems, Sudan grass hay should rarely be stacked, baled, or piled in a haymow until two weeks after cutting. At the Fort Hays Experiment Station, Hays, Kans., Sudan grass 5 to 6 feet high was cut in July, 1914. After three or four good drying days the hay looked cured, and about 30 tons of it were stacked in a large rick. Small samples taken at stacking time lost 30 per cent of their weight upon further air drying. When the stack was fed out, much hay in the center showed injury from heating. In September, 1914, at the same station, some apparently cured hay was placed in a barn on a damp day. A week

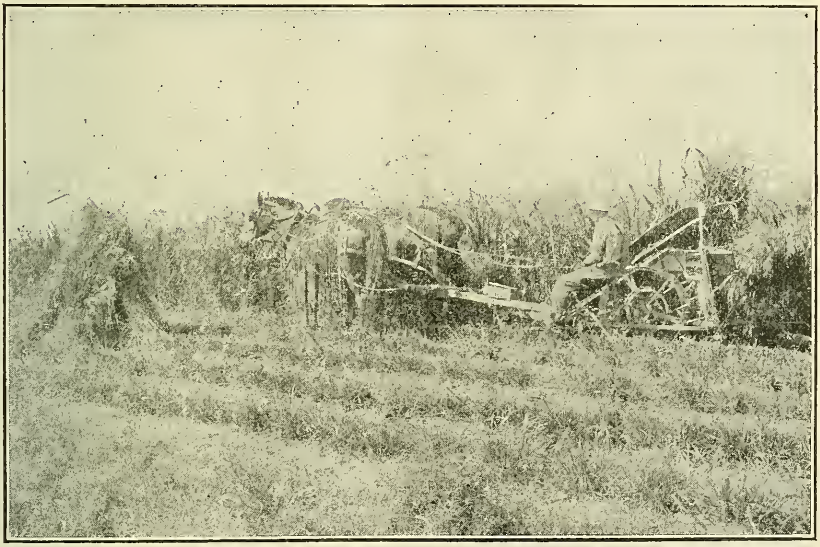

FIG. 20.—Cutting Sudan grass seeded in rows 40 inches apart at Dalhart, Tex.

later this Sudan grass was found to be heating. The temperature 1 foot below the surface was 128° to 130° F., though there were but a few tons of hay in the center of a large well-ventilated haymow.

In humid regions, a proportionately longer time is required for curing. The leaves do not shatter easily, however, and a few rains do not materially injure the quality of the hay. The crop should be removed from the field as soon as safe, in order to avoid injuring the next cutting, or so that the aftermath may be pastured.

SUDAN GRASS AND LEGUME MIXTURES.

The growing of legumes in mixtures with nonlegumes is a very old practice in agriculture. In the United States this practice of mixed seedings is not common except with hay crops, because the harvesting is done by machinery, and unless the two crops mature at the same time and the separation of grain from the legume seed is easy, growing grain crops in mixtures will be found impracticable. This objection does not apply with equal force to hay crops, because uniformity in maturity is not so essential. Several notable examples of such mixtures are found in American agriculture, the most common of which is timothy and red clover. Rye and vetch, oats and vetch, oats and field peas, and barley and field peas are other combinations illustrating this practice.

Cowpeas or soy beans are often sown with millet or sorghum by southern farmers, and the combination of these legumes with Sudan grass has been found equally promising in the humid regions. (Fig. 21.) Table VII shows in detail the results of mixed plantings of

Fig. 21.—A mixed planting of Sudan grass and soy beans at the Arlington Experimental Farm, Va., 1914.

these forage crops in the Southeastern States. Tests of the same mixtures were made in the semiarid regions, but in regions of limited rainfall the practice was found unprofitable. The Sudan grass almost invariably started growth quicker and overcame the legume plants by exhausting the available soil moisture before the legumes had become well rooted, or the grass increased in height so rapidly that they were shaded out, the result usually being that at harvest time only the Sudan grass was present in any quantity.

The data in Table VII indicate that so far as the yields are concerned it makes little difference whether cowpeas or soy beans are used in the mixtures. The quality of the hay is first-class in both cases, but it is generally conceded that the soy bean, on account of its more upright habit of growth, is better suited for these mixed plantings than the cowpea. Nearly as much hay is obtained from the Sudan grass alone as from the mixed seedings, but the addition of a legume to the hay adds to its value by increasing the protein content.

Table VII.—*Yields of hay from mixtures of Sudan grass and legumes compared with yields from Sudan grass when seeded alone.*

Location of tests.	Years of test.	Plats.		Rate of seeding in mixtures.		Yields of cured hay per acre.		
		Size.	Replications.	Sudan grass.	Legumes.	Sudan grass and soy beans.	Sudan grass and cowpeas.	Sudan grass alone.
		Acres.		*Lbs.*	*Lbs.*	*Tons.*	*Tons.*	*Tons.*
Baton Rouge, La	1913	0.05	2	12	60		2.05	2.00
Do	1913	.05	2	20	60		2.95	2.00
Do	1913	.05	2	12	40		2.30	2.00
Do	1914	.05	2				3.15	4.50
Agricultural College, Miss	1913	.05	1	12	60	1.85	1.90	2.45
Do	1913	.05	1	20	60	2.38	2.38	2.45
Do	1913	.05	1	12	40	2.25	1.80	2.45
Knoxville, Tenn	1913	.05	2	12	60	2.13	1.72	1.70
Do	1913	.05	2	20	60	1.38	1.66	1.70
Jackson, Tenn	1914			24	60		1.39	1.80
Do	1914			40	60		1.96	1.80
Do	1915			15	60		2.36	1.94
Do	1915			20	60		1.63	2.93
Do	1915			25	60		1.96	2.49
Do	1915			30	60		2.80	2.09
Do	1915			35	60		1.78	2.39
Lexington, Ky	1915					5.70	5.30	4.60
Blacksburg, Va	1913 to 1917	.05	1	12	60	2.27	2.24	1.46
Do	1913 to 1917	.05	1	20	60	2.51	2.20	1.62
Do	1913 to 1917	.05	1	12	40	2.29	1.72	1.46
Arlington Farm, Va	1912	.10	1	20	30	4.40	4.60	3.50
Do	1913	.05	2	12	60	1.24	.98	.97
Do	1913	.05	2	20	60	1.32	1.11	.97
Do	1913	.05	2	12	40	1.10	1.07	.97
College Park, Md	1913	.05	2	12	60	3.26	3.48	3.58
Do	1913	.05	2	20	60	3.47	3.09	3.90
Do	1913	.05	2	12	40	3.38	3.67	3.58
Do	1914	.05	1	15	90	4.51	4.09	3.64
Do	1914	.05	1	15	120	3.77	4.34	3.64
Do	1914	.05	1	20	120	3.72	4.10	3.98
Do	1914	.05	1	15	40	4.04	4.19	3.64
Do	1914	.05	1	15	60	4.60	4.76	3.64
Do	1914	.05	1	20	60		4.34	3.98
Do	1915	.05	1	15	90	3.10	3.04	2.75
Do	1915	.05	1	15	120	3.24	3.25	2.75
Do	1915	.05	1	20	120	3.06	3.39	2.59
Average [1]						2.96	2.93	2.67

[1] The averages include only the stations and years where data are presented for all methods.

The proper proportion of Sudan grass and legumes in the mixtures has not been determined, but a mixture containing three plants of Sudan grass to one plant of the legume is theoretically obtained by sowing 10 pounds of Sudan grass with 50 pounds of cowpeas, 12 pounds of Sudan grass with 60 pounds of cowpeas, or 16 pounds of Sudan grass with 80 pounds of cowpeas. The total weight of seed used can be regulated according to the wishes of the planter and the fertility of the soil. The proportions of Sudan grass and soy-bean seed can be made the same as those with cowpeas. Generally speaking, the seed of soy beans is somewhat larger than that of cowpeas, but there is a wide variation among varieties in this respect. The Peking and the Arlington are two varieties which have exceptionally small seed. These varieties average 6,800 seeds per pound, while four other well-known varieties, Wilson, Guelph, Ito San, and Mammoth, average only 2,600 seeds to the pound. This difference in the size of the seed should be taken into consideration in determining the proportions of grass and legume seed. The varieties mentioned above are all very well adapted for use in mixtures, because all of them make a luxuriant growth of vines.

The greatest drawback to the use of mixtures lies in the difficulty of seeding the two elements uniformly. This can be accomplished most easily by broadcasting the mixture. If a drill is used, great caution is required to keep the Sudan grass and legume seed thoroughly mixed in the drill box. Experimental plantings have been made most successfully by going over the ground twice with a drill in which alternate holes have been closed. In this way rows of the legume can be made to alternate with rows of Sudan grass. This method is too expensive, however, for extensive use by farmers. With drills which have a grass-seeder attachment it is possible to run the Sudan grass seed through the seeder and the cowpeas or soy beans through the grain feed.

General experience indicates that it is usually more practicable, except in localities where cowpeas or soy beans succeed especially well, to sow the Sudan grass and legumes on separate fields. The greater ease of seeding and harvesting the crops is likely to overcome the advantages which might be derived from a mixed seeding.

Another feature of mixed plantings of annual crops which has received little attention is the effect on the chemical composition of the Sudan grass produced by its association with the legumes. Lyon and Bizzell (13, pp. 365–368), of New York, found a marked increase in the percentage of protein in nonlegumes when grown in association with legumes; e. g., timothy with alfalfa and oats with field peas. Westgate and Oakley (27), on the contrary, could detect no effect of this nature.

TABLE VIII.—*Proportions of protein and ash in Sudan grass when grown alone and when grown with legumes at the Arlington Experimental Farm in 1913.*

Crop.	Protein.	Ash.
Sudan grass alone ... per cent..	6.63	7.46
Do ... do....	6.59	7.56
Sudan grass with cowpeas ... do....	6.40	8.60
Sudan grass with soy beans ... do....	7.30	10.46
Sudan grass with bonavist beans ... do....	7.66	9.11
Average, Sudan grass alone ... do....	6.61	7.51
Average, Sudan grass with legumes ... do....	7.12	9.39

In 1913 Sudan grass grown at the Arlington Experimental Farm, Va., in mixtures with cowpeas, soy beans, and the bonavist bean (*Dolichos lablab*) was analyzed with the results shown in Table VIII.

UTILIZATION OF SUDAN GRASS.

HAY.

Sudan grass is essentially a hay crop, its slender leafy stems making it easy to handle with the ordinary haying machinery. It yields well in most parts of the United States, as shown by Tables II to V, and the hay is relished by cattle, horses, and sheep.

The feeding value of Sudan grass hay is practically equal to that of millet, Johnson grass, timothy, and other nonlegume roughages. This is shown both by chemical analyses and by practical feeding tests. A statement of the percentages of the different food elements in Sudan grass hay and other common hay and fodder crops is given in Table IX. These percentages are given on a water-free basis, because there seems no other way at the present time to make them comparable for the different feeds. It is realized that hay and fodder when fed to live stock contain an appreciable quantity of water and that this necessarily means a lower percentage of the other nutrients such as protein, carbohydrates, and fat. In order to be ready for use in computing balanced rations, the composition of feeds should be stated on the basis of their average moisture content at the time they are being fed. The data now available, however, on the moisture content of hays and fodders at the time they are removed from the stacks and barns are very limited (1, 25, 26). It is impossible, therefore, to estimate accurately the average percentage of moisture in the different kinds of roughage as they are fed.

TABLE IX.—*Average composition of hay made from Sudan and other grasses and legumes and of corn and sorghum fodder.*

Feed.[1]	Number of analyses.	Average constituents.				
		Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.
Hay:		*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Sudan grass	71	8.6	10.2	29.5	49.9	1.8
Johnson grass	77	7.7	9.0	32.6	47.7	3.0
Timothy	226	6.2	7.8	32.3	50.6	3.1
Millet	40	8.8	9.8	30.1	48.3	3.0
Alfalfa	247	9.7	17.4	29.6	40.5	2.8
Red clover	99	7.9	15.6	27.7	44.9	3.9
Cowpeas	78	14.3	19.4	22.7	40.5	3.1
Fodder:						
Corn	45	6.6	8.4	26.1	56.2	2.7
Sorghum	18	10.1	10.1	28.4	49.4	2.0

[1] These analyses were supplied by the Cattle Food and Grain Investigation Laboratory, Bureau of Chemistry, United States Department of Agriculture.

The remarkably close similarity in the composition of Sudan grass, Johnson grass, timothy, and millet hay is shown by Table IX. The legume hays, of course, show a high percentage of protein, and this must be taken into consideration in feeding. Corn fodder and sorghum fodder are very similar in composition, and each is of lower feeding value than any of the hays because there is more waste in feeding them.

Only a few determinations of the digestibility of Sudan grass hay have been made, but these show that its rank in digestibility, as in composition, is practically equal to that of millet and timothy hays. One of the tests was carried out at the Maryland Agricultural Experiment Station in 1915 with a young bull, another at the Iowa Agricultural Experiment Station in December, 1916, with two Guernsey heifers, and the third with two sheep at the Texas Agricultural Experiment Station. (Table X.)

TABLE X.—*Coefficients of digestibility of Sudan grass, millet, and timothy hays.*

Constituents.	Digestion coefficients.				
	Sudan grass.			Millet.[4]	Timothy.[4]
	Iowa.[1]	Maryland.[2]	Texas.[3]		
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Dry matter	64.9	60.6	....	65	59
Protein	47.4	35.4	61.3	60	57
Crude fiber	67.8	63.3	47.2	68	57
Nitrogen-free extract	70.6	67.1	59.4	67	63
Ether extract	58.4	41.2	53.2	64	48

[1] Data from Gaessler (9, p. 73).
[2] Data from Schmitz (20, p. 62).
[3] Data from Fraps (7, p. 10); average of digestion experiments 60 and 62.
[4] Data from Henry and Morrison (10, p. 649); Hungarian millet and timothy cut when in bloom.

The digestion experiments at the Texas station showed that sheep, as compared with cattle, will digest a much larger percentage of the protein but considerably less of the carbohydrates of Sudan grass. A larger number of tests are necessary to determine accurately the digestibility of Sudan grass.

A peculiar feature of the effect of climate on the composition of Sudan grass is shown in Table XI. The grass when grown in regions of light rainfall, such as the Great Plains, has a higher percentage of ash and protein than when grown in the more humid regions farther east.

The differences apparent in the averages shown in Table XI very fairly represent the actual differences in the composition of the grass, it is believed, when grown in different sections of the United States; that produced in the semiarid regions has a higher percentage of all the really essential food elements except fat and must therefore be a better feed.

TABLE XI.—*Comparison of the composition of Sudan grass when grown under different climatic conditions.*

Locality where grown.	Number of samples.	Constituents.				
		Ash.	Ether extract.	Protein.	Crude fiber.	Nitrogen-free extract.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Humid regions:						
Arlington Farm, Va.	7	7.07	1.47	6.25	34.85	50.36
College Park, Md.	1	4.74	1.87	6.57	34.83	51.99
Ames, Iowa	1	7.35	3.53	6.57	32.36	50.19
Average [1]	9	6.85	1.74	6.32	34.57	50.52
Dry regions:						
Hays, Kans.	8	9.85	1.55	10.65	29.68	48.27
Chillicothe, Tex.	20	7.61	1.75	9.06	27.93	53.65
Average [1]	28	8.25	1.69	9.52	28.43	52.11

[1] These averages are weighted according to the number of samples.

Actual feeding tests furnish the best measure of the value of Sudan grass hay. The Kansas Agricultural Experiment Station (22, pp. 21–27) in 1914 and 1915 conducted a series of feeding tests which furnish a direct comparison between Sudan grass hay, alfalfa hay, and kafir stover. One of these tests was made at the Fort Hays Experiment Station during the winter of 1914–15 to determine the value of Sudan grass hay as a roughage for wintering work animals. The 12 horses and 6 mules used in this test were taken from a normal grain and hay ration when work ceased in the fall and fed a daily ration of 20 pounds of roughage alone, with the results outlined in Table XII. Each lot consisted of 4 horses and 2 mules. The animals had warm stalls at night and ran in an open corral during the day.

TABLE XII.—*Comparison of Sudan grass hay with alfalfa hay and kafir stover as a roughage for wintering idle work stock.*

Items of comparison.	Test weighings.					
	Jan. 11.	Jan. 21.	Jan. 31.	Feb. 10.	Feb. 20.	Mar. 3.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Sudan grass hay:						
Total weight	7,436	7,270	7,300	7,513	7,419	7,387
Loss (−) or gain (+) from initial weight.		−166	−136	+77	−17	−49
Alfalfa hay:						
Total weight	7,753	7,630	7,590	7,801	7,817	7,783
Loss (−) or gain (+) from initial weight.		−123	−163	+48	+64	+30
Kafir stover:						
Total weight	8,241	7,945	7,840	8,022	7,918	7,941
Loss (−) from initial weight		−296	−401	−219	−323	−300

As would be expected, all the animals when deprived of the grain ration lost weight at first, the loss being greatest in the lot fed upon kafir stover. At the end of the period of seven weeks the lot fed alfalfa had recovered this loss and made a gain of 5 pounds a head over the initial weight. The lot fed upon Sudan grass, after recovering the initial loss, ended the feeding period only 8 pounds per head lighter than at the beginning; while the lot fed kafir stover never regained their original weight and averaged 50 pounds lighter at the end of the period than at the beginning.

Farmers in western Kansas report that horses and mules stand plowing and other hard work in the hot summer months better when fed upon Sudan grass hay than when their hay ration consists of alfalfa.

A second feeding test at the Fort Hays Experiment Station showed that Sudan grass hay was an efficient feed for carrying stock cattle through the winter. When "long-yearling" heifers were fed Sudan grass hay with a small supplementary ration of silage and linseed meal, steady gains in weight were obtained at a reasonable cost. The results of this test are given in Table XIII.

TABLE XIII.—*Comparison of Sudan grass hay with alfalfa hay, kafir stover, and sorgo stover as a roughage for wintering stock cattle.*

[Feeding period 120 days, Dec. 17, 1914, to Apr. 15, 1915, 25 heifers in each lot.]

Items of comparison.	Lot 1.	Lot 2.	Lot 3.	Lot 4.
Daily ration per animal:				
Silage .... pounds..	10.00	10.00	10.00	10.00
Sudan grass hay .... do....	7.54	....	....	....
Kafir stover .... do....	....	12.89	....	....
Alfalfa hay .... do....	....	....	8.14	....
Sorgo stover[1] .... do....	....	....	....	10.24
Straw .... do....	2.64	3.78	3.10	2.60
Linseed meal .... do....	1.00	1.00	1.00	1.00
Results of weighing:				
Average initial weight .... do....	620.8	650.6	661	655.6
Average final weight .... do....	701.2	733.2	740	736.4
Gain per head .... do....	80.4	82.6	79	80.8
Gain per head per day .... do....	.670	.688	.658	.673
Cost comparisons:				
Cost per head per day	$0.057	$0.058	$0.063	$0.057
Cost per pound of gain	.085	.084	.096	.085

[1] The supply of sorgo stover was exhausted on March 6. After that date Sudan grass hay was substituted for the sorgo stover in feeding lot 4.

In this test the feeds were evaluated as follows: Silage, $3; alfalfa hay, $6; kafir stover, $3; sorgo stover, $3; Sudan grass hay, $5; straw, 50 cents a ton; linseed meal, $1.54 a hundredweight. These prices are all much lower than the present market rates, but are representative of farm values in 1914. The alfalfa hay had been damaged considerably in curing, and its feeding value was no doubt less than that of good hay. This perhaps accounts for the rather poor showing of the animals fed upon alfalfa. This lot, despite its handicap, had smoother coats and a better general appearance than any of the other lots. The different lots received all the Sudan grass hay, kafir stover, alfalfa hay, and sorgo stover that they would eat up clean and were allowed all the straw they would eat in addition to 10 pounds of silage and 1 pound of linseed meal a head daily. The proportion of silage in the ration was small, but it no doubt had much to do with the good showing made by the different roughages other than alfalfa. Without the silage the results would probably have been much more favorable to alfalfa.

The third test, which was designed to ascertain the value of Sudan grass hay as a feed for dairy cows, was made at Manhattan, Kans. Six cows were separated into two lots of three each, as nearly alike as possible in regard to the period of lactation. The ration consisted of corn silage, a grain mixture of 4 parts of ground corn, 2 parts of bran, and 1 part of oil meal, in addition to chopped Sudan grass hay in one case and chopped alfalfa hay in the other.

In lot 1 the cows were fed alfalfa hay with the above supplementary ration for a 15-day preliminary period and a 30-day actual test. At the end of this time Sudan grass hay was substituted for the alfalfa hay in the ration, and during a 10-day change period and a 30-day test period they were fed upon Sudan grass hay and the same supplementary ration as in the first period.

In lot 2 the cows were fed upon Sudan grass hay, with the supplementary ration during the first period and alfalfa hay during the second period, under the same conditions as in lot 1.

The results are given in detail in Table XIV.

TABLE XIV.—*Comparison of alfalfa and Sudan grass hay for milk production.*

Lot.	Hay ration.	Production.		Body weight.
		Milk.	Butter fat.	
Lot 1	Cow No. 1:	*Pounds.*	*Pounds.*	*Pounds.*
	Alfalfa	597.0	31.01	884
	Sudan grass	527.4	26.14	877
	Difference	69.6	4.87	7
	Cow No. 2:			
	Alfalfa	633.3	29.76	929
	Sudan grass	597.0	29.01	921
	Difference	36.3	.75	8
	Cow No. 3:			
	Alfalfa	1,291.6	55.91	942
	Sudan grass	1,082.6	46.41	887
	Difference	209.0	9.5	55
Lot 2	Cow No. 4:			
	Sudan grass	603.2	22.33	1,032
	Alfalfa	576.3	21.36	1,024
	Difference	26.9	.97	8
	Cow No. 5:			
	Sudan grass	663.5	22.98	1,203
	Alfalfa	530.2	20.38	1,248
	Difference	133.3	2.6	−45
	Cow No. 6:			
	Sudan grass	547.8	21.44	1,402
	Alfalfa	483.5	19.88	1,429
	Difference	64.3	1.56	−27
Lots 1 and 2	Total (comparison):			
	Alfalfa	4,111.9	178.30	6,461
	Sudan grass	4,021.5	168.30	6,319
	Difference	90.4	10.00	142

Although an attempt was made to separate the cows into practically equal groups from the standpoint of milk production, the quantity of milk produced by the different cows varied considerably, and this affected the results. Cow No. 3 in lot 1 produced twice as much milk as either of the other cows, and this made the difference in the milk produced in the alfalfa period and the Sudan grass period proportionately great. Since the alfalfa was fed earlier in the lactation period of this cow, the large yield of milk resulted in a disadvantage to the Sudan grass. Notwithstanding this fact, the cows produced 97.8 per cent as much milk on Sudan grass as on the alfalfa hay, though the Sudan grass hay was coarse and poorly cured, while the alfalfa hay was first-class.

Testimonials of hundreds of farmers who have fed Sudan grass hay to all classes of live stock confirm the results of these more or less definite experiments, indicating the high value of Sudan grass hay as a roughage for work animals, stock cattle, and dairy cows. The consensus of these reports from farmers is that cattle, horses, and sheep all relish Sudan grass hay and eat it with no derangement of the digestive processes and with good results when measured in gains of flesh and ability to work or to produce milk.

Experts in feeding live stock claim that Sudan grass gives the best results only when fed in connection with other forage. It is not well adapted to use as the sole roughage in rationing any kind of animals.

PASTURE.

Sudan grass is perhaps most important as a hay grass, but it is used more and more widely as a summer pasture. A number of tests, more or less well arranged, have been made in pasturing Sudan grass at the different agricultural experiment stations throughout the United States. These have been described briefly in Farmers' Bulletin 1126, copies of which may be obtained free, on request, from the Division of Publications, United States Department of Agriculture.

At the experiment farm at Dodge City, Kans., Sudan grass furnished abundant pasturage at the rate of one milk cow per acre for a grazing period of 125 days, and the cows made a daily average of 3.2 pounds more milk per cow on the Sudan grass than on native grasses. At the Chillicothe (Tex.) substation, horses, mules, and cows all showed a decided preference for Sudan grass over millet and Amber sorgo. At the Arizona experiment farm, near Prescott, Sudan grass maintained 20 sheep to the acre continuously for 100 days. No irrigation was given the grass during this period, yet the sheep fattened perceptibly and did much better than those grazing on Amber sorgo. At the California Agricultural Experiment Station, Davis, Calif. (14, pp. 215–216), Sudan grass seeded on silt loam maintained approximately 22 head of sheep per acre and produced gains of about one-third pound a day during the pasture period. This flock of sheep was composed of 16 lambs and 6 ewes. The land was irrigated before seeding the grass but not afterwards. The field was pastured intermittently from July 24 to October 29, and 2.32 tons per acre of hay were obtained in addition to the pasturage.

As a pasture on irrigated lands Sudan grass probably ranks next to alfalfa, and has an advantage over the latter crop in not causing bloat in cattle and sheep, as alfalfa sometimes does. At the Yuma experiment farm, Bard, Calif., in the summer of 1915, a field of Sudan grass maintained an average of three head per acre of work horses and milk cows over a period of six months. The field was divided in halves and the halves pastured alternately in periods of two to three weeks. The grass was irrigated in each case as soon as the stock were removed and left unpastured until the ground became firm and the growth was 4 or 5 inches high.

A comparison of Sudan grass with Dallis grass (*Paspalum dilatatum*) on the Murrumbidgee irrigation areas of New South Wales is also of interest (3, p. 14). Cows to the number of 28 which had been grazing on the Dallis grass were transferred to a field of Sudan grass, with the results shown in Table XV.

TABLE XV.—*Comparison of the milk and butter produced daily by 28 cows when grazing on Sudan grass and on Dallis grass.*

Kind of pasture.	Daily production (pounds).		
	Milk.	Butter fat.	Commercial butter.
Sudan grass	574	28.24	34.50
Dallis grass	518	24.03	28.31

Although the cows pastured the Sudan grass later in their lactation period than they did the Dallis grass, the results showed an increase of 56 pounds of milk and 4.21 pounds of butter fat, or 6.19 pounds of butter, in the daily output of the 28 cows when they were changed from the Dallis grass to the Sudan grass. The records were made just before the cows were taken off the Dallis grass and again after they had been on the Sudan grass two weeks.

In addition to the foregoing experiments some very conclusive results have been obtained by the Kansas Agricultural Experiment Station in pasturing milk cows on Sudan grass (5). An upland field containing 5.4 acres was seeded to this grass on June 6, and 6 Holstein cows, which had previously been fed on alfalfa hay, silage, and grain, were turned into the field on July 10. The grass was then 3 or 4 feet high, lack of labor preventing the inauguration of the experiment earlier, when the grass was at the proper height for pasturing.

The cows had free access to salt and water, and a shelter was provided for them where they were fed and milked. In addition to the pasturage, the cows received daily 1 pound of a grain mixture for each 4 pounds of milk produced. This mixture was made up of corn, bran, and oil meal in the proportion of 4 to 2 to 1.

The cows were weighed before being turned on the pasture and again each 10 days thereafter. Composite samples of the milk were taken every 10 days and tested for butter fat by the Babcock method. On account of the rank growth it was found advisable to mow the grass after the cows were turned into the field. Half the field was first mowed, and two weeks later the other half was cut. A total of 7.33 tons of hay was obtained, and after these cuttings the cows had no trouble in keeping the grass eaten down. Notwithstanding the fact that the rainfall for July, August, and September was light, the pasturage proved sufficient for the cows until frost. The cows were taken off the pasture on October 11. Table XVI shows in detail the results obtained from the Sudan grass pasture.

TABLE XVI.—*Results obtained in pasturing Sudan grass with dairy cattle at Manhattan, Kans.*

Cow.	Weight.						Values.		
	At start.	At close.	Gain or loss.	Milk produced.	Butter fat produced.	Grain fed.	Butter fat and skim milk.	Grain.	Pasture above cost of feed.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			
No. 19	1,343	1,302	−41	2,658.5	82.08	684.00	$60.54	$20.52	$40.03
No. 16	1,325	1,267	−58	2,473.9	92.19	656.50	65.82	19.69	46.14
No. 102	1,175	1,200	25	1,104.3	37.92	366.25	27.44	10.98	16.46
No. 114	1,248	1,185	−63	3,334.5	93.87	870.75	70.49	26.12	44.37
No. 106	1,375	1,397	22	2,104.8	64.01	595.00	47.35	17.85	29.51
No. 112	1,391	1,380	−11	587.2	19.11	263.25	14.46	7.89	6.58
Total	7,857	7,731	−126	12,263.2	389.18	3,435.75	286.14	103.05	183.09

Table XVI shows an average loss in weight of 21 pounds a head, but this is not as much as milk cows ordinarily lose while on pasture during dry summers. The low average production of milk and butter fat was due to the poor performance of cows 102 and 112. This fact is attributed not so much to the feed as to the lack of persistency of these two cows in maintaining their milk flow late in the lactation period.

In arriving at the values given in Table XVI, the butter fat has been rated at 60 cents a pound and the skim milk at 50 cents a hundred pounds, assuming that 85 pounds of skim milk would remain after the cream was separated from 100 pounds of fresh milk. If the value of the 7.33 tons of Sudan grass hay at $10 a ton is added to the value of the butter fat and skim milk that the cows produced, the Sudan grass pasture must then be credited with a net return of $47.47 an acre above the value of the grain fed. With the whole milk valued at 30 cents a gallon, each acre of pasture returned $73.55 above the cost of the grain consumed by the cows.

Hogs provided with Sudan grass pasture make good gains with 60 to 70 per cent of the customary grain ration. Some experiment stations have found that Sudan grass is not equal to alfalfa as a pasture for brood sows during the summer months. The alfalfa pasture is ready earlier in the spring and continues growth later in the fall. Sudan grass can not be sown until the soil becomes warm and it is generally killed by the first frost in the fall.

The most serious drawback to the use of Sudan grass as pasture for cattle, horses, and sheep is the danger of prussic-acid poisoning. All sorghums contain small amounts of this acid, and under certain conditions, such as an acute drought, the quantity is likely to reach dangerous proportions. Both Sudan grass and Johnson grass are less likely to contain injurious amounts of prussic acid than the larger sorghums. This has been definitely proved by Menaul and Dowell (15), who found by careful analysis only one-third as much prussic acid in Sudan grass as in the grain sorghums. Very few cases of poisoning due to pasturing Sudan grass have been reported to the United States Department of Agriculture, but at least three authentic cases are known. In each of these instances the trouble occurred while pasturing the grass after it had been injured by drought or frost. Caution and good judgment are therefore required in pasturing Sudan grass with any kind of live stock other than hogs, which do not appear susceptible to this form of poisoning.

SOILING AND SILAGE.

Green feed for dairy cattle and work animals can be supplied as needed during the summer from a field of Sudan grass. It is well adapted to soiling, because the growth is renewed quickly after cutting, and it is relished by both cattle and horses in the green state. The cost of labor prevents any very extended use of soiling crops in the United States, although the return per acre of land is much larger by this method of furnishing a succulent feed than it is by pasturing.

Sudan grass silage has been used very little, for three reasons: (1) Sudan grass can be easily made into hay; (2) there is little waste in feeding it as hay; and (3) both sorghum and corn, which can be grown in the same regions as Sudan grass, make larger yields of silage. Because of these facts there have been very few experiments with Sudan grass silage. The Oklahoma Agricultural Experiment Station (6, 8) has done some work along this line. Its earliest publication (Bulletin 115) is concerned chiefly with chemical analyses and temperatures. In the 1918 work reported by Dowell and Friedemann,

(6) the acids, sugars, and alcohols present in the silage were also determined.

In 1917 Sudan grass was stored in a steel silo 25 feet high and 9 feet in diameter, having an approximate capacity of 75 tons. Because the grass was somewhat dry when placed in the silo it was found necessary to run considerable water in with it. Under these conditions the resulting spoilage of 10 per cent does not seem excessive. Sheep seemed to relish the silage less than they did corn silage, but ate it fully as well as the silage made from grain sorghums.

TABLE XVII.—*Composition of Sudan grass and corn silage compared on a water-free basis.*

Kind of silage.	Constituents.				
	Ash.	Ether extract.	Protein.	Fiber.	Nitrogen free extract.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Sudan grass (fresh)	7.21	2.33	9.38	30.55	50.53
Corn (fresh)	6.58	2.16	8.39	23.39	59.48
Sudan grass (near top, 122 days)	5.60	2.17	8.20	33.53	50.50
Corn (near top, 148 days)	6.80	2.60	9.56	23.62	57.42
Sudan grass (from middle, 140 days)	6.51	2.77	10.36	33.57	46.79
Corn (from middle, 182 days)	6.20	2.95	8.85	22.84	59.15

It appears from Table XVII that the composition of Sudan grass silage is practically the same as that of corn silage. The experiments in 1918 showed that the density of the former was only 54 per cent of that of the latter. Notwithstanding the fact that the grass silage always seemed fluffier than corn silage, the spoilage was not unreasonably great in either year.

The silo used in the experiments in 1918 was a cylindrical iron structure 4 by 9 feet. The acidity of Sudan grass silage, as determined by the average of two samples, one taken near the top and the other near the bottom of the silo 245 days after it was filled, was as follows: Lactic acid, 1.16; acetic acid, 0.39; propionic acid, 0.03; total acids, 1.58 per cent. As determined at the Kansas Agricultural Experiment Station, the acidity of corn silage was 2.03; sorgo silage, 1.46; and kafir silage, 1.43 per cent. It will be seen, therefore, that Sudan-grass silage is less acid than corn silage but slightly more acid than sorgo or kafir silage. The Sudan grass silage made in 1918 was fed to cattle, and they seemed to relish it very much, eating it much more freely than they did the Sudan grass hay.

The feeding value of Sudan grass silage was compared with that of corn silage at the California Agricultural Experiment Station in a test with 21 dairy cows (28, pp. 33–36). The experiment covered three periods of four weeks each, the test period in every case being preceded by a preliminary feeding period of one week. In addition to silage, the cows were fed alfalfa hay and a grain mixture of dried-beet pulp, coconut meal, wheat bran, and rolled barley in the proportion of 4 to 1 to 1 to 1 by weight. The cows received 1 pound of this grain mixture for each 5 pounds of milk they produced. Corn silage was fed in the first and third periods, Sudan grass silage in the second period.

The results were slightly in favor of the corn silage. The average daily production of milk in periods 1 and 3 was 19.6 pounds; in the second period it was 18.9 pounds. Butter fat, periods 1 and 3, 0.916 pound; period 2, 0.879 pound. If the production is indicated on the basis of dry matter fed in the different periods, it is found that the production of milk was 10 per cent larger and the fat 11 per cent larger for the corn-silage periods than it was for the period when Sudan grass silage was fed.

Some experimental work with Sudan grass as a silage crop has been carried on at the Nevada Agricultural Experiment Station and also at the Manitoba Agricultural College. The yields, however, are sure to be the determining factor as to whether Sudan grass will be used in making silage. The best yield that can be expected from Sudan grass in most localities is 6 to 10 tons per acre. Corn in the real corn States and sorghum in the semiarid regions will yield nearly double that quantity; hence, there seems little chance for Sudan grass to be widely used as a silage crop.

SUDAN GRASS AS A GRAIN CROP.

The yields of the seed are so small (see Table XX) that Sudan grass has never been seriously considered as a grain crop. If, however, a strain of Sudan grass or a hybrid between Sudan grass and sorghum could be developed which would produce seed more abundantly and retain the vegetative characteristics of Sudan grass as well as its ability to withstand drought, it might be a good substitute for oats in the semiarid region. Such a grass sorghum would become popular on account of the ease of harvesting and thrashing, even though the average yield of seed were somewhat less than that of kafir or milo. A grass sorghum the height of Sudan grass could be harvested easily with a grain binder and thrashed like bundle grain. The straw would be much superior to that of the ordinary small grains; in fact, practically equal to prairie hay as a roughage for live stock.

In so far as the composition of the seed is concerned, Sudan grass seed is equal in feeding value to most other cereals. A comparison of the composition of Sudan grass seed with that of the common cereal grains of the United States is given in Table XVIII.

The presence of a slight amount of tannin in the seed of Sudan grass would perhaps lower its feeding value somewhat. This objectionable feature may be overcome by the development of a white-seeded strain.

TABLE XVIII.—*Comparison of the composition of Sudan grass seed with that of the common cereal grains.*

Grain.	Constituents (per cent).					
	Moisture.	Ash.	Ether extract.	Protein.	Crude fiber.	Nitrogen-free extract.
Sudan grass seed [1]	10.47	3.09	3.81	13.62	5.38	63.63
Oats	9.20	3.50	4.40	12.40	10.90	59.60
Barley	9.30	2.70	2.10	11.50	4.60	69.80
Wheat	10.20	1.90	2.10	12.40	2.20	71.20
Corn	10.50	1.50	5.00	10.10	2.00	70.90
Kafir seed	11.80	1.70	3.00	11.10	2.30	70.10

[1] The analysis of Sudan grass seed was made by Dr. G. S. Fraps, of the Texas experiment station; all other analyses were taken from Henry and Morrison (10, p. 633-635).

SEED PRODUCTION.

The production of Sudan grass seed in the United States is a matter of considerable importance, not only because most of the acreage will always be cut for hay, but because good, pure seed is obtained only when care is used in its production.

LOCALITIES ADAPTED TO SEED PRODUCTION.

Ever since Sudan grass became a crop of importance, northwestern Texas has been the center of production for the seed. The total production of Sudan grass seed in the United States in 1914 was estimated at 5,000,000 to 6,000,000 pounds, approximately 3,000,000 pounds of which were produced in the vicinity of Lubbock, Tex. There have been almost no failures of Sudan grass in this part of Texas. East of the ninety-eighth meridian in Texas, seed production is uncertain, however, owing to the presence of the sorghum midge (17).

Kansas and Oklahoma rank next to Texas in the production of Sudan grass seed. (See the map, fig. 22.) The sorghum midge is not troublesome in either of these States, but drought often causes a short seed crop. In the irrigated regions of Colorado, New Mexico, Arizona, and California the seed yields are heavy and the quality of the seed first class, but only limited quantities are grown under these conditions, owing to the high price of the land and the profitable returns from other crops. Yields of more than 2,000 pounds of seed per acre have been reported from California and Arizona, and 1,700 pounds from the vicinity of Lubbock, Tex., but the average in both regions is much less. In other parts of the United States 300 to 500 pounds of seed per acre is all that should be expected, as will be observed in Table XX. The results in the growing of Sudan grass for six years indicate that the seed can be produced successfully in all but the States farthest north, where the seasons are too short, and the Southeastern States, where the sorghum midge is present.

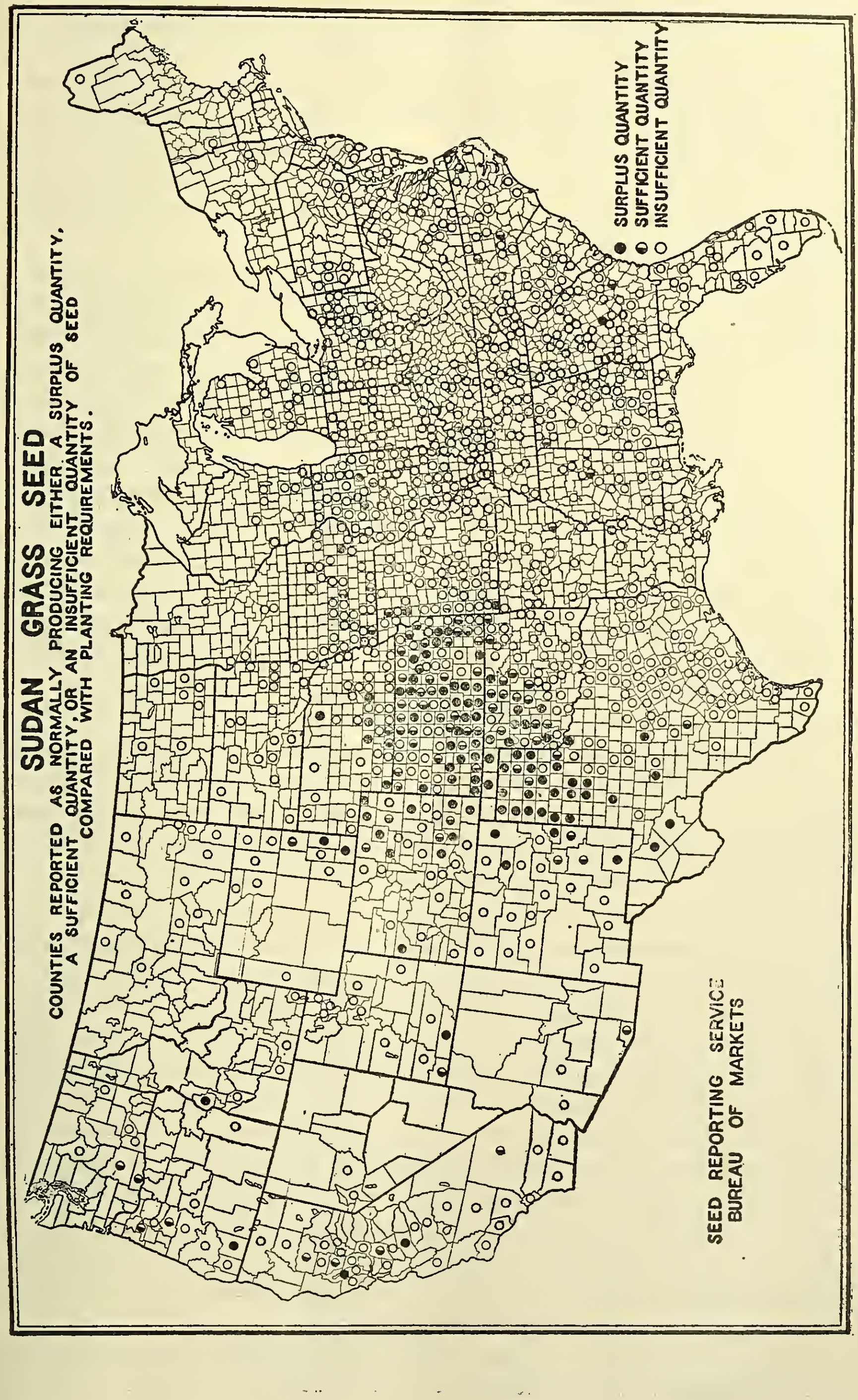

FIG. 22.—The production o Sudan grass by counties in 1918. From the Seed Reporter, Bureau of Markets, April 5, 1919.

Table XX shows yields of 350 to 400 pounds of seed in the humid corn-belt States, while the average yield in the semiarid regions is only 250 to 300 pounds per acre. Seed produced in the latter region, however, is likely to be of better quality than that from the more humid regions. In arid regions where irrigation is practiced, yields of 1,200 to 1,400 pounds of good seed per acre are to be expected. An increased acreage of Sudan grass devoted to seed production in these irrigated sections would appear justified as soon as a reliable market for the seed has been developed.

Only a small acreage was planted in 1913, and owing to extensive advertisement of the crop the seed sold readily at retail for $1 a pound. Prices as high as $2.25 a pound were recorded near the close of the 1914 planting season. These prices stimulated seed production in 1914 and resulted in the large crop of that year. Unreasonableness on the part of certain growers and seed dealers in expecting 1913 prices for the large crop of 1914 caused a surplus to be carried over into 1915 and that winter the price dropped to 4 cents a pound wholesale. The producers of the seed received much less than this, and their discouragement resulted in a marked decrease in the acreage devoted to Sudan grass seed production in 1916 and 1917. A price to the farmer of 5 or 6 cents a pound for the seed is necessary to make seed production worth while under ordinary conditions, if the yields given in Table XX are representative of what may be expected in different parts of the United States.

In determining the suitability of any given locality for Sudan grass seed production, the presence of Johnson grass (*Andropogon halepensis*) should be taken into account. The seeds of Johnson grass are very much like those of Sudan grass in size and general appearance. No mechanical method for separating the two kinds when mixed is known. It is highly important, therefore, that pure Sudan grass seed be used on farms in the South where Johnson grass is not present. Johnson grass is a dangerous pest only where it behaves as a perennial. That portion of the United States where Johnson grass ordinarily lives over winter is shown on the map (fig. 13). Broadly speaking, the region in which it perennates lies south of 38° north latitude except for that area west of the Cascade and Coast Ranges in California, Oregon, and Washington. Outside of the district described Johnson grass behaves normally as an annual and can be easily killed out. Admixtures of Johnson grass seed in Sudan grass seed sown north of 38° north latitude is not a matter of any great importance when the crop is to be harvested for hay, because it can be easily controlled and it does not injure the Sudan grass hay crop appreciably.

It is well for those living in that section of the United States where Johnson grass perennates to remember: (1) That a farmer may grow sufficient seed for his own plantings and thus be assured of its purity; (2) that if the farmer finds it necessary to buy Sudan grass seed and his land is free from Johnson grass, he should purchase only seed grown outside the Johnson grass region or from responsible growers in the South who are willing to guarantee its purity; (3) and that if the Sudan grass is to be seeded on land already foul with Johnson grass the presence of seed of the latter is a matter of small importance.

The southern planter can afford to pay a slight advance in price for seed produced north of 38° north latitude or by responsible growers south of that parallel. (See the map, fig. 13.) It must be remembered, however, that some of the Sudan grass seed handled by northern seedsmen is purchased by them in the South, so that to be absolutely safe the seed must be registered as northern grown, and even then it will not be pure unless the grower has sown seed free from Johnson grass seed and other impurities.

The Texas Agricultural Experiment Station has done more to safeguard the production of Sudan grass seed than any other agency in the United States. Through the Texas Experiment Association, an organization intended to assist in all movements to improve agricultural conditions, a campaign was launched in 1914 to require each bag of Sudan grass seed to be labeled with the name and address of the grower, together with information as to the grade of the seed and whether it had been inspected in the field by a representative of the association. Instructions regarding the proposed grades of seed and the methods of tagging the package offered for sale were issued by the secretary of the association on August 3, 1914. Much good was accomplished by this effort in stimulating the production of pure seed and in acquainting farmers with the extreme care required in such work.

DESCRIPTIONS OF THE SEEDS OF SUDAN GRASS AND JOHNSON GRASS.

The seeds of Sudan grass and Johnson grass resemble each other so closely that it becomes a matter of extreme difficulty to detect the presence of small numbers of Johnson grass seeds in the seed of Sudan grass. Bulk lots of Sudan grass seed are easily distinguished from Johnson grass seed on account of their uniformly larger size (fig. 23), but the variations in size, color, and other factors of appearance are so slight that individual seeds may be indistinguishable except under very close examination and with the aid of a magnifying glass. Certain points of difference in the seeds of these two grasses were pointed out, first by Oakley in 1912 (18, p. 504) and later by the senior writer (23). No critical investigation of this rather important question was attempted, however, until it was necessitated by the action of horticultural inspectors in certain California counties, who refused to allow the importation of Sudan grass seed, claiming that it was impossible to ascertain by seed inspection whether it was adulterated with Johnson grass seed. F. H. Hillman, after a critical study of the seeds of the two grasses, published (11) complete instructions for their identification. The method is based chiefly on the character mentioned by Oakley, that of the attachment of the seed to the rachis branch, but this was amplified and explained by drawings in a way which now makes it possible, at least for a trained seed analyst, to identify the two seeds with reasonable certainty. (Figs. 24 and 25.)

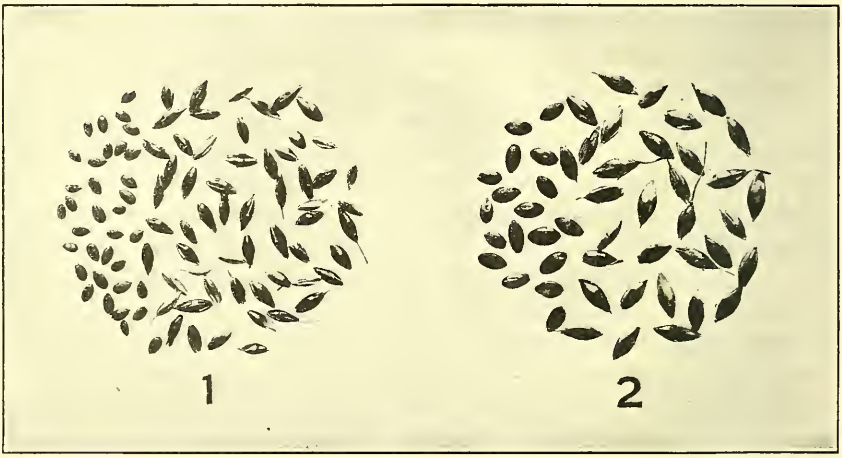

FIG. 23.—Seeds of Johnson grass (1) and Sudan grass (2). Hulled grains appear at the left of each group. (Natural size, from a photograph.)

TABLE XIX.—*Distinguishing characters of the seeds of Sudan grass and Johnson grass.*

Kind of seeds.	Length of seeds.		Prevailing color.	
	Unhulled.	Hulled.	Hulls.	Hulled seeds.
	Inches.	*Inches.*		
Sudan grass	0.18 to 0.25	0.13 to 0.18	Straw or light tawny, some reddish and some blackish brown.	Light reddish brown.
Johnson grass	0.15 to 0.22	0.08 to 0.12	Blackish brown, some reddish and some straw color.	Dark reddish brown.

Kind of seeds.	Character of the—		Apex of the seed appendages.	Shape of the hulled seed.
	Attachment of seeds.	Embryo.		
Sudan grass	No distinct suture or scar tissue; portion of rachis segment usually adhering.	Relatively large.	Jaggedly broken, not expanded.	Elliptical in outline.
Johnson grass	Distinct suture or scar; usually no rachis segment adhering.	Smaller and narrower than that of Sudan grass.	Smooth, expanded, cup shaped.	Usually oval or oval-elliptical.

The contrasting characters of the two seeds, as described by Hillman, are set forth in Table XIX.

It will be noticed that there is an overlapping in several of these characters, particularly in the size and color of the unhulled seeds; also that a small percentage of Sudan grass seeds has no portion of the rachis adhering and an equally small percentage of Johnson grass seeds is found in which a portion of the rachis adheres. In all such cases, however, Hillman declares that an examination of the seed surface at the point of attachment, the size of the seed, together with the size, form, and color of the grain, should suffice to distinguish the seed of one grass from that of the other. Most States now have seed laboratories in connection with their agricultural experiment stations. By referring samples of all Sudan grass seed importations to the analysts in these laboratories the seed dealer may ascertain whether these samples are free from Johnson grass seed.

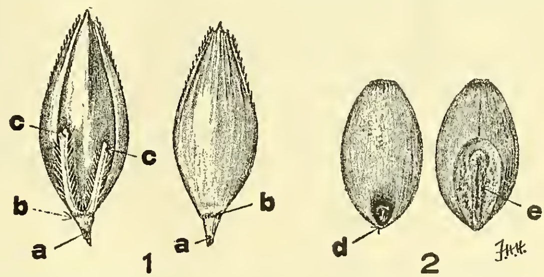

FIG. 24.—Sudan grass seeds, enlarged. Unhulled seeds, spikelets (1); hulled grains (2): *a*, *a*, Seed stem; *b*, *b*, construction at the junction of seed and stem; *c*, *c*, appendages of the seed with broken apexes; *d*, scar of the grain; *e*, embryo.

CULTURAL METHODS FOR SEED PRODUCTION.

Most Sudan grass seed is produced in cultivated rows, because this method of planting with its accompanying cultivation more nearly assures a crop, especially in regions subject to drought. Table XX shows the yields obtained in both wide and narrow rows, as compared with broadcast or close drills.

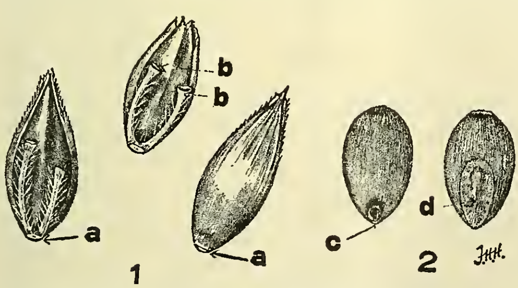

FIG. 25.—Johnson grass seeds, enlarged. Unhulled seeds, spikelets (1); hulled grains (2): *a*, *a*, Scar of the hull; *b*, *b*, appendages of the seed with expanded, cup-shaped apexes; *c*, scar of the grain; *d*, embryo.

Table XX shows that cultivated rows give better yields of seed in the humid regions and also in the semiarid regions if the crop is not irrigated. Under irrigation the results are reversed, the broadcasted or close-drilled seedings being markedly superior. Narrow rows, 18 to 24 inches apart, give larger yields than the wide rows, 36 to 44 inches apart, but it is hardly advisable for a farmer to plant in narrow rows unless he has on hand machinery adapted for their cultivation. Wide rows can be cultivated with an ordinary corn cultivator, but narrow rows require some such tools as are used for sugar beets. Specific directions for the planting, cultivating, and harvesting of row plantings have been given under "Hay production." The method of planting and cultivating the rows is the same whether they are intended for hay or for seed. The rate of planting in rows or close drills should be about the same as for hay, because the seed matures more uniformly in thick stands. The usual practice has been to sow rather thinly for seed production, but this has been warranted only by the scarcity and high price of seed.

TABLE XX.—*Yields of Sudan grass seed under different methods of seeding.*

Location of test.	Years of test.	Plats.		Yields of seed per acre.		
		Size.	Replications.	Broadcast or in close drills.	Cultivated rows.	
					18 to 24 inches apart.	36 to 44 inches apart.
		Acres.		*Pounds.*	*Pounds.*	*Pounds.*
Humid regions:						
Beeville, Tex	1913		1	380	360	400
Temple, Tex	1913		1		556	361
Stillwater, Okla	1914	0.10	1	195		324
Manhattan, Kans	1914					640
Jackson, Tenn	1913			293	320	245
Arlington Farm, Va.	1912	.45	1	118	457	
Blacksburg, Va	1913, 1914, 1916	.05	1 or 2	258	398	274
College Park, Md	1914	.05	2	339	228	142
Madison, Wis	1916, 1918	.025	2	484		754
St. Paul, Minn	1913	.015	2	370	778	708
Average				328	417	354
Dry regions (not irrigated):						
Davis, Calif	1913 to 1915	.05	1 or 2	908	919	784
Chillicothe, Tex	1913 to 1919	.05	2	86	141	158
Amarillo, Tex	1913 to 1917	.05	2	211	223	228
Spur, Tex	1914		12	1,026		
Lubbock, Tex	1913, 1914		4 or 5			633
Dalhart, Tex	1912	.10	1	460		540
Hays, Kans	1913 to 1919	0.05 to .10	2	28	116	111
Garden City, Kans	1914	.10 to 5.5	1	0	311	243
Dodge City, Kans	1914				252	335
Colby, Kans	1914			0	0	100
Ritzville, Wash	1914, 1915					910
Wenatchee, Wash	1915	.25	1			500
Average				206	285	271
Dry regions (irrigated):						
Bard, Calif	1914, 1915			518	466	494
Davis, Calif	1913, 1914, 1916	.025 to .05	1	1,292	1,183	1,010
Chico, Calif	1914, 1915	.05	2	1,560	1,250	1,210
Phoenix, Ariz	1913		1			2,254
Reno, Nev	1915, 1916					1,506
Umatilla, Oreg	1914		1			508
San Antonio, Tex	1911, 1913, 1914	.20	1			627
Average[1]				1,123	966	905

[1] These averages include only those stations where data are given for all three methods of seeding.

Harvesting for seed is nearly always done with a row binder or a grain binder rather than a mower. The grass when tied in bundles can be thrashed more efficiently and is easier to care for in the field. The shockers should follow closely after the binder, because the seed will become discolored if the bundles are allowed to lie on the ground for any length of time. In humid regions it is profitable to protect the grass with shock covers; otherwise the seed will be damaged by wet weather.

The proper time for harvesting must be decided very largely by the grower. Sudan grass tillers freely, and this gives rise to a progressive ripening of seed panicles; those on the main stem ripen first and those on the tillers mature successively in the order of their age. The period of ripening is thus continued almost indefinitely. Sudan grass seed does not shatter easily. Harvesting, therefore, may de delayed for several days after the panicles on the main stems are mature without any particular loss unless high winds prevail, birds are abundant, or the stems become so weakened by red-spot that they break down. Because of these risks it is well not to wait too long after the first heads are ripe, and in addition the gain in seed from the ripening tillers will not be sufficient to balance the loss of hay or pasture from the aftermath. Obviously, the earlier the seed crop is taken off the larger will be the aftermath.

It is best, then, to watch the crop carefully and harvest as soon as the main stems have fully ripened their seed unless the seed crop from the main stems promises to be small as compared with that from the tillers. Immature heads usually ripen considerably in the shock.

The crop is ready for thrashing after it has been in the shock for two or three weeks, if good curing weather has prevailed. There is danger in stacking the seed crop unless it is thoroughly cured. Sudan grass has a large amount of sap in the stems and will often heat in the stack and injure the germination of the seed even if stacked when the leaves are fully cured. It is usually safer to use shock covers to protect the seed from rain and birds and leave the crop in the field until it is thrashed.

CARE NECESSARY TO PREVENT HYBRIDIZATION.

Sudan grass crosses very freely with all sorghums, but especially with the sweet sorghums, such as Minnesota Amber. Extreme care is necessary, therefore, to prevent the hybridization of Sudan grass and sorghum in field plantings where a seed crop is to be harvested. There is usually little danger of cross-pollination if the Sudan grass field is 100 yards from any sorghum, but on the Great Plains, where the atmosphere is usually in motion, pollen may be carried for a greater distance. Under such conditions 60 to 80 rods is not too far to have fields of these two crops separated.

Another source of cross-pollination is the volunteer sorghum growth sometimes found in Sudan grass fields. This trouble can be avoided by seeding the grass on a field which has been planted to some crop other than sorghum the preceding year, or by careful roguing before the Sudan grass or sorghum has headed. The sorghum plants can be easily distinguished by their broader leaves and heavier stems.

Johnson grass does not cross-pollinate as freely with Sudan grass as the sorghums do, but natural crossing does occur when the two grasses grow in mixtures or in adjoining rows. It is important, therefore, to see that no Johnson grass is allowed to bloom in the Sudan grass field, because of the possibility of hybridization.

ROGUING THE FIELDS.

If pure seed is to be produced, every grower must remove from his Sudan grass field all sorghum and Johnson grass, and also hybrids between these crops and Sudan grass. Sorghum plants and sorghum-Sudan grass hybrids are coarser and usually taller than the Sudan grass. Some growers have found that the most effective way of locating these rogues is to ride through the field on horseback. This places the rider's vision above the tops of the Sudan grass and enables him to discover, from a considerable distance, plants which are off type.

Johnson grass and Johnson-Sudan grass hybrids are much more difficult to discover in a Sudan grass field. The only way to be sure there are no such plants in the field is to sow absolutely pure seed on land which is known to be free from Johnson grass. Roguing a field infested with Johnson grass, unless it be done with more than ordinary care, will not insure the removal of all the plants. It is well, then, for both buyer and producer to remember that preventing contamination is the only safe plan for dealing with Johnson grass, because it is so much like Sudan grass in appearance.

All rogues should be removed before the Sudan grass has come into bloom, in order to preclude any chance of cross-pollination.

THRASHING AND CLEANING THE SEED.

Sudan grass can be thrashed in an ordinary grain separator if care is used in regulating the air blast so that seed will not be blown over into the straw pile. The sieves which are used in thrashing wheat or sorghum can be used for Sudan grass. If dry, the straw will run through the machine without clogging, but when not well cured or somewhat moist at thrashing time it may be desirable to top the bundles, so that only the heads need to be run through.

Prices paid in 1920 for thrashing in Oklahoma and Texas varied from 50 cents to $1 per hundredweight, depending on whether the crew is furnished with the machine and on the quantity of grass to be thrashed. The thrashed Sudan grass makes a good roughage for either horses or cattle. Many stockmen believe it equal to prairie hay in feeding value.

A farmer may flail out small quantities of Sudan grass for his own seeding. If this is done, the grass should be thoroughly dry before it is placed on the canvas. Seed thrashed in this way has to be separated from the chaff, either by passing it through a fanning mill or winnowing it in a breeze. Machine-thrashed seed usually has to be recleaned in a fanning mill before it is ready for sale.

Good recleaned seed weighs 36 to 40 pounds per bushel. Seed grown in the humid sections where the vegetative growth has been luxuriant and the conditions for ripening not particularly favorable is not often plump, and only a small percentage is hulled in thrashing. Such seed with the glumes attached usually weighs 30 to 36 pounds per bushel.

Sudan grass seed if stored in good condition, either bagged or loose in a bin, keeps much better than seed of the larger sorghums, like kafir, milo, or feterita. No trouble need be anticipated if the seed is dry and well cured when placed in storage.

SEED GRADES.

The quantity of Sudan grass seed handled by the trade has not been large enough yet to call for the establishment of grades. Certain seed grades based primarily on color were suggested by the Texas Agricultural Experiment Association in August, 1914. These grades have not been generally accepted, because they did not indicate the quality of the seed, as seed grades should, but attempted to establish values for different strains of the grass. According to the proposed Texas standards, seed might be classed as grade 1 only when it was "pure creamhul"; that is, absolutely free from seeds with black or purple glumes. Grade 2 was described as "creamhul with not to exceed 5 per cent blackhul" and grade 3 as "creamhul with more than 5 per cent blackhul." The chief idea in the advocacy of such grades was that the detection of Johnson grass seeds would be much easier if the Sudan grass seeds were uniformly light colored. This is true, because more than 90 per cent of the Johnson grass seeds are black or purple.

The general effect of the Texas grades was to put a premium on strains of Sudan grass with light-colored ("creamhul") seeds. No superiority in forage value attached to or was claimed for these strains. The impracticability of such grades was realized when it became known that climate had much to do with the coloration of the seed. Seed produced in the arid regions was more often "pure creamhul" than that grown in the humid regions. Even in the arid regions seed harvested early in the season might be without color, while that from the same field harvested later in the fall would contain a large percentage of black and purple seeds. Mr. R. E. Blair (2, p. 16) reports from the experiment station at Bard, Calif., as follows:

As the cool nights of autumn set in, Sudan grass seed has a tendency to become highly colored in red and black shades * * *. The fields producing a second crop of highly colored seed produced a first crop of excellent light-colored seed.

It is quite probable that in time we shall have recognized grades of Sudan grass seed, applying equally well to all strains of the grass, if differing strains are actually developed. Stipulations such as were adopted by the Chicago Board of Trade June 20, 1916, for timothy seed might be applied to Sudan grass seed. These require "prime" seed to be "good average color, clean, sound, not too much hulled, and reasonably free from foul or foreign seed." Descriptions of the grades of Sudan grass seed would need to be more definite, but these descriptions would necessarily have to be similar to those already found satisfactory for other grass seeds by the trade.

When grades are established they should indicate, in addition to more closely defining the color requirements, the definite percentages of inert matter and foreign seed allowable in each grade. Sudan grass seed grades, to be useful, must be based on some such specifications as follows:

(1) Condition of seed.
- (a) Color: Bright and free from discolorations due to weathering or disease.
- (b) Plump, sound, and dry. In condition for storing.

(2) Purity of seed.
- (a) Inert matter: Reasonably free from dirt, broken stems, etc., the percentages allowable in different grades to be specified.
- (b) Foreign seed: The percentages of weed seed allowable in different grades to be given and certain dangerous weeds, like Johnson grass, to be specifically named, the presence of such seeds to be considered cause for classing the sample as "No grade."

BREEDING FOR CROP IMPROVEMENT.

Considerable work has been done at the different agricultural experiment stations in breeding Sudan grass; but so far little progress has been made in producing a new strain that seems likely to prove more valuable than the Sudan grass as it came direct from Africa. Dwarf strains with finer, more leafy stems have been segregated from the parent variety, but these dwarf strains yield less than the pure Sudan grass. Larger, coarser strains were obtained by crossing Sudan grass with sorghum. These coarse-stemmed hybrids make higher yields than pure Sudan grass, but the hay therefrom is poor in quality, and such forms are not able to compete with sorghum and corn as fodder and silage crops.

Considering these facts, one of the best opportunities for success seems to lie in the development of a grass sorghum like Sudan grass, able to resist the attacks of red-spot, or sorghum blight. In attempting to develop such a strain many crosses of Sudan grass with Tunis grass, tabucki grass, and Kamerun grass have been made. Not enough work with these hybrids has been done to warrant a statement as to their value. Several of these hybrids look promising from a forage standpoint, but the work so far has been done in southern

California, and the selections will have to be tried in the Gulf coast region before their disease resistance can be determined.

Another opportunity for success in breeding operations lies in the production of a grain-bearing strain of grass sorghum, as discussed under the section "Sudan grass as a grain crop." The difficulties in the way of producing such a strain of Sudan grass seem to be less than those connected with the production of a disease-resistant strain. It is an easy matter by crossing with the Freed sorghum, feterita, or kafir to obtain intermediate forms with nearly pure-white seeds. These hybrids yield much more seed than Sudan grass, but none have been found as yet which will compete with the grain sorghums. The present results, however, make it seem worth while to continue work along this line.

DISEASES OF SUDAN GRASS.

The most destructive disease of Sudan grass is the red-spot, or sorghum blight, a bacterial disease which in its effect on the plant resembles the rust on small grains. Red-spot is present wherever Sudan grass is grown, but is a limiting factor in the production of Sudan grass only in the warm, humid regions along the South Atlantic and Gulf coasts.

The kernel smut of sorghums, *Sphacelotheca sorghi* (Link) Clinton, also attacks Sudan grass, but this can be controlled by treating the seed with formaldehyde.[6]

Besides the two rather important diseases named above, Taubenhaus (21, p. 22) declares that a rust caused by the organism *Puccinia purpurea* Cooke was prevalent in Texas during the season of 1919 and lists the anthracnose caused by *Colletotrichum cereale* Manns as present on Sudan grass. The causal fungus of the anthracnose is carried over in the seed and in the stubble or straw. Rotation of crops and treatment of the seed with formaldehyde, as suggested for grain smut, are the most effective methods of control. Taubenhaus states that little is yet known about methods for controlling rust, but that it is destructive only in wet seasons.

INSECT ENEMIES OF SUDAN GRASS.

The same insects which interfere with the culture of sorghum also attack Sudan grass. Grasshoppers are fond of it and do considerable damage in localities where they are abundant. The most effective method of controlling their depredations is by scattering poisoned bran mash about the edges of the Sudan grass fields. Chinch bugs are troublesome at intervals when the seasonal conditions are favorable for their multiplication in other crops. The sorghum midge

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[6] For methods of seed treatment with formaldehyde, see Farmers' Bulletin 939, entitled "Cereal Smuts and the Disinfection of Seed Grain."

(*Contrarinia* (*Diplosis*) *sorghicola* Coq.) usually prevents the profitable production of Sudan grass seed in the Southern States east of central Texas.

The diseases and insect enemies of Sudan grass and methods for their control are discussed in Farmers' Bulletin 1126, entitled "Sudan Grass." A full account of the insects which attack Sudan grass is given in Circular No. 7 (new series) of the Texas Agricultural Experiment Station (17).

WEEDS.

There are but few weeds which cause any considerable trouble in Sudan grass fields. The preparation of the seed bed usually destroys the spring crop of weeds, and if the soil is warm the grass starts off quickly and grows so rapidly that as a rule weeds are not able to compete with it. Sudan grass probably ranks next to millet in its ability to overcome weeds.

The common weeds, such as the pigweeds, Russian thistle, foxtail, and the sand burs, are sometimes found in fields of Sudan grass. They rarely occur in sufficient numbers, however, to affect the yield of hay. The worst weed pest is undoubtedly Johnson grass, which behaves as a perennial south of the thirty-eighth parallel of north latitude and is widely distributed on the better soils of that region. Its relation to the seed production of Sudan grass has been discussed under that topic.

The presence of Johnson grass in a field of Sudan grass being cut for hay is of little consequence except for the very slight reduction in yield that it entails. The quality of the hay when Sudan grass is mixed with Johnson grass is fully as good as that of Sudan grass alone. The immediate effect, therefore, of Johnson grass in Sudan grass fields is not especially objectionable, but the aggressive rootstocks of Johnson grass make it difficult to eradicate and cause it to persist and interfere with the following crop. The succeeding crop, especially if it is corn or cotton, will be injured appreciably by the Johnson grass, and this fact causes farmers to resist its incursion into any of their cultivated fields. Because of its tendency to persist on the land after another crop has replaced the Sudan grass, extreme care should be exercised by the farmer to avoid introducing Johnson grass in the Sudan grass seed with which he plants his fields.

SUMMARY.

The value of the 1918 crop of Sudan grass in the United States was estimated at $10,500,000. Practically all this crop was derived from the 8 ounces of seed obtained in 1909 by the United States Department of Agriculture from R. Hewison, Director of Agriculture and Lands, Sudan, Africa.

Sudan grass is technically known as *Andropogon sorghum sudanensis* and belongs to the agronomic group known as grass sorghums.

Several other grass sorghums have been obtained from Africa and one from South America, but none of these has proved as valuable as Sudan grass.

After its introduction into the United States Sudan grass was tested and is now being grown successfully in Australia, South America, the Philippines, Hawaii, Porto Rico, and Cuba.

Sudan grass is most successful in the southern half of the Great Plains in the States of Texas, Oklahoma, and Kansas. It does not succeed well at high altitudes nor within 200 miles of the northern boundary of the United States.

Sudan grass, although it has a high water requirement, is able to withstand protracted periods of drought and recover quickly when rain comes.

This grass is of most value as an emergency hay crop. It is now being used to replace millet as a catch crop in many localities and is also suited for use as a summer pasture.

For hay production it is best to drill or broadcast 20 to 25 pounds of seed per acre in the humid regions and 10 to 15 pounds per acre in the drier portions of the United States; for seed production 3 to 4 pounds of seed drilled in rows 36 to 42 inches apart is best.

Sudan grass should not be cut for hay until it has headed. Very little difference in yield or feeding value of the hay is occasioned by cutting any time between the date when the grass is fully headed and when the seed is in the soft-dough stage.

Sudan grass cures slowly on account of the juicy stems, and considerable time must be allowed for it to cure before placing it in a stack or hay mow, especially when a seed crop is being stored.

Mixed plantings of Sudan grass and legumes, such as cowpeas or soy beans, are profitable only in the more humid regions where the legumes and Sudan grass both grow successfully.

The composition of the hay of Sudan grass is very similar to that of Johnson grass, timothy, and millet; in digestibility it ranks somewhat above timothy but slightly below millet hay.

Sudan grass grown in the humid regions has a lower percentage of protein and ash than that grown in the semiarid regions.

Feeding experiments show that Sudan grass hay is an effective roughage for work stock, dairy cows, and stock cattle.

A large number of tests have shown Sudan grass to be a valuable summer pasture, but care must be observed in pasturing it with cattle, on account of the danger of prussic-acid poisoning.

Sudan grass is useful as a soiling crop, but it is not of much value for silage, because other crops, such as corn and sorghum, make larger yields.

Seed production at present is very often unprofitable on account of low yields and uncertainty as to price. Seed yields are highest in western Texas and the irrigated regions of New Mexico, Arizona, and California.

The greatest difficulty attending the production of Sudan grass seed is the danger of the admixture of Johnson grass seed. Extreme care is required to prevent such mixtures, because it is practically impossible to separate the seed of the two grasses by mechanical means.

A method of identifying the seed of Johnson grass when mixed with Sudan grass has been developed and described by F. H. Hillman (11), of the United States Department of Agriculture.

Great care is necessary in growing Sudan grass for seed to prevent its hybridization with the sorghums. Sudan grass intended for seed production should never be sown on a field which has produced sorghum the previous year, and the field ought to be situated at least 80 rods from any field of sorghum.

The same diseases and insects that attack sorghums also injure Sudan grass. The most important diseases are red-spot and kernel smut; the most destructive insects are grasshoppers, chinch bugs, and the sorghum midge.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 982

Contribution from the Bureau of Markets
GEORGE LIVINGSTON, Chief

Washington, D. C. ▼ June, 1921

MARKET STATISTICS.[1]

Prepared under the direction of Carl J. West, *Specialist in Market Statistics*, assisted by Lewis B. Flohr, *Investigator in Marketing*.

CONTENTS.

The statistics of this bulletin are based primarily upon the data of prices, receipts, shipments, inspections, and other figures of the marketing of agricultural products obtained by the Bureau of Markets in the conduct of its various reporting and regulatory services. Reports of other governmental bureaus have been drawn upon, particularly the Bureau of Crop Estimates, for farm prices and farm crop estimates, and the Bureau of Foreign and Domestic Commerce, for exports and imports. In some instances material has been taken from recognized commercial sources to complete or round out the tables.

[1] Mention should be made of the following members of the statistical staff who assisted with the compilations of the following sections: Miss Edna M. Jordan and Mrs. Florence C. Fitch, Live Stock and Meats; Messrs. W. F. Logan, John W. Strowbridge and Mrs. June A. Hodgkins, Grain, Hay, Feed, and Seeds; Mr. Norman R. Angney and Mrs. Maude E. Murphy, Fruits and Vegetables.

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PART I.—LIVE STOCK AND DRESSED MEATS.

TABLE 1.—*Cattle: Monthly average price per 100 pounds, 1918–1920.*

CHICAGO.

Month.	Beef cattle. Good to prime.	Beef cattle. Common and medium.	Butcher stock. Heifers. Good and choice.	Butcher stock. Heifers. Common and medium.	Butcher stock. Cows. Good and choice.	Butcher stock. Cows. Common and medium.	Butcher stock. Bulls, bologna and beef.	Canners and cutters.	Stocker and feeder steers. Good, choice, and selected.	Stocker and feeder steers. Common and medium.	Veal calves, good and choice.	Western range cattle. Beef steers, medium to choice.	Western range cattle. Cows and heifers, medium to choice.
1918.													
June....	$17.25	$14.39	$12.76	$9.31	$12.53	$9.15	$10.94	$7.42	$11.94	$9.76	$16.02	......	......
July....	17.57	14.07	12.53	9.23	12.25	9.09	10.61	7.27	11.69	9.19	16.67	......	......
Aug....	17.87	13.57	12.22	8.73	11.99	8.71	10.81	7.03	11.72	8.98	17.28	......	......
Sept....	17.92	13.30	11.87	8.66	11.57	8.52	10.38	6.96	12.48	9.46	18.63	$15.70	$11.24
Oct.....	17.32	12.36	11.29	8.04	10.75	7.81	10.13	6.48	11.70	8.86	16.83	15.56	10.55
Nov....	17.59	12.46	11.69	8.00	10.67	7.39	9.75	5.80	11.35	8.53	16.86	15.96	10.47
Dec.....	17.54	12.34	11.28	7.80	10.74	7.57	9.76	6.63	11.75	8.66	16.01	15.92	10.22
1919.													
Jan.....	18.06	12.95	11.76	8.58	11.18	8.09	10.22	7.08	12.25	9.16	15.62	......	......
Feb.....	18.21	13.49	12.63	8.89	12.14	8.49	10.46	6.62	12.82	9.53	15.75	......	......

Month.	Beef steers. Medium and heavyweight (1,100 lbs. up). Choice and prime.	Beef steers. Medium and heavyweight. Good.	Beef steers. Medium and heavyweight. Medium.	Beef steers. Medium and heavyweight. Common.	Beef steers. Lightweight (1,100 lbs. down). Choice and prime.	Beef steers. Lightweight. Good and medium.		Beef steers. Lightweight. Common.	Butcher cattle. Heifers, common to choice.	Butcher cattle. Cows, common to choice.	Butcher cattle. Bulls, bologna and beef.	Canners and cutters. Cows and heifers.	Canners and cutters. Canner steers.
1919.													
Mar.....	$19.12	$17.17	$14.81	$12.57	$17.80	$14.59		$11.27	$11.35	$11.09	$10.60	$6.26	$8.45
Apr.....	19.00	16.81	14.90	12.82	17.54	14.87		11.79	11.57	11.34	10.85	6.76	8.71
May....	17.60	15.64	14.18	12.56	16.25	14.18		11.70	11.44	11.22	11.09	7.09	9.14
June....	15.52	14.06	12.76	11.57	14.72	12.96		10.87	10.36	10.00	10.06	6.67	8.79
July....	16.82	15.21	13.55	11.84	16.25	13.93		11.13	10.97	10.28	10.34	6.67	8.29
Aug....	17.70	15.49	13.48	11.38	17.39	14.28		10.96	11.16	10.58	10.27	6.59	7.91
Sept....	16.79	14.60	12.32	10.00	17.00	13.55		10.10	10.66	9.90	9.10	5.91	7.20
Oct.....	17.87	15.36	12.46	9.72	17.73	13.71		9.39	10.48	9.66	8.68	5.84	6.74
Nov....	19.04	15.95	12.43	9.76	18.89	14.25		9.22	10.64	9.83	8.80	5.94	6.68
Dec.....	19.51	16.22	12.49	9.85	19.39	14.52		9.25	10.63	9.88	9.33	5.72	6.88
1920.													
Jan.....	18.14	15.59	12.64	10.32	17.63	13.84		9.78	10.50	9.86	9.75	6.06	7.04
						Good.	Medium.						
Feb.....	15.58	13.52	11.90	10.19	14.89	$12.83	$11.36	9.63	9.65	9.03	9.03	5.80	6.98
Mar.....	14.68	13.16	12.01	10.75	14.50	12.96	11.83	10.46	10.33	9.68	9.08	6.01	6.82
Apr.....	14.19	13.00	11.97	10.87	14.27	12.94	11.85	10.63	10.73	9.87	9.11	6.02	7.11
May....	13.37	12.60	11.82	10.90	13.71	12.77	11.87	10.70	10.72	9.67	9.33	6.29	7.38
June....	15.93	15.10	13.87	12.19	15.95	15.04	13.80	12.00	10.93	9.89	9.56	6.00	7.14
July....	16.59	15.64	14.01	11.78	16.69	15.56	13.79	11.36	10.63	9.47	9.14	5.29	6.01
Aug....	16.85	15.64	13.55	11.21	16.83	15.38	13.23	10.46	10.49	8.85	8.64	5.05	5.80
Sept....	17.53	15.95	13.48	10.91	17.42	15.60	13.12	10.09	10.55	9.20	8.41	4.93	5.94
Oct.....	17.66	16.02	13.57	10.48	17.59	15.74	12.87	9.74	9.46	8.07	7.98	4.28	5.56
Nov....	16.68	14.63	11.88	9.29	16.57	14.29	11.33	8.66	8.93	7.75	7.43	4.05	4.89
Dec.....	14.01	12.03	9.92	8.16	14.08	11.73	9.42	7.58	7.96	7.10	6.57	3.91	4.62

TABLE 1.—*Cattle: Monthly average price per 100 pounds, 1918-1920*—Continued.

CHICAGO—Continued.

Month.	Veal calves: Light to medium weight, medium to choice.	Veal calves: Heavy weight, common to choice.	Feeder steers: Heavy, (1,000 lbs. up), common to choice.	Feeder steers: Medium (800 to 1,000 lbs.), common to choice.	Feeder steers: Light (800 lbs. down), common to choice.	Stock cattle: Steers, common to choice.	Stock cattle: Cows and heifers, common to choice.	Stock cattle: Calves. Good and choice.	Stock cattle: Calves. Common and medium.	Western range cattle: Beef steers. Good and choice.	Western range cattle: Beef steers. Common and medium.	Western range cattle: Cows and heifers, medium to choice.
1919.												
Mar.....	$15.01	$11.56	$14.06	$12.68	$11.73	$10.49	......	......	......	......	......	......
Apr.....	14.31	10.48	14.15	13.10	12.09	11.03	$9.44	$11.86	$9.19	......	......	......
May.....	14.66	11.03	13.82	12.82	11.99	10.89	9.47	11.86	9.22	......	......	......
June....	16.37	11.20	12.55	11.61	11.05	10.10	8.59	11.20	9.38	......	......	......
July.....	17.88	11.44	11.37	11.08	10.48	9.69	8.14	11.09	9.33	$14.63	$11.12	$10.63
Aug.....	19.62	11.15	11.43	10.57	9.84	9.12	7.91	10.40	8.83	15.00	11.48	11.02
Sept.....	20.52	10.20	10.45	9.66	8.91	8.28	7.10	9.50	8.50	13.76	10.30	10.22
Oct.....	18.05	9.83	10.66	9.97	9.01	8.20	6.92	9.70	8.46	13.66	9.88	10.16
Nov.....	17.60	10.19	10.84	10.05	8.95	8.20	7.00	10.25	8.56	13.26	9.41	10.06
Dec.....	16.56	9.92	10.45	9.58	8.99	8.24	6.91	10.30	8.51	12.86	9.13	10.03
1920.												
Jan.....	17.74	10.80	10.78	10.03	9.62	8.92	7.53	10.27	8.70	......	......	......
Feb.....	16.73	10.18	10.15	9.57	9.34	8.65	7.88	10.25	8.51	......	......	......
Mar.....	16.73	10.41	10.54	10.30	10.02	9.20	8.24	10.36	8.62	......	......	......
Apr.....	14.22	9.40	10.51	10.33	10.13	9.28	8.29	10.29	8.71	......	......	......
May.....	12.12	9.03	10.64	10.40	10.19	9.44	8.52	9.93	8.44	......	......	......
June....	13.68	10.08	11.05	10.78	10.53	9.46	7.91	9.80	8.16	......	......	......
July.....	13.98	9.27	10.68	10.26	9.71	8.46	6.95	9.25	7.50	......	......	......
Aug.....	15.08	9.18	10.23	9.84	9.22	7.87	6.91	......	......	......	......	......
				Light and medium weight (750 to 1,000 lbs.), common to choice.								
Sept.....	16.39	8.84	10.48	$9.84		8.09	6.85	......	......	13.30	9.89	8.57
Oct.....	14.18	8.30	10.23	9.46		6.89	6.19	......	......	12.48	9.21	7.25
Nov.....	13.74	7.57	9.63	9.06		6.80	5.85	......	......	11.68	8.90	7.30
Dec.....	10.39	6.66	8.33	7.77		6.27	5.25	......	......	9.38	7.37	6.53

KANSAS CITY.

Month.	Beef steers: Medium and heavyweight (1,100 lbs. up). Choice and prime.	Good.	Medium.	Common.	Beef steers: Lightweight (1,100 lbs. down). Choice and prime.	Good and medium.		Common.	Butcher cattle: Heifers, common to choice.	Cows, common to choice.	Bulls, bologna and beef.
1919.											
April..............	$18.06	$16.67	$14.85	$12.81	$16.74	$14.54		$11.65	$11.61	$10.46	$9.73
May..............	16.95	15.45	13.95	12.53	15.59	13.29		11.03	10.95	10.22	9.48
June..............	15.00	13.74	12.57	11.59	14.13	12.00		10.17	9.97	9.26	8.43
July..............	15.91	14.50	13.13	11.76	15.48	13.14		10.70	10.21	9.24	8.38
August..............	17.76	15.67	13.65	11.48	17.07	13.97		10.52	10.19	9.18	8.05
September..............	16.98	14.86	12.53	10.50	16.72	12.95		9.41	9.85	8.73	7.47
October..............	16.91	14.59	11.98	9.82	16.83	12.87		9.23	10.02	8.97	7.45
November..............	17.34	14.82	12.03	9.79	17.17	13.13		9.29	9.86	8.83	7.28
December..............	17.59	14.89	12.06	9.76	17.11	13.12		9.19	9.91	8.87	7.62
1920.											
January..............	17.10	14.79	12.25	10.12	16.64	13.20		9.47	10.19	9.13	8.44
						Good.	Medium.				
February..............	14.52	12.70	11.17	9.73	14.19	$12.38	$10.67	8.89	9.39	8.79	8.30
March..............	13.86	12.63	11.62	10.42	13.65	12.32	11.12	9.69	9.76	8.92	7.95
April..............	13.54	12.45	11.57	10.15	13.48	12.31	11.23	9.83	9.98	9.25	8.18
May..............	12.69	11.60	10.86	9.94	12.98	11.73	10.85	9.79	9.73	9.31	8.25
June..............	15.10	13.70	12.53	11.11	15.23	13.77	12.38	10.50	10.21	9.11	8.55
July..............	15.84	14.30	12.68	10.95	15.91	14.05	11.87	9.82	10.03	8.54	7.79
August..............	15.95	14.21	12.31	10.79	16.01	13.79	11.17	9.14	9.53	8.03	6.95
September..............	16.72	14.91	12.71	10.92	16.69	14.24	11.21	9.04	9.67	8.18	6.60
October..............	16.70	14.78	12.39	10.30	16.51	14.08	10.99	8.50	9.03	7.42	5.95
November..............	15.33	13.49	11.06	9.12	15.13	12.92	10.06	7.82	8.78	7.16	5.82
December..............	13.01	11.17	9.07	7.73	12.67	10.45	8.05	6.59	7.37	5.92	5.15

TABLE 1.—*Cattle: Monthly average price per 100 pounds, 1918–1920*—Continued.

KANSAS CITY—Continued.

Month.	Canners and cutters.		Veal calves.		Feeder steers.			Stock cattle.			
	Cows and heifers.	Canner steers.	Light to medium weight, medium to choice.	Heavy weight, common to choice.	Heavy (1,000 lbs. up), common to choice.	Medium (800 to 1,000 lbs.), common to choice.	Light (800 lbs. down), common to choice.	Steers, common to choice	Cows and heifers, common to choice.	Calves. Good and choice.	Calves. Common and medium.
1919.											
April	$5.69	$9.26	$12.48	$10.13	$14.29	$13.45	$12.68	$11.72	$8.75	$11.83	$8.22
May	6.06	8.94	12.30	9.95	13.97	13.12	12.59	11.32	8.86	11.64	8.10
June	5.87	8.16	13.55	10.69	12.81	12.10	11.70	10.17	8.58	10.80	7.37
July	5.91	8.29	14.37	10.73	12.04	11.74	11.44	9.78	8.26	10.15	7.26
August	5.76	7.75	14.93	10.21	12.19	11.74	11.19	9.07	7.78	9.52	7.15
September	5.50	7.09	15.29	9.47	11.54	10.86	10.35	8.35	7.35	9.17	6.77
October	5.73	6.90	15.07	8.44	11.50	10.54	9.92	7.80	7.12	9.13	6.60
November	5.70	6.73	14.90	9.04	11.26	10.47	9.76	8.12	6.93	9.48	6.88
December	5.75	6.71	14.62	8.59	10.85	10.16	9.52	8.04	6.74	9.31	6.85
1920.											
January	5.91	6.90	14.84	8.92	11.05	10.37	9.80	8.56	7.29	9.82	7.06
February	5.85	6.66	14.10	8.20	10.90	10.26	9.76	8.65	8.25	9.98	7.31
March	5.63	6.06	14.60	9.13	10.94	10.62	10.28	9.07	8.38	9.92	7.19
April	5.84	6.30	13.98	8.63	10.76	10.54	10.10	8.96	8.23	9.92	7.14
May	5.66	6.33	11.41	8.91	10.54	10.29	9.98	9.14	7.74	9.56	7.03
June	5.50	6.46	11.70	9.37	10.85	10.57	10.34	8.90	7.10	9.04	6.93
July	4.76	5.60	11.64	9.29	10.82	10.57	10.16	8.32	6.38	9.32	6.80
August	4.50	5.25	11.03	8.25	10.54	10.08	9.51	7.39	5.84	9.08	6.35
						Light and med. wt. (750 to 1,000 lbs.), common to choice.					
September	4.60	5.37	12.19	8.91	10.94	$10.30		7.48	6.08	9.26	6.33
October	4.50	5.15	11.95	7.09	10.34	9.64		7.09	5.77	8.89	6.18
November	4.21	4.84	11.72	7.31	9.62	8.75		6.45	5.41	8.50	5.83
December	3.73	4.22	9.53	5.77	8.46	7.75		5.98	4.94	7.12	4.78

OMAHA.

Month.	Beef steers.								Butcher cattle.			Canners and cutters.	
	Medium and heavyweight (1,100 pounds up).				Lightweight (1,100 pounds down).				Heifers, common to choice.	Cows, common to choice.	Bulls, bologna and beef.	Cows and heifers.	Canner steers.
	Choice and prime.	Good.	Medium.	Common.	Choice and prime.	Good and medium.		Common.					
1919.													
May	$16.98	$15.19	$13.89	$12.66	$15.25	$13.53		$11.22	$11.04	$10.50	$10.06	$6.31	......
June	14.85	13.40	12.43	11.29	14.10	12.61		10.87	10.14	9.74	9.57	6.46	......
July	15.88	14.60	13.64	12.46	15.73	14.25		12.33	10.89	10.29	9.34	6.67	......
Aug	17.08	15.48	13.77	12.25	16.60	14.41		12.33	10.67	9.95	9.23	6.40	......
Sept	16.22	14.33	12.07	10.10	16.20	13.33		10.94	9.79	9.26	7.93	5.94	......
Oct	16.48	14.38	12.01	9.77	16.67	13.42		10.45	9.78	9.14	7.53	5.86	......
Nov	17.14	14.65	12.25	9.96	17.13	13.48		10.01	10.13	9.47	7.59	5.94	......
Dec	17.23	14.66	12.24	10.12	17.11	13.54		10.11	9.86	9.38	7.77	5.64	......
1920.													
Jan	17.03	14.68	12.71	10.81	16.80	13.88		10.68	10.27	9.98	8.57	6.19	......
						Good.	Medium.						
Feb	14.23	12.79	11.42	9.91	14.09	$12.53	$10.94	9.30	9.14	8.77	8.05	5.77	$6.95
Mar	13.99	12.82	11.75	10.40	13.85	12.58	11.21	9.86	9.55	9.17	8.24	5.44	6.96
Apr	13.58	12.58	11.52	10.38	13.49	12.46	11.29	10.00	9.59	9.14	8.37	5.48	6.95
May	12.67	11.77	10.89	10.04	13.01	12.08	10.99	9.59	9.83	9.20	8.54	5.62	6.81
June	15.25	14.27	13.19	12.20	15.32	14.17	12.81	11.31	10.73	9.92	9.19	5.92	7.31
July	16.12	15.05	13.24	11.56	16.29	14.93	13.08	10.72	10.35	9.31	8.46	5.11	6.09
Aug	16.08	14.87	13.08	11.06	16.26	14.98	13.05	10.63	9.70	8.70	8.50	4.79	5.66
Sept	16.71	15.32	13.33	11.02	16.84	15.41	13.25	10.48	9.66	8.49	8.28	4.69	5.78
Oct	16.60	15.01	12.65	10.17	16.59	14.84	11.93	9.10	9.01	7.86	7.63	4.40	5.36
Nov	15.35	13.49	11.08	9.00	15.16	13.01	9.93	7.56	8.42	7.38	6.71	4.19	4.88
Dec	13.19	11.55	9.36	7.64	12.85	10.91	8.49	6.85	7.49	6.42	5.75	3.89	4.29

TABLE 1.—*Cattle: Monthly average price per 100 pounds, 1918-1920*—Continued.

OMAHA—Continued.

Month.	Veal calves.		Feeder steers.			Stock cattle.				Western range cattle		
								Calves.		Beef steers.		
	Light to medium weight, medium to choice.	Heavyweight, common to choice.	Heavy (1,000 pounds up), common to choice.	Medium (800 to 1,000 pounds), common to choice.	Light (800 pounds down), common to choice.	Steers, common to choice.	Cows and heifers, common to choice.	Good and choice.	Common and medium.	Good and choice.	Common and medium.	Cows and heifers, medium to choice.
1919.												
May	$12.58	$9.64	$13.63	$12.95	$12.17	$10.44	$8.84	$11.20	$9.07	......	......	......
June	13.03	10.19	12.27	11.67	11.13	9.92	8.06	10.55	8.52	......	......	......
July	14.34	11.27	12.22	11.46	10.74	9.96	7.70	10.05	8.35	$12.78	$10.49	$9.44
Aug	13.14	10.07	12.18	11.25	9.67	9.08	7.52	9.38	8.04	13.82	10.81	8.96
Sept	12.81	9.80	10.84	9.41	8.60	8.32	7.27	9.02	7.39	13.26	9.76	8.80
Oct	12.83	9.04	10.96	9.67	9.10	8.66	7.16	9.65	7.81	13.54	9.93	8.85
Nov	13.70	9.21	10.87	9.92	9.21	8.80	7.10	9.84	7.83	13.52	9.60	8.94
Dec	13.75	8.99	10.86	9.86	9.24	8.88	6.71	9.78	7.68	......	......	......
1920.												
Jan	14.26	9.55	11.67	10.56	9.95	9.57	7.14	10.42	8.30	......	......	......
Feb	14.80	9.95	10.35	9.94	9.47	8.83	7.07	10.21	8.21	......	......	......
Mar	15.01	10.00	10.52	10.24	9.86	9.06	7.32	9.73	7.73	......	......	......
Apr	14.19	9.18	10.37	10.12	9.90	9.02	7.41	9.75	7.77	......	......	......
May	11.88	8.55	10.49	10.20	9.95	8.83	7.26	9.51	7.31	......	......	......
June	12.87	9.71	10.62	10.34	10.05	9.08	7.24	9.47	7.64	......	......	......
July	11.85	8.38	10.32	9.85	9.22	8.58	6.76	8.50	6.73	......	......	......
Aug	11.20	8.13	10.61	9.94	8.98	8.18	6.38	8.03	5.88	11.32	8.69	7.70
				Light and medium weight, (750 to 1,000 pounds,) common to choice.								
Sept	11.23	7.73	11.03	$9.69		8.07	6.16	8.49	6.07	12.16	9.10	7.59
Oct	11.13	7.60	9.89	9.14		7.57	5.88	7.63	5.54	11.83	8.57	6.99
Nov	11.81	7.81	9.44	8.77		7.03	5.58	7.52	5.29	11.08	8.13	6.79
Dec	10.05	6.42	8.37	7.57		6.13	4.95	6.62	4.57	9.07	6.85	5.95

EAST ST. LOUIS.

Month.	Beef steers.								Butcher cattle.		
	Medium and heavyweight (1,100 pounds up).				Lightweight (1,100 pounds down).						
	Choice and prime.	Good.	Medium.	Common.	Choice and prime.	Good and medium.		Common.	Heifers, common to choice.	Cows, common to choice.	Bulls, bologna and beef.
1919.											
May	......	$15.41	$14.18	$12.97	......	$13.98		$11.13	$12.19	$9.97	$9.58
June	......	14.05	12.87	11.52	......	13.09		10.71	11.47	9.09	8.87
July	......	15.02	13.25	11.63	......	13.79		11.07	11.35	9.75	8.96
August	$17.95	16.18	13.56	11.40	$17.62	14.55		10.96	11.37	9.70	8.56
September	17.13	14.93	12.14	10.29	17.14	13.55		9.68	11.45	8.93	8.25
October	17.04	14.99	12.23	9.75	16.91	13.21		9.15	11.58	8.96	8.56
November	18.34	15.90	12.59	9.81	18.03	13.74		9.44	11.38	9.14	8.14
December	18.67	15.58	12.57	9.96	18.68	13.90		9.45	11.46	9.46	8.15
1920.											
January	16.61	14.37	11.92	9.82	16.60	13.38		9.50	11.41	9.62	8.57
						Good.	Medium.				
February	15.01	13.19	11.60	9.84	14.99	$13.02	$11.38	9.56	10.91	9.10	8.78
March	14.31	12.90	11.45	10.02	14.18	12.75	11.34	9.73	10.85	9.33	8.64
April	14.05	13.09	11.78	10.48	13.96	13.23	11.68	10.30	11.64	9.51	8.88
May	13.24	12.44	11.40	10.31	13.85	12.67	11.43	10.26	11.61	9.33	8.95
June	15.64	14.62	12.82	11.33	15.65	14.57	12.80	10.73	11.90	8.91	8.52
July	16.44	15.28	12.97	11.10	16.53	15.31	12.91	10.30	11.50	8.67	7.87
August	16.34	15.12	12.49	10.33	16.62	15.26	12.23	9.16	11.05	8.53	7.10
September	16.97	15.59	12.88	10.24	16.97	15.59	12.55	9.08	11.13	8.23	6.91
October	17.23	15.38	12.04	9.47	17.23	15.39	11.57	8.02	10.48	7.34	6.42
November	15.65	13.69	11.06	9.00	15.55	13.53	10.46	7.70	9.75	7.16	6.76
December	12.94	10.81	8.64	7.53	12.77	10.64	8.29	6.69	8.76	6.31	5.95

TABLE 1.—*Cattle: Monthly average price per 100 pounds, 1918–1920*—Continued.

EAST ST. LOUIS—Continued.

Month.	Canners and cutters.		Veal calves.		Feeder steers.			Stock cattle.			
	Cows and heifers.	Canner steers.	Light to medium weight, medium to choice.	Heavy weight, common to choice.	Heavy (1,000 lbs. up), common to choice.	Medium (800 to 1,000 lbs.), common to choice.	Light (800 lbs. down), common to choice.	Steers, common to choice.	Cows and heifers, common to choice.	Calves. Good and choice.	Calves. Common and medium.
1919.											
May	$6.28	$7.08	$13.18	$10.60	$12.02	$11.37	$10.84	$10.05	$8.30	$9.76	$8.09
June	6.54	7.50	14.14	12.66	11.54	10.46	9.89	9.57	7.84	8.84	7.60
July	6.55	8.05	14.56	12.88	....	10.15	9.37	9.01	8.24	8.89	7.32
August	6.46	7.77	16.90	12.23	11.08	10.27	8.94	8.63	7.47	8.71	6.99
September	5.74	7.13	17.51	11.40	10.92	10.04	8.97	8.54	7.15	9.13	7.05
October	5.79	6.63	16.28	11.48	10.63	9.55	8.50	8.16	6.78	9.07	7.17
November	5.84	6.76	15.53	10.49	10.69	9.52	8.50	8.21	6.77	9.02	7.15
December	5.91	6.70	14.60	9.82	10.84	9.86	8.59	8.38	7.04	9.13	7.22
1920.											
January	6.14	6.86	15.74	9.99	10.82	9.93	9.73	8.70	7.35	9.13	7.25
February	6.14	6.49	14.95	9.58	10.76	10.05	9.65	8.74	7.12	9.66	7.90
March	5.87	6.25	14.66	9.50	10.60	10.15	9.69	8.78	7.39	9.75	8.00
April	6.01	6.38	14.51	10.00	10.45	10.05	9.68	8.72	7.54	9.75	8.00
May	5.99	6.37	12.78	10.13	10.03	9.77	9.26	8.51	7.55	9.73	8.00
June	5.66	6.12	12.85	10.17	10.39	10.02	9.05	8.65	6.97	9.50	8.00
July	5.19	5.60	12.47	9.19	10.36	9.62	8.79	7.87	6.24	....	....
August	5.00	5.35	12.09	8.65	9.58	8.66	8.08	7.38	5.68	....	....
						Light and medium weight (750–1,000 lbs.) common to choice.					
September	4.65	5.18	14.44	7.51	9.58	$8.93		7.71	5.66	7.27	5.38
October	4.21	4.52	12.96	7.55	9.23	8.41		7.31	5.21	6.94	5.06
November	4.06	4.34	12.04	8.08	9.01	8.32		7.06	5.14	6.96	5.43
December	3.71	4.14	10.06	7.06	7.92	7.25		6.14	4.88	6.89	5.17

TABLE 2.—*Cattle: Monthly and yearly average price per 100 pounds of good beef steers, Chicago, 1910 to 1920.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	$6.20	$6.15	$6.85	$7.80	$8.45	$8.05	$8.35	$10.15	$12.10	$15.80	$13.95	$9.44
February	6.35	6.15	6.60	8.25	8.30	7.50	8.35	10.50	12.00	15.95	13.05	9.36
March	7.35	6.20	7.20	8.30	8.35	7.65	8.75	11.25	12.60	16.05	13.10	9.71
April	7.55	6.10	7.65	8.15	8.50	7.70	9.10	11.75	14.70	15.85	12.30	9.94
May	7.50	5.95	7.95	8.00	8.40	8.35	9.50	11.90	15.40	15.00	12.25	10.02
June	7.50	6.05	8.00	8.15	8.60	8.80	9.85	12.15	15.85	13.55	14.95	10.31
July	7.10	6.30	7.90	8.25	8.80	9.20	9.25	12.35	16.05	15.60	14.68	10.50
August	6.85	6.95	8.50	8.30	9.10	9.05	9.45	12.70	15.75	16.45	14.30	10.67
September	6.80	6.80	9.15	8.50	9.35	8.95	9.40	13.10	16.00	15.50	14.95	10.77
October	6.60	6.75	7.90	8.40	9.05	8.80	9.75	11.70	14.80	16.15	14.61	10.41
November	6.20	6.70	8.10	8.25	8.60	8.70	10.15	11.10	15.05	15.10	11.65	9.96
December	6.00	6.65	7.85	8.20	8.35	8.35	10.00	11.40	14.90	14.35	10.08	9.65
Average[2]	6.83	6.40	7.80	8.21	8.65	8.43	9.33	11.67	14.60	15.45	13.32	10.05

[1] Prior to July, 1920, from Chicago Drovers' Journal.
[2] Simple average of monthly average prices.

TABLE 3.—*Calves: Monthly and yearly average price per 100 pounds, Chicago, 1910 to 1920.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	$8.60	$8.75	$8.75	$9.75	$11.00	$9.85	$10.15	$13.40	$15.35	$15.62	$17.74	$11.72
February	8.65	8.40	7.50	9.85	10.75	10.35	10.65	12.65	14.15	15.75	16.73	11.40
March	9.00	7.40	8.00	10.50	9.00	10.00	9.65	13.40	15.25	15.01	16.73	11.27
April	7.85	6.60	7.40	8.50	8.85	8.40	8.75	12.50	14.50	14.31	14.22	10.17
May	7.35	7.25	7.75	9.25	9.50	9.15	10.40	13.25	13.50	14.66	12.12	10.38
June	7.85	7.60	8.00	9.75	9.40	9.60	11.25	13.40	16.02	16.37	13.68	11.17
July	7.60	7.40	8.75	10.40	10.60	10.25	11.40	13.00	16.67	17.88	13.98	11.63
August	7.75	8.00	9.75	11.50	11.00	11.50	12.00	15.15	17.28	19.62	15.08	12.60
September	8.50	8.75	11.25	11.25	11.40	11.25	12.40	15.00	18.63	20.52	16.39	13.21
October	8.65	8.60	10.00	10.50	10.65	10.85	11.50	14.85	16.83	18.05	14.18	12.24
November	8.75	8.35	9.85	10.35	10.35	10.15	11.85	13.50	16.86	17.60	13.74	11.94
December	8.50	7.85	10.25	10.75	8.65	9.65	11.75	15.25	16.01	16.56	10.39	11.42
Average[2]	8.25	7.91	8.94	10.19	10.10	10.08	10.98	13.78	15.92	16.83	14.58	11.60

[1] Prior to June 1918, from Chicago Drovers' Journal.
[2] Simple average of monthly average prices.

TABLE 4.—*Cattle: Monthly and yearly top price per 100 pounds of beef cattle, Chicago, 1910 to 1920.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	$8.40	$7.10	$8.75	$9.50	$9.50	$9.70	$9.85	$11.95	$14.30	$20.00	$20.00	$11.73
February	8.10	7.05	9.00	9.25	9.75	9.50	9.75	12.25	14.50	20.25	17.25	11.51
March	8.85	7.35	8.85	9.30	9.75	9.15	10.05	12.95	14.75	20.50	16.00	11.59
April	8.65	7.10	9.00	9.25	9.55	8.90	10.00	13.50	17.60	20.50	16.00	11.82
May	8.75	6.50	9.40	9.10	9.60	9.65	11.05	13.70	17.75	20.00	14.50	11.82
June	8.85	6.75	9.60	9.20	9.45	9.95	11.50	13.90	18.00	17.00	17.25	11.95
July	8.60	7.35	9.85	9.20	10.00	10.40	11.30	14.15	18.75	18.50	17.25	12.30
August	8.50	8.20	10.65	9.25	10.90	10.50	11.50	16.50	18.90	19.35	17.75	12.91
September	8.50	8.25	11.00	9.50	11.05	10.50	11.50	17.90	19.60	18.15	18.35	13.12
October	8.00	9.00	11.05	9.75	11.00	10.60	11.65	17.50	19.75	19.50	18.50	13.30
November	7.75	9.25	11.00	9.85	11.00	10.55	12.50	17.25	19.75	20.50	18.15	13.41
December	7.55	9.35	11.25	10.25	11.40	11.60	12.60	16.25	20.25	21.50	17.25	13.57
For year	8.85	9.35	11.25	10.25	11.40	11.60	12.60	17.90	20.25	21.50	20.00	14.09

[1] Prior to June 1918, from Chicago Drovers' Journal.

TABLE 5.—*Calves: Monthly and yearly top price per 100 pounds for veal calves, Chicago, 1910 to 1920.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	$10.00	$10.00	$10.50	$11.00	$12.00	$11.00	$11.00	$15.00	$16.50	$17.50	$19.50	$13.09
February	10.00	9.50	8.25	11.00	11.60	12.00	11.50	15.00	16.00	17.50	19.50	12.90
March	10.25	9.00	9.00	12.00	11.00	10.75	11.25	15.25	17.50	18.25	19.00	13.02
April	9.25	7.35	9.00	9.50	10.75	9.25	10.50	14.00	17.00	17.50	18.00	12.01
May	8.50	8.25	9.40	11.00	11.00	10.00	11.75	15.50	15.35	17.25	14.50	12.05
June	9.25	8.75	9.00	11.10	10.50	10.50	12.25	15.85	17.00	18.50	15.25	12.54
July	9.00	8.25	10.00	11.50	11.50	11.35	12.25	15.25	17.50	19.25	17.25	13.01
August	9.40	9.10	11.50	12.35	12.00	12.35	12.75	16.25	18.50	21.25	17.75	13.93
September	10.15	9.75	12.00	12.50	12.50	12.25	13.25	16.50	19.50	21.50	18.50	14.40
October	10.25	9.75	11.50	11.85	11.50	12.00	12.75	16.00	18.75	21.25	17.75	13.94
November	10.25	9.00	10.75	11.50	11.75	11.25	13.25	14.75	17.75	19.00	15.25	13.14
December	9.75	8.75	11.25	11.75	10.25	10.50	13.50	16.75	18.00	18.00	13.00	12.86
For year	10.25	10.00	12.00	12.50	12.50	12.35	13.50	16.75	19.50	21.50	19.50	14.58

[1] Prior to June 1918, from Chicago Drovers' Journal.

TABLE 6.—*Beef cattle: Monthly farm price per 100 pounds, United States, 1910 to 1920.*

Date.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11 yr. av.
Jan. 15	$4.71	$4.58	$4.46	$5.40	$6.04	$5.99	$5.85	$6.86	$8.33	$9.65	$8.99	$6.44
Feb. 15	4.64	4.57	4.61	5.55	6.16	5.93	5.99	7.36	8.55	10.02	8.98	6.58
Mar. 15	4.87	4.66	4.75	5.88	6.28	5.92	6.37	7.91	8.85	10.34	9.08	6.81
Apr. 15	5.31	4.67	5.15	6.08	6.29	5.96	6.66	8.57	9.73	10.81	9.20	7.13
May 15	5.23	4.59	5.36	6.01	6.33	6.13	6.73	8.70	10.38	10.84	8.97	7.21
June 15	5.20	4.43	5.23	6.02	6.32	6.20	6.91	8.65	10.40	10.20	9.32	7.17
July 15	4.84	4.28	5.17	5.98	6.38	6.07	6.78	8.30	10.07	9.96	8.93	6.98
Aug. 15	4.64	4.39	5.37	5.91	6.47	6.18	6.51	8.17	9.71	9.82	8.56	6.88
Sept. 15	4.65	4.43	5.35	5.92	6.38	6.06	6.55	8.40	9.63	9.02	8.29	6.79
Oct. 15	4.64	4.32	5.36	6.05	6.23	6.04	6.37	8.35	9.33	8.65	7.77	6.65
Nov. 15	4.48	4.36	5.22	5.99	6.02	5.85	6.44	8.21	9.14	8.65	7.15	6.50
Dec. 15	4.45	4.37	5.33	5.96	6.01	5.75	6.56	8.24	9.28	8.63	6.36	6.45
Weighted average	4.76	4.45	5.15	5.91	6.24	6.09	6.47	8.16	9.44	9.56	8.32	6.77

TABLE 7.—*Cattle and calves: Yearly receipts at principal markets, and number on farms, 1900 to 1920.*

[In thousands of animals; i. e., 000 omitted.]

Year.	Receipts at principal markets.[1]										Number on farms Jan. 1.	
	Chicago.	Kansas City.	Omaha.	St. Paul.	East St. Louis.	Fort Worth.	Denver.	Sioux City.	St. Joseph.	Total.	Milk cows.	Other cattle.
1900	2,865	2,083	828	221	698	(²)	240	300	390	7,625	17,136	50,586
1901	3,213	2,127	818	190	892	(²)	227	309	439	8,215	16,834	45,500
1902	3,193	2,279	1,011	306	1,113	132	324	405	517	9,280	16,697	44,728
1903	3,704	2,137	1,071	303	1,140	447	286	379	625	10,092	17,105	44,659
1904	3,527	2,163	944	389	1,074	643	265	331	587	9,923	17,420	43,629
1905	3,791	2,423	1,026	489	1,124	813	294	403	547	10,910	17,572	43,669
1906	3,742	2,556	1,079	487	1,121	838	329	385	606	11,143	19,794	47,068
1907	3,727	2,670	1,159	520	1,133	1,022	307	410	616	11,564	20,968	51,566
1908	3,461	2,458	1,037	463	1,145	1,069	420	385	584	11,022	21,194	50,073
1909	3,340	2,660	1,125	497	1,241	1,197	426	426	592	11,504	21,720	49,379
1910	3,553	2,507	1,224	604	1,208	1,071	399	439	565	11,570	20,625	41,178
1911	3,453	2,370	1,174	539	1,067	884	298	487	513	10,785	20,823	39,679
1912	3,158	2,147	1,017	524	1,200	1,039	414	431	494	10,424	20,699	37,260
1913	2,888	2,319	962	532	1,100	1,186	499	394	450	10,330	20,497	36,030
1914	2,601	1,957	939	585	1,041	1,176	443	368	356	9,466	20,737	35,855
1915	2,685	1,963	1,218	856	992	944	424	534	441	10,057	21,262	37,067
1916	3,250	2,331	1,434	941	1,200	1,081	601	602	480	11,920	22,108	39,812
1917	3,820	2,902	1,720	1,197	1,405	1,960	653	707	670	15,034	22,894	41,689
1918	4,448	3,320	1,993	1,430	1,509	1,665	728	818	870	16,781	23,310	44,112
1919	4,253	3,085	1,975	1,491	1,473	1,267	824	814	750	15,932	23,475	45,085
1920	3,849	2,500	1,603	1,373	1,254	1,134	617	752	643	13,725	23,619	44,750

[1] Compiled from Drovers' Journal. [2] Not in operation.

TABLE 8.—*Cattle and calves: Combined monthly and yearly receipts at Chicago, Kansas City, Omaha, and East St. Louis, 1910 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-year av.
January	641	700	660	606	526	518	606	807	763	998	847	697
February	515	516	486	486	445	377	534	567	709	682	642	542
March	590	555	502	481	481	523	558	533	779	646	698	577
April	498	498	515	523	445	465	452	600	881	706	532	556
May	553	612	484	452	404	461	558	708	688	668	642	566
June	630	620	462	525	473	474	530	701	705	641	696	587
July	662	680	516	568	457	462	535	773	967	881	669	652
August	915	764	667	688	565	611	807	808	911	926	868	775
September	995	766	868	923	784	730	861	1,029	1,347	1,131	1,032	951
October	1,040	1,044	1,010	824	813	834	1,146	1,309	1,320	1,362	932	1,058
November	834	757	674	606	558	798	915	1,148	1,167	1,169	1,029	878
December	617	555	676	588	581	605	716	864	1,032	976	618	712
Total	8,490	8,067	7,520	7,270	6,532	6,858	8,218	9,847	11,269	10,786	9,205	8,551

[1] Figures prior to 1915 compiled from Drovers' Journal.

TABLE 9.—*Cattle and calves: Monthly and yearly receipts, 1910 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

CHICAGO.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-year av.
January	293	328	323	270	241	216	259	360	297	421	382	308
February	252	242	245	204	218	153	231	247	325	302	295	247
March	272	269	271	227	232	223	240	228	370	282	302	265
April	254	253	289	274	235	220	223	289	397	319	243	272
May	266	312	268	226	205	221	270	315	315	309	326	276
June	288	266	220	240	217	227	225	261	308	300	308	260
July	281	283	225	215	191	201	212	247	368	346	270	258
August	338	286	236	202	210	227	267	269	300	282	301	265
September	318	259	248	259	236	230	283	359	434	342	351	302
October	367	359	299	262	247	227	368	472	462	464	329	351
November	347	326	252	234	130	272	356	421	442	453	441	334
December	277	270	283	277	239	267	316	362	429	433	301	314
Total	3,553	3,453	3,159	2,890	2,601	2,684	3,250	3,821	4,447	4,253	3,849	3,451

KANSAS CITY.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	172	196	165	159	135	144	149	182	207	268	196	179
February	127	139	110	132	110	97	132	141	165	180	157	135
March	158	142	107	128	124	136	131	132	179	160	171	143
April	122	128	115	130	99	113	109	153	203	191	98	133
May	141	142	102	106	87	102	134	177	160	162	137	132
June	163	168	112	133	106	100	137	210	165	160	177	148
July	196	213	147	191	128	118	164	314	309	250	206	204
August	291	245	218	291	175	186	287	283	317	323	315	266
September	335	262	322	374	272	241	285	328	477	380	336	328
October	358	372	363	309	302	314	394	385	464	435	279	361
November	267	231	202	206	263	272	256	360	379	341	293	279
December	176	132	184	157	155	139	153	237	295	235	135	182
Total	2,506	2,370	2,147	2,319	1,956	1,962	2,331	2,902	3,320	3,085	2,500	2,491

OMAHA.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	83	99	95	84	83	81	122	147	152	165	167	116
February	81	81	79	79	67	70	111	101	134	124	109	94
March	96	93	80	72	75	103	123	109	151	121	138	106
April	74	68	67	70	65	90	76	107	183	106	136	95
May	75	84	59	62	55	84	90	127	129	107	109	89
June	64	72	44	55	55	80	74	107	119	96	97	78
July	74	75	48	45	41	55	61	89	135	146	79	77
August	143	129	83	77	74	93	122	133	158	182	118	119
September	174	128	130	143	136	147	153	184	245	258	194	172
October	164	162	168	123	124	173	226	250	212	285	192	189
November	110	101	80	79	75	144	153	222	201	219	163	141
December	85	80	85	73	85	100	124	142	173	166	101	110
Total	1,223	1,172	1,018	962	935	1,220	1,435	1,718	1,992	1,975	1,603	1,387

EAST ST. LOUIS.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	93	77	77	93	67	77	76	118	107	144	102	94
February	55	54	52	71	50	57	60	78	85	76	81	65
March	64	51	44	54	50	61	64	64	79	83	87	64
April	48	49	44	49	46	42	44	60	98	90	55	57
May	71	74	55	58	57	54	64	89	84	90	70	70
June	115	114	86	97	95	67	94	123	113	85	114	100
July	111	109	96	114	97	88	98	123	155	139	114	113
August	143	104	130	118	106	105	131	123	136	139	134	124
September	168	117	168	147	140	112	140	158	191	151	151	149
October	151	151	180	130	140	120	158	202	182	178	132	157
November	110	99	140	87	90	110	150	145	145	156	132	124
December	79	73	124	81	102	99	123	123	135	142	81	106
Total	1,208	1,072	1,196	1,099	1,040	992	1,202	1,406	1,510	1,473	1,253	1,223

[1] Figures prior to 1915 compiled from Drovers' Journal.

TABLE 10.—*Cattle and calves: Yearly receipts, local slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920.*[1]

RECEIPTS.

Market.	1915	1916	1917	1918	1919	1920
Albany, N. Y.	....	42,167	106,717	46,078	39,326	36,376
Amarillo, Tex.	115,683	132,726	351,997	271,631	184,670	146,625
Atlanta, Ga.	....	....	27,586	21,715	18,484	20,747
Augusta, Ga.	....	....	14,086	13,615	14,354	12,761
Baltimore, Md.	146,463	178,419	228,139	226,846	249,198	286,910
Billings, Mont.	1,950	5,495	8,295	8,470	15,996	2,273
Birmingham, Ala.	....	19,136	18,551	21,995	23,714	24,418
Boston, Mass.	43,383	89,830	90,602	103,502	97,545	75,332
Buffalo, N. Y.	363,239	476,895	531,035	667,671	749,029	676,676
Chattanooga, Tenn.	....	23,765	24,616	13,317	12,157	12,522
Charleston, S. C.	....	....	211	181	....	....
Cheyenne, Wyo.	....	....	40,248	47,483	46,652	23,325
Chicago, Ill.	2,684,973	3,249,800	3,820,271	4,447,689	4,253,408	3,849,495
Cincinnati, Ohio	281,122	352,040	452,836	455,291	460,487	441,044
Cleveland, Ohio	122,343	181,327	295,913	301,854	304,558	281,254
Columbia, S. C.	....	5,664	4,227	5,192	6,709	5,956
Columbus, Ohio	942	1,515	1,370	3,491	2,767	2,351
Dallas, Tex.	....	9,105	8,401	11,984	9,061	7,643
Dayton, Ohio	17,699	21,339	26,034	29,561	30,702	32,625
Denver, Colo.	424,341	601,460	653,377	728,268	823,727	616,565
Detroit, Mich.	122,393	200,220	262,944	252,326	227,268	234,058
Dublin, Ga.	....	....	653	2,419	2,266	3,912
East St. Louis, Ill.	991,709	1,200,320	1,404,741	1,509,409	1,472,830	1,253,550
El Paso, Tex.	225,001	130,154	189,916	211,632	202,777	151,693
Emeryville, Calif.	....	....	37,740	32,279	36,015	38,159
Erie, Pa.	....	....	....	56,582	37,947	28,038
Evansville, Ind.	....	22,925	34,807	44,643	38,017	44,565
Fort Worth, Tex.	944,431	1,080,522	1,959,537	1,665,009	1,266,635	1,134,323
Fostoria, Ohio	8,454	12,444	12,322	9,581	10,850	13,753
Indianapolis, Ind.	351,741	405,069	501,156	504,190	515,347	597,097
Jacksonville, Fla.	....	3,240	9,308	39,764	16,331	6,662
Jersey City, N. J.	491,131	746,341	754,976	649,620	744,860	833,254
Kansas City, Mo.	1,963,498	2,331,467	2,902,253	3,319,511	3,085,007	2,500,166
Knoxville, Tenn.	13,619	17,319	19,626	19,038	21,190	20,992
Lafayette, Ind.	10,239	10,075	14,291	13,954	16,882	19,143
Lancaster, Pa.	114,518	144,161	258,245	303,705	238,982	287,218
Logansport, Ind.	247	380	1,010	1,259	668	1,111
Louisville, Ky.	141,802	201,766	220,933	218,428	246,373	245,361
Marion, Ohio	....	....	....	1,510	13,106	31,562
Memphis, Tenn.	....	1,552	5,040	3,685	5,570	18,953
Milwaukee, Wis.	223,750	243,607	295,472	370,431	398,136	443,947
Mobile, Ala.	16,913	8,034	5,780	....	....	....
Montgomery, Ala.	....	....	7,233	34,295	51,998	68,337
Nashville, Tenn.	....	38,997	117,930	87,585	83,057	98,773
Nebraska City, Nebr.	....	....	....	2,389	2,127	1,928
New Brighton, Minn.	29,608	37,733	50,099	80,663	120,583	72,526
New Orleans, La.	....	153,813	165,823	174,482	191,340	213,289
New York, N. Y.	351,819	321,735	276,300	385,121	402,221	316,291
Norfolk, Va.	....	....	....	1,970	....	....
Ogden, Utah	....	....	63,779	117,470	104,036	63,617
Oklahoma, Okla.	226,827	324,853	620,175	690,109	593,282	399,706
Omaha, Nebr.	1,218,342	1,434,304	1,719,822	1,993,366	1,975,236	1,602,799
Orangeburg, S. C.	....	....	....	789	79	....
Pasco, Wash.	....	....	....	3,452	6,095	7,839
Peoria, Ill.	12,820	19,802	24,737	31,688	27,193	36,446
Philadelphia, Pa.	135,756	179,764	192,421	193,663	201,047	226,461
Pittsburgh, Pa.	338,380	168,883	559,570	522,683	616,263	732,770
Portland, Oreg.	75,414	82,506	105,409	119,639	125,203	140,705
Pueblo, Colo.	130,074	130,051	185,808	205,301	216,942	178,249
Richmond, Va.	23,299	28,635	25,966	22,497	28,540	30,091
St. Joseph, Mo.	441,471	479,946	670,167	869,888	750,151	642,899
St. Louis, Mo.	31,653	42,932	35,040	26,181	....	....
St. Paul, Minn.	855,589	941,125	1,197,129	1,430,408	1,490,926	1,373,114
Salt Lake City, Utah	....	11,973	41,970	53,906	66,698	49,071
San Antonio, Tex.	139,412	208,076	192,885	175,919	250,097	233,284
Seattle, Wash.	....	24,955	39,093	56,036	66,024	57,939
Sioux City, Iowa	534,154	601,667	706,718	817,593	814,093	751,658
Sioux Falls, S. D.	....	....	6,972	6,962	7,754	14,301
Spokane, Wash.	691	16,903	25,881	51,086	74,003	67,166
Tacoma, Wash.	....	15,525	20,316	26,883	28,540	22,172
Toledo, Ohio	33,905	26,055	32,129	44,289	57,231	64,147
Washington, D. C.	....	14,892	15,780	18,042	22,559	26,559
Watertown, Mass.	....	....	....	1,479	....	....
Wichita, Kans.	153,035	220,133	371,307	393,914	310,965	242,113
Total	14,552,833	17,675,537	23,065,721	25,294,557	24,623,884	22,196,665

[1] Complete information for 1915 and 1916, particularly on disposition of stock is not obtainable from many of these markets.

TABLE 10.—*Cattle and calves: Yearly receipts, local slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920*[1]—Continued.

LOCAL SLAUGHTER.

Market.	1915	1916	1917	1918	1919	1920
Albany, N. Y.	...	...	7,464	5,779	3,669	3,020
Amarillo, Tex.	...	...	...	...	848	802
Atlanta, Ga.	...	...	15,141	11,361	10,854	15,456
Augusta, Ga.	...	...	10,391	7,616	8,846	7,714
Baltimore, Md.	91,900	112,510	121,518	125,768	145,357	169,866
Billings, Mont.	...	...	1,595	1,192	539	64
Birmingham, Ala.	...	15,195	15,238	20,565	21,616	23,538
Boston, Mass.	...	...	...	...	...	...
Buffalo, N. Y.	...	196,704	211,743	205,307	202,300	190,356
Chattanooga, Tenn.	...	...	...	8,832	9,815	10,346
Charleston, S. C.	...	...	211	181	...	...
Cheyenne, Wyo.	...	...	...	...	...	...
Chicago, Ill.	2,292,928	2,523,583	2,953,073	3,422,380	3,032,001	2,602,863
Cincinnati, Ohio	186,629	233,112	299,471	302,801	305,313	283,197
Cleveland, Ohio	111,041	164,300	223,104	223,169	243,886	228,296
Columbia, S. C.	...	5,097	...	4,305	5,609	5,956
Columbus, Ohio	942	879	975	374	188	856
Dallas, Tex.	...	9,105	8,401	11,984	9,011	7,643
Dayton, Ohio	17,097	18,014	23,114	25,434	24,741	26,563
Denver, Colo.	65,988	89,040	131,407	185,043	174,350	152,959
Detroit, Mich.	...	164,990	173,626	192,322	188,857	202,242
Dublin, Ga.	...	...	8	408	...	47
East St. Louis, Ill.	723,089	887,722	1,087,367	1,139,805	1,018,740	743,928
El Paso, Tex.	...	...	10,036	19,294	24,151	21,044
Emeryville, Calif.	...	...	37,440	32,191	35,747	38,159
Erie, Pa.	...	...	...	13,054	12,926	8,669
Evansville, Ind.	...	13,099	14,598	14,568	15,758	23,675
Fort Worth, Tex.	361,860	473,641	991,323	954,038	715,090	557,575
Fostoria, Ohio	...	...	2,424	2,626	2,381	2,771
Indianapolis, Ind.	175,524	208,135	269,752	268,428	245,263	256,605
Jacksonville, Fla.	...	...	6,330	38,422	15,665	5,917
Jersey City, N. J.	491,131	746,341	754,976	649,620	744,826	833,098
Kansas City, Mo.	935,025	1,300,544	1,677,122	1,915,017	1,617,169	1,263,882
Knoxville, Tenn.	10,839	13,045	9,606	8,731	8,990	11,514
Lafayette, Ind.	...	6,526	6,013	5,348	7,159	8,394
Lancaster, Pa.	...	...	...	27,751	45,185	55,032
Logansport, Ind.	112	89	47	38	54	53
Louisville, Ky.	53,861	69,610	76,276	74,386	87,386	86,607
Marion, Ohio	...	...	...	298	1,095	1,047
Memphis, Tenn.	...	...	...	...	1,169	387
Milwaukee, Wis.	178,921	213,893	262,930	320,738	334,423	389,887
Mobile, Ala.	12,844	7,162	4,784	...	...	...
Montgomery, Ala.	...	...	...	...	2,752	3,777
Nashville, Tenn.	...	7,041	27,058	31,721	40,875	45,879
Nebraska City, Nebr.	...	...	...	...	19	...
New Brighton, Minn.	...	...	...	...	...	...
New Orleans, La.	...	140,979	154,855	160,409	162,535	174,059
New York, N. Y.	351,819	321,735	276,300	385,121	399,510	315,500
Norfolk, Va.	...	...	...	208	...	...
Ogden, Utah	...	...	11,682	11,973	10,766	15,734
Oklahoma, Okla.	129,795	220,684	415,173	528,224	367,574	227,584
Omaha, Nebr.	682,549	842,901	996,385	1,137,977	1,135,517	913,645
Orangeburg, S. C.	...	...	...	789	79	...
Pasco, Wash.	...	...	...	53	90	14
Peoria, Ill.	9,533	13,758	13,983	25,769	17,849	18,365
Philadelphia, Pa.	...	...	182,721	185,587	195,508	221,225
Pittsburgh, Pa.	50,810	91,704	167,936	163,163	150,987	170,641
Portland, Oreg.	40,116	42,168	55,622	65,411	62,208	69,927
Pueblo, Colo.	...	...	...	413	...	...
Richmond, Va.	11,037	12,729	14,266	12,758	16,700	18,508
St. Joseph, Mo.	267,083	331,124	458,552	569,110	531,100	410,054
St. Louis, Mo.	19,975	25,137	25,271	21,585	...	...
St. Paul, Minn.	327,121	380,620	487,022	615,635	529,562	710,058
Salt Lake City, Utah	...	998	11,046	23,184	18,866	13,940
San Antonio, Tex.	...	...	55,155	20,015	14,468	36,938
Seattle, Wash.	...	24,955	38,903	55,618	63,621	55,585
Sioux City, Iowa	244,202	232,795	295,849	385,253	362,570	342,264
Sioux Falls, S. Dak.	...	...	183	857	1,128	5,603
Spokane, Wash.	229	3,180	14,273	36,053	36,402	34,668
Tacoma, Wash.	...	15,525	20,316	25,528	24,338	21,981
Toledo, Ohio	...	12,368	10,471	12,539	13,487	18,301
Washington, D. C.	...	14,892	12,277	15,253	20,380	25,361
Watertown, Mass.	...	...	...	...	...	...
Wichita, Kans.	67,452	85,984	122,365	145,000	133,298	84,487
Total	7,911,502	10,293,613	13,275,168	14,874,380	13,633,166	12,194,126

[1] Complete information for 1915 and 1916, particularly on disposition of stock is not obtainable from many of these markets.

TABLE 10.—*Cattle and calves: Yearly receipts, local slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920*[1]—Continued.

STOCKER AND FEEDER SHIPMENTS.

	1916	1917	1918	1919	1920
Albany, N. Y	...	1,295	1,152	770	702
Amarillo, Tex	109,575	262,543	197,138	122,148	90,453
Atlanta, Ga	...	...	1,705	3,948	902
Augusta, Ga	...	727	3,084	2,492	2,257
Baltimore, Md	6,800	8,250	10,650	4,612	4,627
Billings, Mont	...	4,835	3,864	9,112	1,343
Birmingham, Ala	898	1,607	346	1,242	41
Boston, Mass	...	...	...	...	...
Buffalo, N. Y	26,080	24,828	31,421	39,096	13,840
Chattanooga, Tenn	...	...	2,311	2,193	2,176
Charleston, S. C	...	...	...	...	...
Cheyenne, Wyo	...	...	...	...	...
Chicago, Ill	255,696	357,819	401,437	508,793	417,483
Cincinnati, Ohio	25,643	22,169	29,772	28,372	27,749
Cleveland, Ohio	...	3,359	4,012	6,043	3,096
Columbia, S. C	...	256	206	473	...
Columbus, Ohio	150	...	30	91	69
Dallas, Tex	...	...	...	...	...
Dayton, Ohio	2,050	300	829	300	967
Denver, Colo	385,587	397,035	402,210	483,326	407,026
Detroit, Mich	8,760	8,381	6,334	17,084	15,641
Dublin, Ga	...	645	295	359	240
East St. Louis, Ill	160,854	220,538	225,073	234,045	167,797
El Paso, Tex	...	159,348	177,559	150,732	114,534
Emeryville, Calif	...	...	383	268	...
Erie, Pa	...	...	...	...	...
Evansville, Ind	...	1,369	2,498	1,150	1,013
Fort Worth, Tex	311,820	436,845	392,496	326,983	278,048
Fostoria, Ohio	6,209	4,070	3,437	4,644	4,702
Indianapolis, Ind	45,413	46,192	55,722	50,033	47,705
Jacksonville, Fla	832	1,053	1,048	244	99
Jersey City, N. J	...	...	...	...	...
Kansas City, Mo	893,488	948,127	1,053,415	1,035,609	778,214
Knoxville, Tenn	715	5,914	7,554	8,190	4,462
Lafayette, Ind	150	543	740	1,509	1,217
Lancaster, Pa	...	...	93,037	95,062	86,855
Logansport, Ind	39	196	215	58	104
Louisville, Ky	...	...	24,055	35,536	30,469
Marion, Ohio	...	...	954	1,046	105
Memphis, Tenn	16	...	...	282	1,557
Milwaukee, Wis	5,084	8,719	10,613	15,744	14,569
Mobile, Ala	...	306	...	...	...
Montgomery, Ala	...	183	5,957	9,263	28,174
Nashville, Tenn	6,519	2,642	2,683	11,029	13,837
Nebraska City, Nebr	...	...	238	508	370
New Brighton, Minn	460	604	2,826	757	948
New Orleans, La	7,991	5,095	5,933	18,326	16,708
New York, N. Y	...	...	...	...	...
Norfolk, Va	...	...	...	...	...
Ogden, Utah	...	4,640	26,716	47,961	28,314
Oklahoma, Okla	88,376	172,248	154,881	135,962	106,322
Omaha, Nebr	532,795	561,242	526,068	656,284	450,647
Orangeburg, S. C	...	...	...	...	...
Pasco, Wash	...	...	462	...	125
Peoria, Ill	2,427	1,701	2,208	300	1,465
Philadelphia, Pa	...	...	...	...	...
Pittsburgh, Pa	...	...	...	...	...
Portland, Oreg	11,934	17,848	17,658	21,329	25,977
Pueblo, Colo	...	...	78,775	6,956	5,385
Richmond, Va	623	502	1,438	1,845	1,891
St. Joseph, Mo	94,872	126,584	115,516	124,096	102,964
St. Louis, Mo	...	...	...	...	...
St. Paul, Minn	357,823	357,137	336,968	416,408	315,977
Salt Lake City, Utah	1,525	25,056	22,680	25,188	15,686
San Antonio, Tex	59,232	43,142	53,433	137,464	95,743
Seattle, Wash	...	190	258	64	...
Sioux City, Iowa	328,121	347,551	302,926	328,984	238,271
Sioux Falls, S. Dak	...	6,025	3,580	614	1,091
Spokane, Wash	...	9,149	11,864	27,671	22,932
Tacoma, Wash	...	...	1,367	3,137	317
Toledo, Ohio	1,034	2,397	5,355	4,288	4,703
Washington, D. C	...	...	122	459	97
Watertown, Mass	...	...	...	...	...
Wichita, Kans	107,083	192,185	187,532	115,847	103,751
Total	3,846,694	4,803,390	5,013,039	5,286,429	4,101,757

[1] Complete information for 1915 and 1916, particularly on disposition of stock, is not obtainable from many of these markets.

TABLE 11.—*Cattle and calves: Combined monthly and yearly receipts at public stockyards, 1915 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1915....	1,029	768	1,017	987	1,111	1,113	1,039	1,246	1,531	1,818	1,724	1,170	14,553
1916....	1,202	1,055	1,201	1,151	1,385	1,319	1,154	1,584	1,779	2,409	1,977	1,460	17,676
1917....	1,696	1,302	1,330	1,539	1,961	1,759	1,729	1,814	2,357	3,054	2,626	1,899	23,066
1918....	1,727	1,498	1,713	2,046	1,863	1,815	2,128	2,024	2,826	2,865	2,648	2,142	25,295
1919....	2,119	1,453	1,517	1,767	1,836	1,588	2,016	2,039	2,396	3,008	2,703	2,182	24,624
1920....	1,881	1,480	1,663	1,557	1,778	1,879	1,671	1,962	2,294	2,209	2,428	1,395	22,197

[1] See note to Table 10.

TABLE 12.—*Cattle and calves: Combined monthly and yearly shipments from public stockyards, 1915 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1915....	390	258	315	334	385	376	333	459	752	962	821	467	5,852
1916....	406	358	428	438	528	510	376	619	788	1,134	843	525	6,953
1917....	568	466	493	560	790	716	595	707	1,096	1,427	1,273	782	9,473
1918....	595	524	681	775	790	764	686	860	1,246	1,337	1,255	798	10,311
1919....	772	537	585	711	801	624	716	911	1,166	1,553	1,399	982	10,757
1920....	767	603	582	605	784	799	734	880	1,087	1,172	1,165	653	9,831

[1] See note to Table 10.

TABLE 13.—*Cattle and calves: Combined monthly and yearly local slaughter at public stockyards, 1915 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1915....	586	481	650	600	652	671	639	682	719	765	791	676	7,912
1916....	747	665	745	680	81[illegible]	787	739	930	947	1,184	1,135	917	10,294
1917....	1,077	817	817	953	1,153	1,053	1,059	1,100	1,229	1,542	1,356	1,119	13,275
1918....	1,088	963	1,015	1,237	1,080	1,058	1,388	1,186	1,532	1,534	1,419	1,374	14,874
1919....	1,313	890	912	1,029	1,037	957	1,266	1,096	1,195	1,434	1,312	1,192	13,633
1920....	1,100	865	1,049	951	986	1,061	933	1,035	1,172	1,050	1,207	785	12,194

[1] See note to Table 10.

TABLE 14.—*Cattle and calves: Combined monthly and yearly stocker and feeder shipments from public stockyards, 1916 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1916....	221	197	250	262	289	264	171	330	464	682	461	256	3,847
1917....	260	213	249	306	401	353	262	330	588	768	729	344	4,803
1918....	222	214	319	385	491	393	274	418	604	704	623	366	5,013
1919....	364	264	277	391	442	272	236	397	611	839	723	470	5,286
1920....	349	240	241	244	323	272	218	314	488	580	553	280	4,102

[1] See note to Table 10.

TABLE 15.—*Cattle and calves: Monthly and yearly receipts, slaughter and stocker and feeder shipments at public stockyards, 1915 to 1920 (number of animals).*

CHICAGO, ILL.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	[1] 1915	1916	1917	1918	1919	1920
Jan.	216,165	259,152	360,062	297,400	420,648	382,043	169,842	213,530	276,036	231,077	311,238	264,585	....	....	21,032	8,685	32,334	30,385
Feb.	152,927	230,654	247,195	324,924	302,399	294,779	127,824	185,305	188,663	260,469	223,680	206,529	....	2,188	15,271	17,501	31,780	25,396
Mar.	222,723	240,170	228,290	370,474	281,882	302,324	194,976	192,990	175,178	275,984	211,940	227,177	....	10,839	16,521	36,194	25,463	21,419
Apr.	219,795	222,593	279,760	397,333	319,495	242,728	188,625	177,143	229,960	326,299	247,383	191,402	....	14,902	14,293	23,226	28,056	12,235
May.	221,209	269,870	315,354	315,303	309,393	325,644	189,189	216,221	261,886	249,617	228,908	221,000	....	13,188	12,383	20,833	26,756	24,783
June.	226,684	225,074	260,771	307,521	299,947	308,014	191,314	177,437	209,054	239,094	213,464	218,260	....	14,141	11,328	23,433	20,695	20,137
July.	201,369	211,774	247,162	368,172	345,845	270,004	168,051	166,306	204,835	303,224	245,272	182,663	....	11,749	11,301	26,190	26,796	23,747
Aug.	227,226	267,212	268,761	299,782	281,681	301,433	178,922	202,535	218,061	229,740	199,356	197,226	....	24,511	21,529	26,905	33,427	34,760
Sept.	230,498	283,205	358,544	433,838	342,359	351,344	194,715	215,897	274,408	333,698	235,525	233,973	....	37,905	56,015	54,911	58,017	54,136
Oct.	227,159	368,291	471,967	462,004	461,159	328,975	223,617	275,550	357,525	341,186	316,310	205,490	....	58,729	75,576	65,623	87,283	55,940
Nov.	271,746	355,527	420,577	442,014	452,587	440,732	245,077	266,798	298,416	312,291	322,226	290,328	....	41,097	66,725	55,556	72,642	65,532
Dec.	267,471	316,278	361,828	428,924	433,013	301,475	220,776	233,871	259,051	319,698	276,699	164,230	....	26,447	35,845	42,380	65,544	49,013
Total	2,684,973	3,249,800	3,820,271	4,447,689	4,253,408	3,849,495	2,292,928	2,523,583	2,953,073	3,422,380	3,032,001	2,602,863	....	255,696	357,819	401,437	508,793	417,483

KANSAS CITY, MO.

Month.	Receipts 1915	1916	1917	1918	1919	1920	Local slaughter 1915	1916	1917	1918	1919	1920	Stocker and feeder shipments [1] 1915	1916	1917	1918	1919	1920
Jan.	144,308	148,533	181,763	206,835	268,256	196,279	62,337	75,178	107,078	137,941	158,195	110,082	72,403	56,626	62,221	41,200	86,498	60,998
Feb.	97,425	132,139	140,786	164,650	180,394	157,448	62,393	69,812	85,425	107,346	90,759	82,742	32,003	53,849	50,508	54,221	66,003	59,247
Mar.	136,352	131,297	132,396	178,605	159,731	170,772	73,154	74,936	80,823	107,665	79,190	100,110	50,468	56,451	48,620	65,250	62,829	50,458
Apr.	113,105	109,366	152,794	203,117	190,884	97,722	54,238	61,016	90,049	128,600	92,572	68,387	54,195	40,850	54,291	58,695	85,203	29,960
May.	102,088	133,895	176,707	169,355	162,214	136,793	63,277	79,353	106,591	103,607	87,609	82,254	33,250	46,304	49,445	61,704	63,503	35,835
June.	99,609	137,785	210,304	164,615	159,999	177,344	71,627	92,469	136,476	112,274	92,117	90,065	23,659	40,306	55,017	41,536	49,695	40,146
July.	117,986	164,022	314,269	308,769	250,263	206,299	82,405	95,888	181,755	191,139	150,539	108,120	28,615	41,685	63,385	60,284	41,918	38,739
Aug.	185,813	236,931	282,677	317,005	322,726	314,723	91,371	153,966	183,763	162,006	161,074	134,677	56,381	112,980	93,900	119,933	92,063	75,333
Sept.	240,943	284,321	323,297	476,759	379,901	335,737	99,847	142,254	162,587	225,088	177,334	150,182	133,684	123,150	131,752	159,074	126,632	115,355
Oct.	314,412	393,391	384,475	464,039	434,786	278,932	109,318	172,857	191,987	246,696	203,398	126,338	185,690	178,372	130,670	174,692	168,840	115,939
Nov.	272,148	256,611	359,984	379,352	340,541	293,072	93,851	174,079	199,563	211,427	181,042	131,983	161,401	100,774	142,706	140,645	122,417	104,008
Dec.	139,309	153,176	237,801	295,410	235,309	135,045	71,207	108,736	151,025	181,228	143,340	78,942	87,486	42,141	65,612	76,181	70,008	52,196
Total	1,963,498	2,331,467	2,902,253	3,319,511	3,085,007	2,500,166	935,025	1,300,544	1,677,122	1,915,017	1,617,169	1,263,882	919,235	893,488	948,127	1,053,415	1,035,609	778,214

OMAHA, NEBR.

Jan......	81,331	121,580	147,249	151,638	165,349	167,148	43,492	74,186	95,204	95,586	108,716	103,318	35,351	42,477	42,628	33,726	41,795	38,246
Feb......	69,911	110,826	100,621	134,390	124,495	109,099	44,837	63,482	59,270	82,499	80,784	68,178	20,038	41,522	32,288	28,366	30,891	6,683
Mar......	102,687	122,936	109,469	150,912	121,103	138,155	63,839	71,297	66,102	81,678	76,857	91,325	28,554	43,863	33,689	35,106	31,470	30,367
Apr......	89,586	75,869	107,401	183,189	105,596	136,339	52,948	47,079	69,205	99,059	67,389	76,440	31,839	24,467	28,667	33,518	27,431	25,713
May......	84,268	90,145	127,034	128,968	107,090	109,036	62,290	68,203	90,512	76,846	75,612	68,915	16,298	15,585	23,845	33,176	21,750	19,691
June.....	79,728	74,147	106,610	118,897	96,137	96,525	60,493	55,178	77,974	62,288	74,219	65,402	12,507	14,723	21,714	19,267	11,213	13,937
July.....	54,546	61,261	89,400	135,493	145,900	78,546	38,874	46,377	68,394	108,052	102,114	53,243	10,176	12,700	17,089	17,991	30,709	16,316
Aug......	92,592	122,355	133,153	157,866	181,934	118,288	60,825	69,519	83,610	91,505	89,905	62,591	27,683	48,634	39,438	44,838	74,664	37,718
Sept.....	146,954	152,672	184,197	244,838	257,846	194,359	68,441	77,578	79,294	124,515	118,440	93,908	75,292	72,201	77,801	90,857	125,646	80,533
Oct......	172,660	225,779	250,256	212,495	285,270	191,521	64,404	116,320	126,379	102,529	127,209	78,862	103,802	105,140	99,546	80,188	136,736	94,456
Nov......	144,210	152,511	222,253	201,237	218,754	162,874	70,597	78,650	99,949	105,497	114,461	96,755	70,081	67,484	100,890	65,346	81,161	54,160
Dec......	99,869	124,223	142,179	173,443	165,762	100,909	51,509	75,032	80,492	107,923	99,811	54,708	43,658	43,999	43,647	43,689	42,818	32,827
Total	1,218,342	1,434,304	1,719,822	1,993,366	1,975,236	1,602,799	682,549	842,901	996,385	1,137,977	1,135,517	913,645	475,279	532,795	561,242	526,068	656,284	450,647

EAST ST. LOUIS, ILL.

Jan......	77,238	75,944	118,179	107,127	144,115	161,776	61,674	62,488	99,305	94,367	94,166	81,200	9,412	7,569	14,668	7,472	21,326	12,272
Feb......	56,726	59,644	77,575	84,766	76,324	81,326	43,899	49,182	62,530	72,693	57,562	43,932	5,376	6,413	12,646	8,743	13,551	10,930
Mar......	60,949	64,148	63,563	78,749	82,598	86,682	48,654	48,644	49,878	61,055	62,707	63,965	7,032	11,503	12,219	15,105	16,057	9,495
Apr......	42,443	43,672	59,854	97,723	90,168	54,919	33,073	32,262	48,246	78,280	63,368	28,538	5,506	9,507	10,023	12,407	19,016	6,892
May......	51,241	63,647	89,110	84,032	90,460	70,175	40,798	51,061	77,253	61,858	63,455	55,224	9,046	8,613	8,610	11,339	15,318	6,233
June.....	66,607	93,690	122,582	113,427	85,371	113,915	47,120	64,395	91,609	86,309	65,273	63,365	8,222	10,881	12,979	12,625	9,384	9,936
July.....	87,500	97,962	122,923	155,189	138,609	114,437	63,636	68,736	94,702	115,925	104,753	61,724	11,760	10,946	15,243	15,140	10,526	9,669
Aug......	105,436	131,479	123,189	135,550	138,824	134,462	64,968	79,124	89,390	93,000	99,712	77,376	24,847	17,981	21,240	23,301	19,099	14,763
Sept.....	112,002	140,120	158,096	191,201	150,772	150,847	70,305	92,253	115,337	133,513	97,415	78,231	31,752	22,803	29,504	33,763	24,283	28,538
Oct......	119,572	157,509	201,833	181,612	177,856	131,882	83,412	114,624	148,399	128,359	111,006	66,758	27,025	23,741	37,176	35,410	31,799	23,669
Nov......	109,910	149,951	144,886	144,674	155,575	131,866	86,008	122,316	108,142	103,971	96,505	81,688	20,153	16,661	27,902	30,015	31,878	22,640
Dec......	99,085	122,554	122,921	135,359	142,158	81,263	79,542	102,637	102,576	110,475	102,818	41,927	15,356	14,236	18,328	19,753	21,808	12,760
Total.	991,709	1,200,320	1,404,741	1,509,409	1,472,830	1,253,550	723,089	887,722	1,087,367	1,139,805	1,018,740	743,928	175,487	160,854	220,538	225,073	234,045	167,797

[1] No stocker and feeder shipments in 1915 on account of quarantine.

TABLE 15.—*Cattle and calves: Monthly and yearly receipts, slaughter and stocker and feeder shipments at public stockyards, 1915 to 1920 (number of animals)*—Continued.

ST. PAUL, MINN.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
Jan.	38,448	47,216	68,044	70,769	107,156	86,308	21,074	25,128	38,680	44,751	54,267	62,454	12,695	15,979	15,052	11,337	31,666	12,936
Feb.	32,757	51,763	57,511	55,987	77,072	85,371	18,868	25,163	34,023	32,139	31,466	60,419	11,588	19,444	15,868	15,443	21,266	16,004
Mar.	55,431	73,737	69,767	81,994	83,433	109,273	25,679	29,270	33,634	38,373	37,028	67,938	24,677	28,012	26,140	29,380	24,403	23,984
Apr.	50,342	55,416	67,064	91,092	90,375	93,186	19,832	19,669	32,988	47,861	39,598	60,844	26,796	31,868	24,709	24,535	26,047	27,171
May	45,169	65,362	68,013	82,505	84,937	83,237	20,430	28,417	35,617	50,786	42,330	49,453	20,736	29,694	19,136	21,629	28,536	24,461
June	46,317	54,988	58,120	76,821	70,615	88,928	21,845	28,491	33,387	44,125	34,518	56,522	17,853	21,761	17,140	17,972	21,720	16,905
July	58,869	57,187	76,767	142,310	124,534	83,137	29,168	28,985	39,660	69,117	36,706	41,533	19,810	19,837	17,813	21,856	31,649	21,824
Aug.	87,622	91,700	99,432	127,008	130,665	122,410	32,628	39,370	41,269	44,434	38,520	52,541	40,740	31,567	22,388	27,860	41,444	29,700
Sept.	122,415	115,581	162,308	183,212	161,516	164,405	34,749	40,076	45,148	59,419	43,463	59,498	70,935	45,006	51,965	42,498	50,972	39,504
Oct.	144,140	166,807	214,540	203,282	228,972	164,764	38,319	48,298	57,626	69,282	54,603	69,229	76,975	62,721	67,605	49,662	61,878	37,474
Nov.	117,897	102,102	169,093	184,630	205,728	218,164	37,070	38,599	57,108	68,439	52,622	81,091	63,216	36,605	55,841	47,024	51,697	47,933
Dec.	55,182	58,266	86,470	130,798	125,893	73,931	27,459	29,154	37,942	46,909	64,441	45,536	24,228	15,329	20,480	27,772	25,130	18,081
Total.	855,589	941,125	1,197,129	1,430,408	1,490,925	1,373,114	327,121	380,620	487,022	615,635	529,562	710,058	410,249	357,823	357,137	336,968	416,408	315,977

FORT WORTH, TEX.

Month.	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
Jan.	70,985	48,836	100,260	126,710	108,489	66,930	31,677	19,991	48,462	74,022	67,524	26,577	....	17,220	11,220	22,107	13,690	25,457
Feb.	60,516	42,495	77,744	78,977	37,793	50,626	22,040	17,023	45,401	46,559	21,399	16,119	....	14,160	13,290	14,949	9,160	23,675
Mar.	56,231	58,225	93,057	94,611	59,880	60,343	25,597	22,921	41,820	46,609	27,470	25,261	....	19,320	20,940	27,940	19,461	24,429
Apr.	64,235	98,754	141,128	143,406	108,118	87,900	21,698	19,999	55,407	53,038	42,648	35,656	....	55,200	38,460	51,419	40,632	34,365
May	95,181	101,723	218,572	119,220	115,892	121,218	33,205	34,958	111,605	50,175	62,786	55,928	....	31,770	32,310	39,679	32,884	17,911
June	95,828	100,712	157,355	123,506	98,893	145,958	45,252	50,091	87,696	66,182	68,310	71,553	....	21,390	23,910	40,896	10,361	12,054
July	90,816	81,977	172,811	182,174	149,103	137,480	46,746	45,860	98,367	106,048	113,857	70,401	....	17,730	26,520	20,879	7,627	13,069
Aug.	60,096	90,043	182,213	155,346	112,733	104,100	26,702	52,907	83,244	100,147	70,180	58,278	....	16,440	36,300	56,580	16,646	17,181
Sept.	80,045	92,547	222,169	185,298	103,780	104,151	24,614	42,545	100,963	113,956	69,479	63,173	....	26,820	73,740	29,040	22,636	23,555
Oct.	93,454	127,641	247,137	184,077	129,355	95,087	25,477	50,699	120,049	119,026	59,356	51,792	....	38,310	64,890	36,331	47,727	32,764
Nov.	113,032	137,103	209,554	144,994	138,904	107,304	34,870	62,984	116,639	94,544	65,325	54,434	....	34,530	56,490	31,547	63,372	35,979
Dec.	63,982	100,466	137,537	126,660	103,695	53,226	23,982	53,653	81,670	83,732	46,756	28,403	....	18,930	38,745	21,129	42,787	17,609
Total.	944,431	1,080,522	1,959,537	1,665,009	1,266,635	1,134,323	361,860	473,641	991,323	954,038	715,090	557,575	....	311,820	436,845	392,496	326,983	278,048

SIOUX CITY, IOWA.

Jan......	46,500	51,261	57,710	66,320	84,119	75,635	22,420	24,604	29,486	25,900	34,988	34,769	11,638	19,436	21,798	16,349	25,530	19,509
Feb......	33,319	47,172	42,194	49,162	54,719	61,181	20,420	18,241	20,762	24,655	24,447	29,626	7,793	19,475	11,731	13,361	17,303	18,451
Mar......	45,438	48,674	49,020	76,912	53,879	62,276	23,330	18,732	19,927	30,897	24,329	29,195	15,949	25,432	21,308	29,189	17,929	14,850
Apr......	40,640	36,590	47,877	74,989	56,453	59,802	18,841	17,817	22,493	35,538	26,631	28,641	19,259	19,241	27,085	23,549	20,128	15,354
May.....	30,254	46,814	62,371	58,695	61,505	56,085	18,838	18,072	23,578	31,691	28,059	23,054	11,910	23,817	29,919	27,218	26,656	14,241
June.....	30,852	42,724	60,138	49,640	60,610	43,390	18,492	15,101	20,217	23,799	25,344	20,965	10,593	26,119	34,283	22,517	26,190	12,939
July.....	33,747	25,481	40,412	54,712	48,360	36,730	17,557	10,617	17,660	36,397	27,420	18,167	14,658	13,261	20,542	14,309	12,060	11,685
Aug......	35,277	40,634	37,844	51,552	44,883	60,453	16,409	14,845	21,088	25,348	20,422	26,970	12,809	21,713	13,333	15,691	17,979	17,232
Sept.....	53,529	64,425	73,237	88,037	91,620	94,836	19,172	15,722	29,085	43,710	30,858	37,328	29,840	46,176	35,850	33,936	46,081	32,290
Oct......	64,242	92,216	103,370	95,871	95,969	83,125	19,403	28,390	31,384	38,142	41,437	32,713	44,022	58,121	55,72[illegible]	18,574	57,035	42,376
Nov......	67,209	58,692	81,451	73,797	85,250	71,380	24,002	27,310	30,222	33,960	36,103	35,140	34,301	31,697	46,215	31,701	39,738	23,837
Dec......	53,147	49,954	51,091	77,915	75,723	46,765	25,318	23,344	26,947	35,216	42,522	25,696	19,639	23,633	23,748	26,538	22,355	15,507
Total.	534,154	601,667	706,718	817,593	814,093	751,658	214,202	232,795	295,849	385,253	362,570	342,261	232,411	328,121	347,551	302,926	328,981	238,271

JERSEY CITY, N. J.

Jan......	36,371	58,592	65,438	37,373	61,312	72,946	36,371	58,592	65,438	37,373	61,312	72,946	....	....	....	....	....	....
Feb......	18,450	50,770	57,279	39,344	56,738	62,856	18,450	50,770	57,279	39,344	56,738	62,856	....	....	....	....	....	....
Mar......	30,551	58,733	64,194	48,863	48,360	79,602	30,551	58,733	64,194	48,863	48,360	79,602	....	....	....	....	....	....
Apr......	51,608	83,398	84,767	81,391	64,092	81,230	51,608	83,398	84,767	81,391	64,092	81,136	....	....	....	....	....	....
May.....	51,625	76,611	72,673	69,318	75,645	60,970	51,625	76,641	72,673	69,318	75,645	60,970	....	....	....	....	....	....
June.....	44,681	69,151	67,625	62,802	63,317	68,956	44,681	69,151	67,625	62,892	63,317	68,927	....	....	....	....	....	....
July.....	48,392	58,626	50,619	55,970	73,521	70,788	48,392	58,626	50,649	55,970	73,521	70,788	....	....	....	....	....	....
Aug......	39,471	51,921	62,914	46,693	54,142	65,630	39,471	51,921	62,914	46,693	54,142	65,630	....	....	....	....	....	....
Sept.....	45,418	68,428	64,152	52,034	55,443	77,616	45,418	68,428	64,152	52,034	55,443	77,616	....	....	....	....	....	....
Oct......	43,590	61,121	66,013	46,215	71,942	66,886	43,590	61,121	66,013	46,215	71,942	66,853	....	....	....	....	....	....
Nov......	38,520	64,246	55,462	58,218	60,594	65,018	38,520	64,246	55,462	58,218	60,560	65,018	....	....	....	....	....	....
Dec......	42,454	53,714	46,810	51,399	59,754	69,756	42,454	53,714	46,810	51,399	59,754	69,756	....	....	....	....	....	....
Total.	491,131	746,341	754,976	619,620	744,860	833,254	491,131	746,341	751,976	649,620	744,826	833,098	....	....	....	....	....	....

TABLE 15.—*Cattle and calves: Monthly and yearly receipts, slaughter and stocker and feeder shipments at public stockyards, 1915 to 1920 (number of animals)*—Continued.

ST. JOSEPH, MO.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
Jan	41,754	38,727	48,319	73,767	80,242	70,582	19,277	21,727	32,345	43,988	54,966	41,342	5,706	6,330	8,792	8,436	11,000	9,712
Feb	32,280	31,494	36,977	66,367	53,376	55,108	20,832	20,070	25,233	32,655	34,610	35,517	5,932	6,309	7,803	6,602	8,182	6,841
Mar	35,411	35,932	37,281	64,311	44,989	53,027	23,335	23,585	26,530	35,852	29,702	30,448	4,162	5,746	6,144	7,754	8,414	6,357
Apr	27,167	24,795	38,492	76,910	46,489	50,956	16,478	17,128	29,470	44,954	29,309	29,473	4,961	4,541	5,481	7,120	6,739	7,457
May	29,326	32,160	55,097	47,816	41,217	45,482	22,501	24,423	36,712	32,737	30,185	28,000	2,689	3,476	10,661	4,841	6,577	3,532
June	31,683	33,527	41,142	42,705	35,561	52,472	25,074	23,222	31,880	34,305	23,740	34,788	3,068	3,947	5,355	3,187	3,807	5,108
July	27,791	28,025	46,117	62,182	48,041	38,078	21,632	23,179	36,625	50,775	40,875	26,957	3,620	3,503	3,667	7,120	3,237	5,521
Aug	40,463	45,769	52,209	68,825	65,367	54,560	25,981	32,913	36,112	48,839	47,002	38,556	5,391	10,852	10,234	12,747	12,361	8,391
Sept	45,291	51,094	72,921	94,223	79,214	70,025	25,038	30,887	50,227	62,113	55,718	45,598	15,261	16,405	16,574	18,705	16,409	14,658
Oct	49,116	64,258	107,108	94,655	100,781	58,904	24,013	43,107	63,030	61,246	69,049	33,669	16,945	16,300	24,273	16,862	24,796	19,615
Nov	46,177	51,013	73,016	97,505	83,507	57,765	24,045	37,890	47,976	64,461	62,812	39,669	11,271	9,982	18,808	13,434	14,408	9,428
Dec	35,012	40,152	61,488	80,622	71,337	35,910	18,847	29,963	42,412	57,175	50,132	26,037	10,263	7,481	8,792	8,708	8,166	6,344
Total	441,471	479,946	670,167	869,888	750,151	642,899	267,083	331,124	458,552	569,110	531,100	410,054	89,269	91,872	126,584	115,516	124,096	102,964

INDIANAPOLIS, IND.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
Jan	21,269	29,960	49,659	35,693	46,853	44.321	13,295	15,714	24,403	20,015	26,024	23,349	....	4,219	3,263	1,412	4,581	2,813
Feb	19,500	27,875	36,346	37,073	39,483	34,960	12,410	14,270	19,042	18,453	20,524	17,532	....	3,762	2,759	3,765	3,434	2,964
Mar	23,918	31,302	34,051	42,011	39,107	49,439	14,758	17,675	18,035	18,036	16,973	27,527	....	3,195	2,921	3,451	3,751	2,703
Apr	23,870	26,362	37,463	45,139	41,266	46,362	15,796	14,164	20,811	25,091	22,921	21,588	....	3,302	2,582	3,060	3,175	2,945
May	24,275	33,997	47,548	47,010	44,760	47,069	15,567	18,515	23,681	23,349	22,309	21,672	....	2,890	2,080	3,268	3,276	3,017
June	25,379	31,988	41,732	48,431	40,713	53,620	16,159	16,145	21,689	23,862	18,672	24,429	....	2,683	3,364	5,424	3,710	5,216
July	29,202	28,619	37,760	44,495	50,663	50,416	14,639	15,320	21,865	25,769	23,251	19,957	....	2,997	2,721	4,570	3,914	3,331
Aug	35,739	39,036	41,151	42,612	43,413	58,052	16,954	19,267	23,262	23,666	19,150	23,625	....	3,294	3,856	6,641	3,653	4,434
Sept	43,966	37,022	42,070	45,030	42,524	59,379	15,316	17,574	21,442	22,175	21,847	21,810	....	6,004	5,890	8,400	4,375	5,216
Oct	45,516	40,154	49,837	42,228	44,469	59,238	12,988	21,015	27,566	24,140	18,720	18,502	....	5,219	6,824	6,461	5,899	6,171
Nov	31,891	38,796	44,799	39,531	38,512	54,406	13,935	19,775	26,342	22,610	15,209	19,509	....	4,496	6,132	5,167	5,644	5,512
Dec	27,216	39,958	38,740	34,934	40,554	39,832	13,707	18,701	21,614	21,262	19,660	17,105	....	3,352	3,800	4,103	4,621	3,353
Total	351,741	405,069	501,156	504,190	515,347	597,097	175,524	208,135	269,752	268,428	245,263	256,605	....	45,413	46,192	55,722	50,033	47,705

BUFFALO, N. Y.[1]

Jan......	25,080	32,075	40,240	49,859	53,052	55,028	....	15,001	16,514	14,133	16,169	12,958	....	477	622	575	420	318
Feb......	16,079	33,471	29,074	39,584	52,412	47,064	....	11,900	12,580	12,274	14,181	14,386	....	496	139	381	1,191	812
Mar......	25,789	36,409	37,257	50,426	74,297	54,531	....	14,980	15,666	16,029	18,162	20,858	....	978	559	772	1,062	335
Apr......	32,315	44,058	46,278	60,094	67,945	53,790	....	21,293	21,083	22,035	19,547	17,819	....	1,013	979	1,521	1,692	774
May......	35,071	43,073	41,399	52,680	62,398	55,104	....	15,674	17,230	19,236	19,644	16,051	....	1,112	461	798	1,166	393
June.....	30,675	38,171	38,951	56,898	53,599	66,579	....	15,554	16,279	15,676	17,107	17,490	....	962	781	2,118	1,142	819
July.....	28,370	32,110	44,377	49,545	59,236	63,065	....	13,857	16,635	18,655	17,070	16,312	....	900	2,002	2,429	2,737	911
Aug......	31,750	37,491	38,856	55,867	67,292	60,109	....	13,807	16,530	16,750	16,543	16,068	....	2,556	2,063	3,608	5,461	1,628
Sept.....	25,076	43,970	49,259	68,783	56,127	55,630	....	17,401	22,248	20,141	15,856	15,041	....	4,053	4,542	5,558	5,814	1,443
Oct......	42,029	51,093	56,212	58,638	76,503	55,029	....	20,722	20,316	17,506	15,935	13,859	....	7,146	6,191	6,581	6,868	1,892
Nov......	43,805	46,360	55,880	71,927	74,211	65,925	....	19,154	20,002	16,908	16,446	17,631	....	4,830	4,596	5,170	8,422	3,557
Dec......	26,200	38,614	53,252	53,370	51,957	44,822	....	17,361	16,660	15,964	15,640	11,883	....	1,557	1,893	1,910	3,121	958
Total.	362,239	476,895	531,035	667,671	749,029	676,676	....	196,704	211,743	205,307	202,300	190,356	....	26,080	24,828	31,421	39,096	13,840

PITTSBURGH, PA.

Jan......	27,390	13,269	46,951	40,719	34,008	48,979	4,170	4,820	12,188	12,202	11,499	10,730	....	....	....	....	....	....
Feb......	23,020	10,121	45,271	42,806	27,433	41,391	1,070	6,031	11,548	10,823	11,168	10,314	....	....	....	....	....	....
Mar......	28,000	10,580	38,469	34,774	26,256	46,216	3,960	6,160	12,945	12,966	12,895	14,965	....	....	....	....	....	....
Apr......	28,280	13,104	42,613	29,427	33,056	43,057	7,240	7,490	14,328	15,385	14,584	15,747	....	....	....	....	....	....
May......	32,780	15,565	39,712	32,994	44,999	55,276	6,720	8,639	15,490	15,512	16,186	17,419	....	....	....	....	....	....
June.....	24,260	12,495	37,390	41,984	49,098	56,535	3,300	6,066	14,954	16,824	14,757	17,131	....	....	....	....	....	....
July.....	28,330	15,542	51,370	49,008	73,262	70,568	2,640	8,559	14,070	12,865	14,833	14,830	....	....	....	....	....	....
Aug......	36,940	14,710	50,756	48,233	66,373	78,652	5,600	8,205	13,956	14,849	13,945	14,939	....	....	....	....	....	....
Sept.....	31,920	15,532	59,428	59,418	73,215	81,262	5,080	8,520	14,598	15,056	14,578	14,244	....	....	....	....	....	....
Oct......	28,230	19,716	55,663	58,184	75,076	85,759	2,580	11,383	16,030	12,848	11,502	14,677	....	....	....	....	....	....
Nov......	26,120	16,699	46,844	48,878	61,540	75,332	5,370	9,459	12,310	12,954	5,626	13,102	....	....	....	....	....	....
Dec......	23,110	11,550	45,103	36,258	51,947	49,743	3,080	6,372	15,519	10,879	9,414	12,543	....	....	....	....	....	....
Total.	338,380	168,883	559,570	522,683	616,263	732,770	50,810	91,704	167,936	163,163	150,987	170,641	....	....	....	....	....	....

[1] Disposition not obtainable for 1915.

TABLE 15.—*Cattle and calves: Monthly and yearly receipts, slaughter and stocker and feeder shipments at public stockyards, 1915 to 1920 (number of animals)*—Continued.

DENVER, COLO.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
Jan.	23,031	39,562	40,587	55,776	61,766	76,823	4,837	5,756	8,967	15,720	16,578	12,637	....	25,210	24,196	25,668	36,843	65,177
Feb.	10,955	14,562	23,715	28,969	34,871	28,696	4,746	5,081	9,245	13,197	10,945	10,819	....	6,575	10,465	8,083	19,348	14,132
Mar.	17,007	27,067	28,355	35,868	35,217	31,981	5,624	6,118	9,653	12,728	13,771	13,195	....	16,436	11,994	15,867	17,013	10,981
Apr.	20,472	24,752	26,119	51,233	39,317	30,172	4,952	5,701	8,853	15,772	12,062	11,258	....	15,362	13,436	23,117	20,733	13,475
May.	44,122	80,816	95,014	81,451	99,193	88,962	5,262	6,851	8,857	13,117	9,823	10,448	....	71,285	75,465	65,392	81,624	75,363
June.	39,995	76,314	74,579	91,185	58,591	69,863	5,199	6,314	7,808	10,384	10,077	13,927	....	69,454	67,911	73,615	50,477	58,357
July.	28,053	19,316	32,682	29,464	32,361	26,654	4,792	6,113	6,572	11,568	13,549	11,217	....	12,457	24,571	16,259	12,866	15,095
Aug.	20,512	25,733	16,918	28,807	43,330	23,748	6,520	7,641	7,456	12,623	14,912	11,035	....	11,460	6,894	8,256	14,615	8,307
Sept.	34,666	46,535	38,799	61,119	61,832	40,747	6,003	9,160	10,559	20,335	14,343	16,420	....	17,134	10,689	18,388	25,376	12,695
Oct.	79,200	109,676	99,060	93,423	119,595	74,527	6,382	12,346	17,435	19,617	21,319	15,885	....	61,165	52,397	46,621	61,502	48,436
Nov.	81,564	99,143	117,933	113,833	136,039	93,390	7,184	10,823	21,671	22,910	18,979	15,511	....	54,107	70,081	68,999	84,090	63,691
Dec.	24,761	37,984	59,616	57,140	101,615	31,002	4,487	7,136	14,331	17,072	17,992	10,577	....	24,942	28,936	31,945	58,839	21,314
Total.	424,341	601,460	653,377	728,268	823,727	616,565	65,988	89,040	131,407	185,043	174,350	152,959	....	385,587	397,035	402,210	483,326	407,026

CINCINNATI, OHIO.

Month.	Receipts 1915	1916	1917	1918	1919	1920	Local slaughter 1915	1916	1917	1918	1919	1920	Stocker and feeder shipments 1915	1916	1917	1918	1919	1920
Jan.	18,142	24,863	31,731	24,328	35,068	33,623	14,888	17,623	23,345	20,112	27,467	23,626	....	1,501	1,269	399	1,516	1,480
Feb.	12,141	21,102	28,770	23,011	29,458	27,915	9,760	15,261	21,044	18,150	23,380	19,473	....	1,227	1,691	823	1,826	1,386
Mar.	19,210	25,981	28,962	30,349	33,909	37,867	13,703	20,728	21,935	20,850	23,970	26,283	....	2,417	1,072	3,142	1,793	1,253
Apr.	17,609	22,663	29,846	36,318	37,270	35,916	13,560	17,837	24,312	25,761	25,881	23,102	....	672	1,017	2,891	2,390	1,544
May.	19,530	25,161	30,803	34,731	36,858	38,196	13,874	20,082	24,897	24,597	25,381	23,971	....	1,285	721	1,608	2,262	1,679
June.	16,804	23,016	32,587	39,104	30,597	41,811	14,292	18,366	24,528	25,359	21,676	25,952	....	1,651	1,269	1,675	1,122	1,917
July.	19,960	22,232	34,985	44,255	44,229	40,379	15,451	15,037	24,543	27,266	28,705	21,752	....	1,642	1,097	2,163	1,241	1,858
Aug.	31,055	33,539	47,274	47,335	43,288	41,796	19,827	19,058	28,397	27,306	24,768	25,330	....	2,142	2,727	2,112	1,935	3,073
Sept.	34,043	37,859	49,927	52,712	47,448	43,756	19,359	20,817	26,602	32,540	26,236	28,038	....	4,105	3,007	4,674	3,777	3,988
Oct.	36,276	45,385	62,042	48,836	51,553	36,967	18,611	24,136	32,193	27,232	31,417	22,511	....	4,143	4,910	5,206	4,559	3,261
Nov.	32,581	38,913	47,070	41,606	35,962	38,074	18,315	23,321	28,381	27,912	21,393	25,156	....	2,801	2,522	3,312	3,322	4,918
Dec.	23,771	31,326	28,839	32,703	34,847	21,744	14,989	20,846	19,264	25,716	25,039	18,003	....	2,057	867	1,767	2,629	1,392
Total.	281,122	352,040	452,836	455,291	460,487	441,014	186,629	233,112	299,471	302,801	305,313	283,197	....	25,643	22,169	29,772	28,372	27,749

OKLAHOMA, OKLA.

Jan.	18,395	13,723	41,194	40,876	59,262	35,270	11,804	9,550	32,808	31,659	46,971	20,401	....	3,438	7,014	7,618	8,018	8,458
Feb.	17,539	12,087	29,808	25,699	26,826	24,899	12,149	7,296	19,383	17,991	15,334	11,682	....	3,812	6,464	7,442	8,366	7,326
Mar.	19,283	17,687	31,742	28,866	28,359	32,883	11,688	11,091	16,891	15,229	15,069	12,789	....	5,224	10,178	11,726	10,056	10,201
Apr.	14,927	16,087	39,229	38,349	42,797	32,044	9,798	7,736	24,736	20,752	17,240	19,591	....	5,656	12,668	11,786	18,100	9,635
May.	17,677	17,341	56,373	46,307	43,569	32,560	11,874	10,880	49,504	31,920	25,933	18,421	....	5,285	7,611	11,574	9,030	10,600
June.	17,011	25,920	55,292	47,224	36,448	33,590	13,365	19,924	41,610	36,113	26,785	21,362	....	3,296	12,308	8,394	4,358	4,855
July.	18,606	31,885	57,297	79,918	69,951	31,677	13,764	25,373	23,443	53,681	54,068	20,543	....	4,368	14,474	7,617	10,310	5,709
Aug.	19,400	37,759	56,671	70,111	50,076	39,845	12,604	28,512	40,386	56,123	33,174	20,963	....	8,568	20,011	14,166	14,057	8,425
Sept.	23,688	32,702	65,133	85,345	58,332	40,948	9,405	20,895	40,772	57,596	30,054	26,722	....	12,454	24,965	22,569	18,479	10,113
Oct.	22,978	44,157	82,562	73,502	66,926	36,240	9,108	27,714	50,332	55,479	39,181	17,691	....	15,353	31,598	18,473	12,686	12,869
Nov.	23,014	47,249	61,700	83,589	63,160	36,969	7,201	33,140	41,561	49,078	37,026	19,656	....	12,624	17,005	21,148	12,452	11,249
Dec.	14,309	28,256	43,174	62,323	47,576	22,781	7,035	18,573	33,747	102,603	26,736	17,763	....	8,298	7,952	9,338	10,020	6,882
Total.	226,827	324,853	620,175	690,109	593,282	399,706	129,795	220,684	415,173	528,224	367,574	227,581	....	88,376	172,248	154,881	135,962	106,322

CLEVELAND, OHIO.

Jan.	7,060	10,873	29,466	25,068	23,237	24,131	6,990	9,778	17,411	16,435	18,352	18,582	....	....	45	59	333	....
Feb.	7,239	12,491	21,955	24,062	22,222	19,509	6,737	11,706	14,977	16,212	19,223	16,892	....	....	138	173	264	160
Mar.	11,189	14,822	24,199	27,187	27,360	24,290	10,451	13,697	17,935	18,735	21,058	19,802	....	....	161	276	517	....
Apr.	10,655	16,052	23,170	30,071	30,141	27,036	9,963	14,743	18,711	23,996	23,772	23,856	....	....	181	134	690	59
May.	11,417	15,406	26,662	27,852	26,631	18,696	11,006	13,921	23,570	20,388	22,836	16,623	....	....	90	380	598	68
June.	10,407	14,689	20,994	26,066	21,375	23,510	9,847	12,990	16,610	20,561	17,882	18,917	....	....	454	261	705	617
July.	10,137	11,230	21,479	26,365	25,622	26,268	9,367	10,355	16,883	21,108	20,612	20,488	....	....	301	187	487	162
Aug.	11,041	15,452	23,931	22,443	29,746	28,061	9,761	14,605	19,810	16,692	22,654	20,111	....	....	419	327	809	602
Sept.	9,609	15,776	22,928	28,164	25,452	24,071	8,343	14,228	18,619	17,235	20,678	18,668	....	....	491	579	776	677
Oct.	11,475	19,348	31,400	22,951	24,641	26,815	10,045	17,566	22,950	18,338	19,974	19,457	....	....	657	845	564	136
Nov.	12,573	18,806	23,552	20,595	23,850	21,453	10,645	15,909	19,188	16,691	18,272	19,050	....	....	315	456	261	420
Dec.	9,541	16,382	26,177	21,030	24,281	17,414	7,886	14,802	16,940	16,778	18,573	15,850	....	....	107	335	38	195
Total.	122,343	181,327	295,913	301,854	304,558	281,254	111,041	164,300	223,104	223,169	243,886	228,296	....	....	3,359	4,012	6,043	3,096

TABLE 16.—*Beef and beef products: Yearly exports and imports, United States, 1910–1920.*[1]

[In millions of lbs.; i. e., 000,000 omitted.]

Calendar year.	Exports.						Imports.[2]	
	Beef.			Tallow.	Oleo oil.	Total beef and beef products.	Beef and veal.	Tallow.
	Fresh.	Canned.	Pickled and other cured.					
1910	56	12	35	16	105	224	....	....
1911	29	11	42	46	163	291	....	....
1912	9	9	29	29	94	170	....	....
1913	7	4	25	28	101	165	....	....
1914	31	31	24	10	85	181	254	....
1915	263	70	43	27	109	511	119	....
1916	182	54	37	15	84	372	40	....
1917	216	66	68	8	33	391	22	....
1918	514	141	44	4	69	772	23	....
1919	174	54	43	39	76	386	39	12
1920	90	24	26	21	74	235	50	14

[1] Compiled from Monthly Summary of Foreign Commerce.
[2] Beef and veal imports not separately reported prior to 1914 and tallow prior to 1919.

TABLE 17.—*Beef products:*[1] *Monthly and yearly exports, all products combined, United States, 1910 to 1920.*[2]

[In millions of lbs.; i. e., 000,000 omitted.]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	17	17	14	13	11	33	22	33	43	42	31	25
February	19	16	16	14	9	35	28	26	32	31	20	22
March	24	23	19	16	11	41	26	36	87	27	18	30
April	20	31	20	14	14	50	33	52	73	40	30	34
May	19	40	16	16	15	40	35	52	97	29	25	35
June	23	33	14	20	13	71	54	33	91	44	28	39
July	18	29	17	15	12	50	28	20	54	25	19	26
August	19	26	16	13	11	43	25	42	69	28	9	27
September	16	25	11	12	17	40	26	32	49	25	11	24
October	15	21	10	11	17	29	36	18	44	46	15	24
November	18	15	8	11	32	37	32	11	84	29	14	26
December	16	15	9	10	19	42	27	36	49	20	15	24
Total	224	291	170	165	181	511	372	391	772	386	235	336

[1] These figures include fresh, canned, pickled, and other cured beef; tallow and oleo oil.
[2] Compiled from Monthly Summary of Foreign Commerce.

TABLE 18.—*Beef: Monthly and yearly exports of beef and beef products, United States, 1910 to 1920.*[1]

[In millions of lbs.; i. e., 000,000 omitted.]

FRESH BEEF.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	6	3	1	1	1	15	10	17	31	17	23	11
February	7	2	2	(2)	(2)	18	18	15	16	14	13	10
March	6	3	1	1	(2)	15	14	17	62	15	6	13
April	5	3	(2)	1	(2)	26	14	32	52	22	18	16
May	4	5	1	(2)	1	20	15	28	60	15	4	14
June	5	3	(2)	1	1	49	40	17	59	15	13	18
July	4	3	1	(2)	(2)	21	17	13	32	8	6	10
August	3	2	1	1	1	26	4	26	45	8	(2)	11
September	3	2	1	1	7	18	7	21	34	7	2	9
October	4	1	(2)	(2)	1	11	17	9	26	31	(2)	9
November	5	1	1	(2)	12	17	14	3	63	16	3	12
December	4	1	(2)	1	7	27	12	18	34	6	2	10
Total	56	29	9	7	31	263	182	216	514	174	90	143

[1] Compiled from Monthly Summary of Foreign Commerce. [2] Less than 500,000 lbs.

TABLE 18.—*Beef: Monthly and yearly exports of beef and beef products, United States, 1910 to 1920*—Continued.[1]

PICKLED AND OTHER CURED.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	3	3	2	2	2	2	3	9	7	6	2	4
February	3	3	3	2	2	2	2	6	3	4	2	3
March	3	3	3	3	2	3	2	7	1	4	2	3
April	2	4	3	2	2	2	3	6	3	3	2	3
May	2	3	3	2	2	7	2	3	6	3	3	3
June	2	4	2	2	2	3	2	5	2	5	2	3
July	3	4	2	2	2	9	3	2	3	3	2	3
August	4	4	3	2	2	2	3	8	2	3	2	3
September	4	4	2	2	2	4	3	5	3	3	2	3
October	3	4	2	3	1	3	2	5	6	3	2	3
November	3	3	2	2	2	3	6	5	4	3	2	3
December	3	3	2	1	3	3	6	7	4	3	3	4
Total	35	42	29	25	24	43	37	68	44	43	26	38

CANNED BEEF.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	1	1	1	([2])	1	8	1	2	4	13	1	3
February	1	1	1	1	([2])	7	2	4	10	8	1	3
March	1	1	1	1	([2])	7	2	5	12	3	1	3
April	([2])	([2])	([2])	1	([2])	8	6	9	12	3	2	4
May	1	([2])	1	([2])	([2])	7	12	13	17	6	6	6
June	1	1	1	([2])	([2])	10	4	8	18	7	7	5
July	1	1	1	([2])	1	9	3	3	13	5	5	4
August	1	1	1	1	3	3	6	5	17	3	1	4
September	1	1	([2])	([2])	3	1	4	2	7	1	([2])	2
October	1	1	([2])	([2])	9	3	7	3	10	2	([2])	3
November	2	2	1	([2])	9	5	4	2	13	1	([2])	3
December	1	1	1	([2])	5	2	3	10	8	2	([2])	3
Total	12	11	9	4	31	70	54	66	141	54	24	43

TALLOW.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	2	1	3	4	1	2	1	1	([2])	([2])	1	2
February	1	1	3	5	1	2	1	1	([2])	1	2	2
March	1	1	2	2	1	5	1	1	1	1	2	2
April	1	3	3	3	1	4	1	1	([2])	5	1	2
May	1	7	3	1	1	2	1	1	2	3	1	2
June	2	9	2	3	1	1	([2])	1	([2])	5	2	2
July	2	7	3	3	1	2	1	([2])	1	4	2	2
August	1	4	3	3	([2])	3	3	1	([2])	6	2	2
September	2	4	2	1	([2])	3	2	1	([2])	7	1	2
October	1	2	2	1	1	2	2	([2])	([2])	3	2	1
November	1	2	1	1	1	1	1	([2])	([2])	1	2	1
December	1	5	2	1	1	([2])	1	([2])	([2])	3	3	2
Total	16	46	29	28	10	27	15	8	4	39	21	22

OLEO OIL.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	5	9	8	5	7	5	6	4	1	6	4	5
February	7	9	7	6	5	6	6	1	3	4	3	5
March	12	15	12	10	8	11	8	6	11	4	6	9
April	11	20	12	8	10	11	9	3	6	8	8	10
May	11	25	9	11	12	5	5	7	13	3	11	10
June	14	16	9	15	10	9	7	2	13	12	4	10
July	9	15	10	10	8	9	5	2	4	4	4	7
August	10	15	8	7	4	8	9	3	5	8	4	7
September	7	14	5	8	5	13	10	4	5	7	6	8
October	5	12	6	7	5	10	8	([2])	1	7	10	7
November	7	7	4	7	7	12	6	([2])	3	7	7	6
December	7	6	4	7	4	10	5	1	4	6	7	6
Total	105	163	94	101	85	109	84	33	69	76	74	90

[1] Compiled from Monthly Summary of Foreign Commerce. [2] Less than 500,000 pounds.

TABLE 19.—*Beef:*[1] *Yearly exports, United States.*[2]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	Year ending June 30.									Calendar years.		
	1910[3]	1911	1912	1913	1914	1915	1916	1917	1918	1918	1919	1920
Belgium	3,271	3,909	4,852	2,328	3,755	2,481	4,546	20,347	31,236	27,108	24,620	37,759
France	409	249	532	153	68	106,455	59,614	58,207	67,816	87,168	6,427	1,196
Germany	33,943	33,170	22,768	20,722	17,951	1,393	1	....	....	1,052	2,127	31,337
Italy	858	831	971	409	438	11,872	53,588	14,019	26,933	55,553	39,814	642
Netherlands	48,043	68,694	67,884	47,073	47,751	35,234	29,858	13,069	....	....	6,829	38,093
Sweden	2,303	2,293	3,353	2,448	2,014	6,690	9,922	2,248	13	2,240	9,025	3,342
United Kingdom	111,699	63,068	33,323	17,183	14,551	144,554	198,276	205,156	384,614	558,344	113,383	29,587
Canada	1,677	2,107	2,461	1,517	1,987	2,503	8,366	35,213	45,438	13,240	4,347	6,753
Newfoundland and Labrador	7,739	7,476	7,037	5,225	6,219	5,457	7,105	8,986	7,719	7,499	7,567	7,024
Other countries	43,555	50,519	47,665	35,851	35,408	41,402	51,502	32,632	14,678	16,907	132,545	58,115
Total	253,497	232,316	190,846	132,909	130,142	358,041	422,778	389,877	578,447	769,111	346,684	213,848

[1] Includes canned, fresh, pickled, and other cured beef, and oleo oil.
[2] Compiled from Monthly Summary of Foreign Commerce.
[3] For 1910 oleo oil includes neutral lard.

TABLE 20.—*Beef, fresh, chilled, and frozen: Yearly exports by principal countries.*

[In thousands of pounds; i. e., 000 omitted.]

Exported by—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Argentina	559,325	689,674	755,849	807,388	813,427	799,694	942,907	870,458	1,092,631	883,452
Australia	109,428	108,786	142,210	218,919	[1] 292,066	[1] 114,676	[1] 242,082	[1] 180,249	[1] 119,990	....
Brazil	....	....	....	....	....	18,770	74,209	146,500	133,397	113,831
British South Africa	37	240	312	165	488	5,986	17,687	47,256	18,656	44,409
Denmark	35,854	27,466	57,853	33,241	38,089	50,181	34,220	35,370	21,337	....
France	6,854	6,789	7,292	12,212	5,715	[2] 1,626	[2] 2,177	2,056	1,547	3,065
Netherlands	34,778	32,890	40,354	40,328	32,865	45,646	33,382	3,741	53	35,648
New Zealand	57,083	27,307	30,803	30,636	69,927	86,477	112,071	99,740	81,960	....
Sweden	3,731	19,720	17,609	8,604	12,280	16,521	7,186	6,148	10	3,693
United States	55,539	28,782	9,026	6,850	31,422	262,813	181,977	216,420	514,342	174,427
Uruguay	20,719	[1] 16,933	[1] 44,847	[1] 109,268	153,016	215,115	157,568	158,398	....	....

[1] Year beginning July 1.
[2] Includes some "other than beef."

TABLE 21.—*Beef and veal: Yearly imports, United States.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Imported from—	1914	1915	1916	1917	1918	1919	1920
United Kingdom	51,245	6	....	....	....	....	....
Canada	18,446	9,934	10,431	18,844	14,910	31,125	37,489
Argentina	117,094	99,658	21,580	733	2,621	261	2,428
Uruguay	38,713	432	116	87	16	94	1,090
Australia	26,090	1,565	....	502	269	1,528	2,268
Other countries	2,731	6,995	7,645	1,906	5,523	5,454	6,907
Total	254,319	118,590	39,772	22,072	23,339	38,462	50,182

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 22.—*Beef, fresh, chilled, and frozen: Yearly imports by principal countries.*

[In thousands of pounds; i. e., 000 omitted.]

Imported by—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Austria-Hungary	95	10,465	3,374	158	....	....	....	....	....	....
British South Africa	1,150	8,246	6,154	5,043	1,504	35	12	17	4	4
Canada	1,312	874	198	4,450	2,279	1,916	4,228	14,663	2,233	1,400
Cuba	111	48	52	76	136	34	17	65	147	....
Denmark	195	1,164	988	415	1,387	1,297	....	....	....	....
France	3,074	5,522	5,250	5,098	33,747	381,614	460,763	414,366	458,494	526,101
Germany	34,994	39,734	79,114	66,746	....	....	....	....	....	....
Netherlands	274	348	2,317	7,413	3,768	1,083	85	5	12	35,992
Sweden	791	843	1,157	1,442	453	52	82	291	10,755	....
Switzerland	3,243	5,371	5,653	4,472	2,109	472	1,276	583	3	126
United Kingdom	785,736	824,443	896,652	1,030,771	990,591	963,389	789,826	681,796	844,055	721,274
United States	....	....	....	35,822	254,319	118,590	39,772	22,072	23,339	38,462

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920.*

CHICAGO.

Week ending—	Beef cattle. Good to prime.	Beef cattle. Common and medium.	Butcher stock. Heifers. Good and choice.	Butcher stock. Heifers. Common and medium.	Butcher stock. Cows. Good and choice.	Butcher stock. Cows. Common and medium.	Butcher stock. Bulls, bologna and beef.	Canners and cutters.	Stocker and feeder steers. Good, choice, and selected.	Stocker and feeder steers. Common and medium.	Veal calves, good and choice.	Western range cattle. Beef steers, medium to choice.	Western range cattle. Cows and heifers, medium to choice.
1918.													
June 8	$17.40	$14.56	$12.88	$9.75	$12.88	$9.75	$11.38	......	$11.13	......	......	......	......
15	17.26	14.58	13.00	9.50	12.75	9.35	11.23	$7.75	12.60	$10.15	$15.53	......	......
22	17.11	14.20	12.75	9.00	12.50	8.75	10.55	7.17	12.13	9.75	16.18	......	......
29	17.23	14.21	12.40	9.00	12.00	8.75	10.60	7.34	11.88	9.38	16.35	......	......
July 6	17.27	14.16	12.75	9.53	12.38	9.35	10.63	7.36	11.71	9.21	16.55	......	......
13	17.34	14.17	12.85	9.54	12.52	9.46	10.83	7.57	11.72	9.25	16.65	......	......
20	17.49	14.16	12.60	9.33	12.35	9.25	10.65	7.55	11.75	9.38	16.58	......	......
27	17.70	13.93	12.15	8.78	11.90	8.65	10.38	6.99	11.75	9.25	16.80	......	......
Aug. 3	18.04	13.95	12.28	8.98	12.10	8.75	10.55	6.90	11.50	8.88	16.75	......	......
10	17.95	13.63	12.13	8.55	11.90	8.44	10.75	6.57	11.50	8.78	16.80	......	......
17	17.82	13.45	12.00	8.45	11.78	8.45	10.75	6.83	11.50	8.75	16.95	......	......
24	17.74	13.40	12.26	8.78	12.05	8.78	10.85	7.18	11.65	9.00	17.48	......	......
31	17.95	13.80	12.50	9.15	12.25	9.15	10.88	7.55	12.23	9.40	17.88	......	......
Sept 7	17.98	13.55	12.28	8.94	12.05	8.81	10.53	7.17	12.50	9.50	18.25	$15.88	$11..0
14	18.08	13.60	12.20	8.92	11.95	8.80	10.42	7.13	12.50	9.50	18.68	15.85	11.55
21	17.95	13.20	11.78	8.71	11.42	8.59	10.36	7.08	12.50	9.50	18.95	15.58	11.13
28	17.67	12.85	11.20	8.06	10.88	7.87	10.21	6.44	12.40	9.35	18.65	15.48	10.78
Oct. 5	17.55	12.79	11.21	7.93	10.86	7.91	10.53	6.68	12.20	9.18	18.23	15.70	10.73
12	17.23	12.35	11.13	7.96	10.84	8.00	10.48	6.97	12.10	9.03	17.30	15.68	10.75
19	16.82	11.67	10.73	7.48	10.48	7.50	9.95	6.25	11.33	8.48	16.08	15.25	10.23
26	17.29	12.25	11.35	8.19	10.65	7.71	9.88	6.24	11.38	8.75	16.05	15.35	10.40
Nov. 2	17.73	12.76	12.03	8.65	10.93	7.93	9.83	6.28	11.50	8.88	16.30	15.83	10.63
9	17.58	12.41	11.73	8.10	10.60	7.43	9.53	5.68	11.18	8.48	16.15	15.75	10.48
16	17.69	12.57	11.75	8.02	10.72	7.42	9.73	5.75	11.25	8.44	16.88	15.84	10.52
23	17.67	12.67	11.83	8.07	10.81	7.53	9.90	5.96	11.45	8.55	17.35	16.19	10.53
30	17.41	12.19	11.46	7.81	10.53	7.17	9.84	5.84	11.53	8.63	17.09	16.09	10.34
Dec. 7	17.87	12.60	11.55	7.92	10.95	7.61	9.97	6.34	11.73	8.63	17.58	16.24	10.71
14	17.34	12.17	10.95	7.48	10.56	7.25	9.64	6.24	11.47	8.43	16.85	15.83	10.10
21	17.38	12.19	11.23	7.75	10.66	7.54	9.67	6.74	11.80	8.73	15.30	15.70	9.84
28	17.55	12.39	11.39	8.06	10.79	7.88	9.75	7.18	12.00	8.84	14 34	......	......
1919.													
Jan. 4	17.95	12.88	11.87	8.79	11.21	8.51	10.08	7.79	12.18	9.05	15.83	......	......
11	18.14	13.14	11.80	8.76	11.17	8.36	10.61	7.57	12.15	9.18	16.90	......	......
18	18.10	12.98	11.79	8.54	11.21	7.89	10.52	6.80	12.10	9.10	16.05	......	......
25	18.13	13.01	11.73	8.57	11.21	7.93	9.97	6.91	12.43	9.35	15.15	......	......
Feb. 1	17.97	12.73	11.61	8.22	11.12	7.74	9.92	6.31	12.38	9.13	14.18	......	......
8	18.44	13.65	12.45	8.91	11.95	8.33	10.55	6.43	12.61	9.51	14.83	......	......
15	18.20	13.45	12.21	8.49	11.64	8.03	10.33	6.25	12.64	9.35	15.18	......	......
22	18.11	13.46	12.87	8.99	12.43	8.74	10.50	6.85	13.05	9.65	16.15	......	......
Mar. 1	18.08	13.40	12.99	9.17	12.55	8.86	10.45	6.95	12.99	9.62	16.85	......	......
8	18.31	13.59	13.30	9.51	12.78	8.99	10.75	6.71	13.05	9.69	17.65	......	......
15	18.43	13.61	13.58	9.56	12.91	8.91	10.73	6 45	13.13	9.69	17.70	......	......

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

CHICAGO—Continued.

Week ending—	Beef steers.								Butcher cattle.			Canners and cutters.	
	Medium and heavyweight (1,100 pounds up).				Lightweight (1,100 pounds down).				Heifers, common to choice.	Cows, common to choice.	Bulls, bologna and beef.	Cows and heifers.	Canner steers.
	Choice and prime.	Good.	Medium.	Common.	Choice and prime.	Good and medium.		Common.					
1919.													
Mar. 22	$19.15	$17.25	$14.74	$12.51	$17.87	$14.59		$11.21	$11.32	$11.10	$10.68	$6.36	$8.45
29	19.09	17.09	14.88	12.63	17.73	14.58		11.32	11.37	11.08	10.51	6.15	8.45
Apr. 5	19.19	17.14	15.18	12.80	17.75	14.87		11.58	11.61	11.34	10.80	6.55	8.50
12	18.95	16.70	14.72	12.58	17.48	14.70		11.50	11.29	11.06	10.75	6.57	8.50
19	18.87	16.79	15.02	12.97	17.58	15.00		11.81	11.74	11.52	10.70	6.87	8.63
26	19.12	16.81	14.95	13.03	17.61	15.09		12.21	11.87	11.62	11.15	7.09	8.98
May 3	18.88	16.60	14.63	12.70	17.26	14.71		11.83	11.36	11.14	10.87	6.74	8.95
10	18.44	16.20	14.41	12.63	16.79	14.45		11.83	11.38	11.13	11.13	6.83	9.05
17	18.06	15.98	14.50	12.70	16.55	14.40		11.83	11.60	11.40	11.18	7.12	9.15
24	17.19	15.49	14.23	12.64	16.04	14.19		11.71	11.58	11.37	11.19	7.27	9.25
31	16.71	14.90	13.56	12.28	15.61	13.69		11.43	11.21	10.97	10.84	7.12	9.09
June 7	15.65	14.00	12.48	11.38	14.72	12.80		10.68	10.10	9.79	9.93	6.38	8.55
14	15.66	14.19	12.84	11.59	14.62	12.91		10.81	10.34	10.11	10.31	6.66	8.83
21	15.60	14.09	12.84	11.60	14.64	12.98		10.94	10.43	10.10	10.33	6.83	8.88
28	15.16	13.95	12.87	11.70	14.88	13.16		11.03	10.55	10.01	9.68	6.82	8.88
July 5	15.14	14.08	12.97	11.84	15.01	13.29		11.09	10.59	9.88	9.75	6.66	8.63
12	16.37	15.11	13.83	12.34	15.98	14.02		11.44	11.26	10.39	10.75	7.10	8.70
19	17.33	15.73	14.08	12.36	16.58	14.36		11.47	11.35	10.53	10.78	6.95	8.60
26	17.72	15.76	13.68	11.53	16.93	14.15		10.93	10.85	10.23	10.20	6.30	8.00
Aug. 2	17.55	15.37	13.20	11.15	16.75	13.85		10.73	10.78	10.38	10.23	6.35	7.50
9	18.01	15.73	13.44	11.40	17.18	14.08		10.88	10.92	10.48	10.30	6.43	7.69
16	18.10	16.01	14.03	11.75	17.85	14.88		11.33	11.53	11.13	10.88	6.86	8.13
23	17.39	15.20	13.43	11.35	17.36	14.23		10.98	11.18	10.58	10.33	6.73	7.98
30	17.28	15.02	13.03	11.03	17.18	13.93		10.63	11.00	10.13	9.58	6.35	7.83
Sept. 6	16.99	14.85	12.65	10.55	16.91	13.74		10.45	10.73	9.92	8.98	6.11	7.63
13	16.82	14.74	12.40	10.15	17.03	13.54		9.75	10.65	9.90	9.25	5.88	7.15
20	16.67	14.40	12.18	9.68	17.02	13.43		9.45	10.63	9.88	9.03	5.76	7.00
27	16.66	14.40	12.05	9.63	17.04	13.48		10.73	10.63	9.90	9.13	5.88	7.00
Oct. 4	17.28	15.20	12.58	9.88	17.32	13.83		9.66	10.63	10.00	9.25	6.00	7.00
11	17.70	15.57	12.70	9.93	17.65	13.88		9.70	10.48	9.73	8.70	5.83	6.90
18	17.96	15.45	12.45	9.63	17.40	13.50		9.33	10.20	9.23	8.15	5.53	6.63
25	18.25	15.43	12.50	9.75	18.13	13.75		9.30	10.53	9.62	8.79	5.92	6.63
Nov. 1	18.18	15.13	12.05	9.40	18.13	13.58		8.98	10.57	9.72	8.52	5.94	6.53
8	18.55	15.45	12.15	9.47	18.51	13.78		8.88	10.32	9.61	8.48	5.79	6.38
15	19.19	16.37	12.86	9.93	19.02	14.56		9.53	10.78	9.98	8.85	6.16	6.90
22	19.09	15.78	12.17	9.65	18.90	14.18		9.23	10.67	9.79	8.80	5.89	6.72
29	19.32	16.18	12.52	9.98	19.14	14.46		9.25	10.78	9.93	9.06	5.93	6.72
Dec. 6	19.65	16.13	12.46	9.90	19.49	14.45		9.18	10.74	9.83	9.03	5.80	6.75
13	20.04	16.38	12.75	10.08	19.87	14.78		9.48	10.93	10.23	9.08	5.89	7.10
20	19.12	15.61	11.92	9.53	19.00	14.05		8.88	10.35	9.60	9.13	5.41	6.85
27	19.39	16.61	12.87	9.94	19.33	14.70		9.34	10.55	9.86	9.58	5.76	6.84
1920.													
Jan. 3	19.33	16.38	12.43	9.78	19.25	14.64		9.38	10.59	9.89	9.83	5.76	6.88
10	19.35	16.43	12.63	9.95	19.23	14.60		9.45	10.65	9.98	9.78	5.89	7.13
17	18.78	16.20	12.88	10.25	18.38	14.35		9.70	10.58	9.95	9.80	5.95	7.03
24	17.75	15.32	12.73	10.53	17.05	13.60		10.00	10.50	9.88	9.88	6.18	6.88
31	16.67	14.42	12.33	10.53	15.84	12.82		9.96	10.27	9.63	9.55	6.20	7.10
						Good.	Medium.						
Feb. 7	16.08	13.90	12.01	10.23	15.37	$13.26	$11.47	9.69	9.86	9.21	9.19	6.03	7.03
14	15.96	13.78	11.82	10.04	15.16	12.97	11.27	9.48	9.55	8.93	8.98	5.84	7.00
21	15.35	13.40	12.05	10.33	14.77	12.83	11.53	9.75	9.71	9.08	8.93	5.74	7.00
28	14.93	12.98	11.70	10.15	14.27	12.30	11.17	9.61	9.48	8.90	9.00	5.60	6.90
Mar. 6	15.15	13.51	12.15	10.47	14.56	12.90	11.68	10.00	10.10	9.43	8.83	5.61	6.68
13	14.93	13.42	12.23	10.77	14.68	13.20	12.07	10.49	10.49	9.85	8.80	5.88	6.75
20	14.53	12.98	11.97	10.79	14.50	12.91	11.89	10.63	10.20	9.64	9.14	6.03	6.80
27	14.39	12.90	11.89	10.89	14.35	12.80	11.74	10.61	10.22	9.62	9.24	6.19	6.88
Apr. 3	14.41	13.01	11.94	10.81	14.41	12.99	11.76	10.56	10.63	9.88	9.38	6.33	7.00
10	14.54	13.36	12.23	10.87	14.49	13.16	11.95	10.62	10.83	10.01	9.10	6.25	7.00
17	14.85	13.64	12.52	11.19	14.94	13.68	12.49	11.01	11.01	10.07	8.77	6.12	7.08
24	13.63	12.30	11.32	10.40	13.77	12.27	11.24	10.20	10.28	9.39	9.08	5.60	7.10
May 1	13.73	12.68	11.81	11.00	13.86	12.64	11.71	10.70	10.80	10.02	9.50	6.12	7.25
8	13.75	12.87	12.02	11.16	13.91	12.90	11.96	10.89	10.85	9.95	9.54	6.35	7.38
15	13.50	12.71	11.94	11.01	13.79	12.81	11.93	10.86	10.81	9.80	9.35	6.38	7.38
22	13.17	12.41	11.68	10.77	13.58	12.63	11.75	10.50	10.68	9.64	9.18	6.31	7.38
29	13.05	12.41	11.64	10.65	13.56	12.73	11.82	10.55	10.53	9.30	9.25	6.13	7.38
June 5	13.99	13.39	12.58	11.52	14.35	13.58	12.74	11.44	10.60	9.57	9.25	6.33	7.45
12	16.08	15.25	14.16	12.69	15.99	15.08	14.03	12.47	11.42	10.33	9.65	6.69	7.70
19	16.61	15.70	14.39	12.44	16.50	15.58	14.27	12.24	11.07	10.00	9.82	6.18	7.35
26	16.60	15.66	14.24	12.27	16.59	15.57	14.12	12.09	10.85	9.85	9.76	5.53	6.73

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

CHICAGO—Continued.

Week ending—	Beef steers. Medium and heavyweight (1,100 pounds up). Choice and prime.	Good.	Medium.	Common.	Beef steers. Lightweight (1,100 pounds down). Choice and prime.	Good.	Medium.	Common.	Butcher cattle. Heifers, common to choice.	Cows, common to choice.	Bulls, bologna and beef.	Canners and cutters. Cows and heifers.	Canner steers.
1920.													
July 3	$16.35	$15.48	$13.99	$12.01	$16.33	$15.40	$13.86	$11.78	$10.71	$9.68	$9.30	$5.27	$6.45
10	16.61	15.78	14.13	11.84	16.61	15.57	13.79	11.51	10.56	9.49	9.00	5.13	6.06
17	16.68	15.71	14.16	11.88	16.77	15.67	13.89	11.43	10.63	9.61	9.15	5.33	5.80
24	16.51	15.53	14.00	11.88	16.74	15.55	13.80	11.38	10.70	9.63	9.25	5.48	6.10
31	16.54	15.53	13.75	11.50	16.63	15.44	13.66	11.10	10.64	9.15	9.15	5.20	6.08
Aug. 7	16.61	15.48	13.55	11.28	16.63	15.30	13.28	10.50	10.38	8.60	8.88	4.93	5.80
14	16.83	15.70	13.70	11.35	16.83	15.38	13.25	10.50	10.49	8.75	8.93	5.08	5.75
21	16.88	15.65	13.43	11.13	16.88	15.35	13.20	10.50	10.50	8.75	8.48	5.13	5.75
28	17.06	15.74	13.53	11.08	16.98	15.50	13.18	10.33	10.60	9.28	8.25	5.05	5.90
Sept. 4	17.32	15.85	13.43	11.00	17.25	15.35	13.05	10.05	10.75	9.38	8.25	5.00	6.00
11	17.50	16.06	13.63	11.06	17.44	15.69	13.25	10.19	10.75	9.41	8.50	5.00	6.00
18	17.68	16.25	13.75	11.13	17.50	15.88	13.38	10.38	10.75	9.50	8.60	5.07	6.00
25	17.63	15.93	13.45	10.85	17.43	15.68	13.20	10.15	10.55	9.20	8.45	4.90	5.95
Oct. 2	17.53	15.65	13.15	10.50	17.48	15.38	12.70	9.70	9.95	8.53	8.23	4.68	5.75
9	17.73	16.05	13.55	10.60	17.71	15.75	12.83	9.78	9.85	8.35	8.13	4.43	5.75
16	17.75	15.95	13.45	10.45	17.75	15.70	12.75	9.68	9.63	8.18	8.08	4.38	5.68
23	17.59	15.93	13.53	10.38	17.45	15.65	12.80	9.70	9.13	7.95	7.95	4.20	5.55
30	17.57	16.15	13.75	10.50	17.45	15.85	13.10	9.80	9.23	7.80	7.75	4.11	5.25
Nov. 6	17.33	15.74	13.25	10.38	17.16	15.49	12.78	9.75	9.58	8.28	8.13	4.53	5.38
13	16.70	14.81	12.08	9.58	16.72	14.60	11.60	8.90	9.13	7.99	7.73	4.09	5.03
20	16.14	13.84	10.98	8.58	16.00	13.45	10.48	8.03	8.55	7.32	6.98	3.73	4.60
27	16.54	14.11	11.19	8.63	16.41	13.63	10.46	7.94	8.47	7.42	6.89	3.86	4.56
Dec. 4	15.30	12.73	10.08	8.20	15.38	12.53	9.68	7.55	8.43	7.42	6.74	4.01	4.63
11	14.53	12.56	10.50	8.44	14.45	12.21	9.98	7.93	8.36	7.53	6.84	4.06	4.75
18	13.58	11.53	9.41	7.70	13.63	11.01	8.65	6.96	7.47	6.67	6.51	3.58	4.35
25	13.88	12.10	9.99	8.27	13.98	11.60	9.24	7.49	7.64	6.81	6.32	3.75	4.50
1921.													
Jan. 1	12.74	11.23	9.63	8.20	12.95	11.30	9.53	7.95	7.91	7.09	6.45	4.13	4.88

Week ending—	Veal calves. Light to medium weight, medium to choice.	Heavy weight, common to choice.	Feeder steers. Heavy (1,000 pounds up), common to choice.	Medium (800 to 1,000 pounds) common to choice.	Light (800 pounds down), common to choice.	Stock cattle. Steers, common to choice.	Cows and heifers, common to choice.	Calves. Good and choice.	Calves. Common and medium.	Western range cattle. Beef steers. Good and choice.	Beef steers. Common and medium.	Cows and heifers, medium to choice.
1919.												
Mar. 22	$15.43	$12.13	$14.03	$12.63	$11.73	$10.48	......	......	......	......	......	......
29	14.58	10.98	14.08	12.73	11.73	10.50	$9.25	$11.63	$9.00	......	......	......
Apr. 5	14.28	10.55	14.30	12.98	11.88	10.78	9.25	11.75	9.13	......	......	......
12	15.68	10.68	14.13	12.98	12.00	10.88	9.25	11.75	9.13	......	......	......
19	14.95	10.48	14.18	13.18	12.15	11.05	9.35	11.78	9.15	......	......	......
26	13.78	10.45	14.23	13.33	12.35	11.33	9.70	12.13	9.38	......	......	......
May 3	12.88	10.25	13.89	13.03	12.08	11.13	9.63	11.88	9.15	......	......	......
10	14.10	10.55	13.83	12.93	12.00	10.95	9.53	11.88	9.13	......	......	......
17	13.63	10.48	14.03	13.03	12.08	10.90	9.50	11.88	9.23	......	......	......
24	15.10	11.30	13.93	12.88	12.05	11.03	9.58	11.88	9.25	......	......	......
31	15.81	11.78	13.47	12.44	11.81	10.69	9.25	11.78	9.25	......	......	......
June 7	14.87	11.20	12.60	11.68	11.27	10.13	8.80	......	......	......	......	......
14	16.08	11.18	12.50	11.80	11.18	10.15	8.75	11.25	9.38	......	......	......
21	17.08	11.15	......	11.58	10.98	10.13	8.55	11.23	9.38	......	......	......
28	17.45	11.25	......	11.38	10.75	10.00	8.25	11.13	9.38	......	......	......
July 5	17.78	11.41	......	11.38	10.75	10.00	8.25	11.13	9.38	......	......	......
12	18.40	12.08	......	11.45	10.88	10.08	8.45	11.45	9.58	......	......	......
19	18.75	12.25	......	11.33	10.88	9.93	8.35	11.50	9.58	......	......	......
26	18.05	11.35	11.38	10.75	10.10	9.33	7.88	11.10	9.35	$14.66	$11.18	$10.63
Aug. 2	16.43	10.13	11.35	10.48	9.78	9.10	7.75	10.25	8.75	14.60	11.05	10.63
9	17.95	10.48	11.35	10.48	9.88	9.00	7.83	10.25	8.75	14.85	11.21	10.80
16	20.30	12.25	11.60	10.73	9.98	9.35	8.23	10.63	8.88	15.34	11.81	11.48
23	20.28	11.40	11.43	10.63	9.80	9.13	7.88	10.50	8.88	15.02	11.53	11.00
30	19.93	10.48	11.33	10.43	9.70	8.98	7.70	10.20	8.80	14.80	11.37	10.78
Sept. 6	20.03	9.85	10.75	9.88	9.13	8.50	7.25	9.50	8.50	14.23	10.87	10.36
13	20.43	9.98	10.47	9.70	8.95	8.35	7.15	9.50	8.50	13.78	10.28	10.13
20	20.75	10.30	10.25	9.50	8.75	8.13	7.00	9.50	8.50	13.50	10.00	10.10
27	20.88	10.65	10.31	9.55	8.80	8.13	7.00	9.50	8.50	13.53	10.05	10.28

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

CHICAGO—Continued.

Week ending—	Veal calves.		Feeder steers.			Stock cattle.				Western range cattle.		
	Light to medium weight, medium to choice.	Heavy-weight, common to choice.	Heavy (1,000 pounds up), common to choice.	Medium (800 to 1,000 pounds) common to choice.	Light (800 pounds down), common to choice.	Steers, common to choice.	Cows and heifers, common to choice.	Calves. Good and choice.	Calves. Common and medium.	Beef steers. Good and choice.	Beef steers. Common and medium.	Cows and heifers, medium to choice.
1919.												
Oct. 4	$20.38	$10.46	$10.38	$9.63	$8.88	$8.13	$7.00	$9.50	$8.50	$13.63	$10.13	$10.38
11	18.15	9.78	10.65	9.98	9.18	8.33	7.00	9.35	8.35	13.58	10.10	10.28
18	16.98	9.23	10.75	10.13	9.13	8.05	6.83	9.30	8.10	13.78	9.83	9.70
25	17.23	9.65	10.93	10.23	9.13	8.35	6.88	10.20	8.70	13.73	9.73	10.13
Nov. 1	17.53	10.03	10.60	9.88	8.75	8.13	6.88	10.15	8.63	13.58	9.60	10.30
8	17.88	10.23	10.50	9.73	8.60	8.00	7.03	9.88	8.43	13.38	9.50	10.00
15	18.23	10.38	10.95	10.13	9.13	8.23	7.13	10.05	8.48	13.53	9.65	10.23
22	17.65	10.13	10.95	10.13	9.00	8.15	6.95	10.50	8.63	13.08	9.28	10.00
29	16.63	10.00	10.97	10.19	9.06	8.41	6.88	10.56	8.69	13.06	9.19	10.00
Dec. 6	16.90	10.05	10.68	9.90	9.13	8.43	6.88	10.63	8.75	12.83	9.13	10.05
13	17.18	10.33	10.45	9.63	9.13	8.38	6.88	10.63	8.75	12.88	9.13	10.00
20	16.53	10.00	10.18	9.40	8.78	8.15	6.70	10.23	8.55	......	......	......
27	15.88	9.59	10.46	9.47	8.89	8.13	6.97	10.00	8.25	......	......	......
1920.												
Jan. 3	16.30	9.63	10.50	9.50	9.00	8.13	7.13	10.00	8.25	......	......	......
10	16.98	9.93	10.73	9.83	9.33	8.45	7.35	10.23	8.53	......	......	......
17	17.38	10.53	10.83	10.08	9.63	8.88	7.38	10.25	8.75	......	......	......
24	17.98	11.05	10.88	10.13	9.75	9.23	7.60	10.25	8.75	......	......	......
31	18.60	11.70	10.69	10.06	9.75	9.13	7.78	10.33	8.75	......	......	......
Feb. 7	17.80	10.83	10.45	9.84	9.63	8.92	7.88	10.25	8.53	......	......	......
14	16.83	10.15	10.15	9.58	9.36	8.66	7.88	10.25	8.50	......	......	......
21	16.50	9.88	10.00	9.43	9.18	8.50	7.88	10.25	8.50	......	......	......
28	15.80	9.85	10.00	9.43	9.18	8.50	7.88	10.25	8.50	......	......	......
Mar. 6	15.85	9.98	10.18	9.84	9.51	8.73	8.05	10.25	8.50	......	......	......
13	16.23	10.15	10.60	10.32	9.98	9.05	8.13	10.25	8.50	......	......	......
20	17.15	10.45	10.62	10.39	10.10	9.30	8.18	10.40	8.60	......	......	......
27	17.43	10.70	10.69	10.49	10.25	9.45	8.44	10.53	8.75	......	......	......
Apr. 3	17.00	10.75	10.63	10.45	10.25	9.45	8.38	10.38	8.75	......	......	......
10	15.25	9.83	10.63	10.45	10.25	9.45	8.38	10.38	8.75	......	......	......
17	14.08	9.23	10.63	10.45	10.25	9.45	8.38	10.38	8.75	......	......	......
24	14.60	9.53	10.45	10.28	10.09	9.23	8.28	10.28	8.70	......	......	......
May 1	12.95	9.00	10.32	10.14	9.92	9.00	8.13	10.13	8.63	......	......	......
8	12.08	9.00	10.78	10.55	10.35	9.48	8.38	10.13	8.63	......	......	......
15	11.88	9.00	10.75	10.52	10.37	9.50	8.63	10.10	8.63	......	......	......
22	11.95	8.78	10.54	10.28	10.05	9.38	8.55	9.75	8.25	......	......	......
29	12.55	9.35	10.50	10.25	10.00	9.38	8.50	9.75	8.25	......	......	......
June 5	13.58	10.43	10.70	10.45	10.28	9.53	8.50	9.75	8.25	......	......	......
12	14.05	10.55	11.55	11.26	10.98	9.93	8.55	9.85	8.25	......	......	......
19	14.28	10.33	11.35	11.07	10.90	9.70	8.00	9.88	8.25	......	......	......
26	13.83	9.95	10.88	10.63	10.38	9.30	7.28	9.88	8.15	......	......	......
July 3	12.68	9.15	10.78	10.48	10.10	8.85	7.20	9.65	7.88	......	......	......
10	12.31	8.88	10.63	10.25	9.75	8.38	6.88	9.25	7.50	......	......	......
17	13.28	9.00	10.68	10.27	9.75	8.38	6.88	9.25	7.50	......	......	......
24	14.48	9.35	10.75	10.36	9.75	8.58	7.08	9.25	7.50	......	......	......
31	15.86	9.85	10.65	10.15	9.58	8.50	6.95	......	......	......	......	......
Aug. 7	15.45	9.70	10.00	9.68	9.18	7.48	6.75	......	......	......	......	......
14	14.80	9.00	10.15	9.78	9.10	7.73	6.90	......	......	......	......	......
21	14.50	9.00	10.38	10.00	9.25	8.13	7.00	......	......	......	......	......
28	15.55	9.00	10.38	9.90	9.35	8.13	7.00	......	......	......	......	......
Sept. 4	16.28	9.00	10.18	9.63	9.25	8.00	7.00	......	......	13.50	10.00	9.13
				Light and medium weight (750 to 1,000 pounds), common to choice.								
11	16.38	9.00	10.56	$10.00		8.25	7.00	......	......	13.50	10.00	8.63
18	16.60	9.00	10.75	10.23		8.38	7.00	......	......	13.50	10.00	8.50
25	16.50	8.70	10.53	9.88		8.33	6.85	......	......	13.25	9.90	8.48
Oct. 2	16.18	8.50	10.38	9.48		7.50	6.40	......	......	12.73	9.53	8.10
9	15.75	8.60	10.35	9.48		7.00	6.25	......	......	12.60	9.33	7.58
16	14.98	8.90	10.30	9.43		7.00	6.25	......	......	12.53	9.18	7.13
23	13.30	8.20	10.08	9.43		6.75	6.25	......	......	12.38	9.13	7.15
30	12.70	7.50	10.18	9.50		6.80	6.00	......	......	12.40	9.18	7.13
Nov. 6	13.55	8.45	10.38	9.75		7.30	6.35	......	......	12.78	9.70	7.62
13	14.05	8.50	9.88	9.23		7.18	6.18	......	......	12.33	9.53	7.40
20	14.00	7.08	9.10	8.58		6.45	5.48	......	......	10.93	8.35	7.09
27	13.34	6.25	9.16	8.66		6.26	5.38	......	......	10.66	8.00	7.09
Dec. 4	12.10	6.55	8.78	8.20		6.35	5.20	......	......	10.15	7.78	7.03
11	10.38	6.48	8.63	8.00		6.58	5.25	......	......	9.83	7.75	6.85
18	9.15	6.23	8.00	7.47		6.06	5.18	......	......	9.19	7.27	6.30
25	9.33	6.63	8.15	7.60		6.17	5.30	......	......	9.15	7.15	6.35
1921.												
Jan. 1	11.00	7.40	8.08	7.60		6.18	5.30	......	......	8.58	6.88	6.10

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

KANSAS CITY.

Week ending—	Beef steers.								Butcher cattle.		
	Medium and heavyweight (1,100 pounds up).				Lightweight (1,100 pounds down).				Heifers, common to choice.	Cows, common to choice.	Bulls, bologna and beef.
	Choice and prime.	Good.	Medium.	Common.	Choice and prime.	Good and medium.		Common.			
1919.											
Mar. 22....	$17.80	$16.87	$15.05	$12.63	$16.93	$14.98		$11.63	$11.38	$10.45	$9.44
29....	17.85	16.78	14.79	12.57	16.79	14.75		11.41	11.45	10.50	9.49
Apr. 5....	17.95	16.78	14.75	12.63	16.77	14.70		11.35	11.54	10.45	9.50
12....	18.25	16.85	14.96	12.82	16.92	14.67		11.82	11.75	10.50	9.88
19....	18.21	16.77	14.96	12.82	16.84	14.60		11.77	11.65	10.46	9.80
26....	18.16	16.68	15.00	12.99	16.82	14.59		11.80	11.69	10.50	9.82
May 3....	17.73	16.26	14.56	12.78	16.36	14.14		11.52	11.43	10.40	9.66
10....	17.38	15.83	14.17	12.58	15.98	13.64		11.19	11.30	10.38	9.62
17....	17.09	15.54	13.98	12.48	15.72	13.35		11.06	11.22	10.36	9.69
24....	17.09	15.62	14.22	12.85	15.80	13.48		11.24	11.00	10.31	9.64
31....	16.23	14.79	13.42	12.20	14.86	12.69		10.61	10.28	9.81	8.96
June 7....	15.33	14.02	12.78	11.70	14.19	12.17		10.20	10.03	9.44	8.65
14....	15.45	14.22	13.04	11.97	14.37	12.39		10.46	10.31	9.53	8.73
21....	14.92	13.62	12.49	11.59	14.13	11.93		10.24	9.95	9.22	8.39
28....	14.28	13.08	11.96	11.11	13.81	11.52		9.79	9.60	8.85	7.95
July 5....	14.36	13.24	12.14	11.23	14.06	11.90		10.01	9.98	9.06	7.93
12....	14.86	13.81	12.80	11.90	14.70	12.77		10.79	10.57	9.53	8.32
19....	15.76	14.47	13.33	12.15	15.37	13.31		11.08	10.33	9.38	8.69
26....	17.14	15.57	13.91	12.16	16.56	14.03		11.15	10.14	9.17	8.63
Aug. 2....	17.45	15.43	13.45	11.38	16.71	13.71		10.46	10.04	9.06	8.34
9....	17.69	15.53	13.51	11.42	16.95	13.87		10.48	10.19	9.18	8.15
16....	17.99	15.98	13.81	11.68	17.24	14.26		10.85	10.51	9.47	8.00
23....	17.71	15.47	13.68	11.44	17.07	13.97		10.44	10.09	9.07	7.97
30....	17.63	15.68	13.58	11.39	17.03	13.79		10.30	9.98	9.00	8.09
Sept. 6....	17.52	15.43	13.23	11.16	17.15	13.54		9.93	9.81	8.84	7.82
13....	17.03	15.01	12.75	10.69	16.81	13.12		9.55	9.87	8.80	7.64
20....	16.61	14.36	11.90	9.91	16.38	12.41		8.92	9.77	8.64	7.32
27....	16.75	14.62	12.24	10.24	16.55	12.72		9.24	9.93	8.65	7.08
Oct. 4....	16.92	14.86	12.46	10.43	16.71	12.95		9.42	10.19	8.94	7.31
11....	16.83	14.70	12.18	10.11	16.77	12.81		9.13	9.93	8.86	7.26
18....	16.95	14.70	12.00	9.76	16.93	13.00		9.23	9.93	8.96	7.45
25....	16.98	14.48	11.74	9.44	16.93	12.86		9.23	10.02	9.08	7.64
Nov. 1....	16.87	14.22	11.54	9.37	16.83	12.71		9.12	10.03	9.03	7.60
8....	16.83	14.16	11.43	9.30	16.78	12.65		9.03	9.80	8.80	7.19
15....	17.50	15.01	12.15	9.90	17.30	13.27		9.43	9.70	8.68	7.10
22....	17.57	15.11	12.31	10.02	17.36	13.35		9.42	9.95	8.90	7.33
29....	17.44	14.98	12.21	9.93	17.24	13.24		9.29	10.00	8.95	7.50
Dec. 6....	17.54	15.02	12.20	9.85	17.15	13.22		9.28	10.08	9.04	7.55
13....	17.58	14.83	11.89	9.53	16.99	12.91		8.94	9.63	8.63	7.18
20....	17.52	14.61	11.74	9.48	16.85	12.74		8.93	9.66	8.63	7.40
27....	17.75	15.04	12.23	9.97	17.30	13.34		9.40	9.93	8.88	7.87
1920.											
Jan. 3....	17.57	14.96	12.25	9.96	17.28	13.41		9.40	10.24	9.19	8.12
10....	17.59	15.03	12.32	10.03	17.23	13.42		9.43	10.19	9.14	8.22
17....	17.54	15.08	12.42	10.17	17.10	13.44		9.49	10.27	9.22	8.48
24....	17.12	14.86	12.36	10.17	16.68	13.26		9.46	10.19	9.13	8.48
31....	16.13	14.18	11.88	10.10	15.55	12.66		9.50	10.10	9.04	8.56
						Good.	Medium.				
Feb. 7....	14.92	12.91	11.07	9.69	14.54	$12.56	$10.76	9.05	9.57	8.98	8.59
14....	14.88	12.84	11.18	9.69	14.38	12.50	10.67	8.81	9.34	8.89	8.31
21....	14.50	12.80	11.43	9.82	14.28	12.53	10.83	8.88	9.36	8.73	8.16
28....	13.79	12.24	11.01	9.73	13.55	11.93	10.41	8.80	9.27	8.56	8.14
Mar. 6....	13.95	12.59	11.41	10.10	13.66	12.22	10.80	9.23	9.52	8.77	7.73
13....	14.23	12.97	11.91	10.65	14.05	12.70	11.38	9.86	9.83	9.00	7.98
20....	13.87	12.67	11.69	10.49	13.74	12.37	11.20	9.82	9.78	8.92	8.00
27....	13.61	12.48	11.56	10.44	13.41	12.16	11.10	9.81	9.83	8.95	8.00
Apr. 3....	13.65	12.42	11.55	10.41	13.40	12.17	11.10	9.75	9.83	8.95	8.03
10....	13.81	12.64	11.68	10.20	13.61	12.45	11.25	9.80	9.84	8.95	8.00
17....	14.04	13.04	12.17	10.54	13.79	12.67	11.54	10.04	10.08	9.29	8.25
24....	13.27	12.21	11.43	10.08	13.21	12.17	11.19	9.75	10.05	9.38	8.23
May 1....	13.02	11.90	11.01	9.78	13.32	11.95	10.94	9.72	9.95	9.38	8.25
8....	12.65	11.48	10.70	9.67	12.89	11.54	10.60	9.51	9.56	9.22	8.25
15....	13.06	11.87	11.06	10.06	13.19	11.92	10.98	9.84	9.83	9.40	8.25
22....	12.61	11.62	10.92	10.08	12.98	11.74	10.94	9.93	9.82	9.37	8.25
29....	12.43	11.43	10.77	9.96	12.87	11.72	10.88	9.88	9.70	9.23	8.25
June 5....	12.72	11.78	11.07	10.15	13.25	12.10	11.27	10.08	9.81	9.14	8.38
12....	15.17	13.95	12.96	11.76	15.24	14.06	12.96	11.27	10.75	9.82	8.86
19....	15.91	14.37	13.11	11.55	15.84	14.41	12.99	10.87	10.38	9.28	8.89
26....	16.03	14.33	12.89	11.23	16.06	14.31	12.59	10.32	10.10	8.75	8.49
July 3....	15.68	14.06	12.60	10.87	15.77	13.95	12.07	9.96	10.01	8.58	8.13
10....	15.93	14.42	12.86	10.99	15.97	14.19	12.13	10.00	10.21	8.72	8.15
17....	15.98	14.38	12.83	11.05	16.02	14.21	12.06	9.96	10.15	8.65	8.03
24....	15.79	14.31	12.70	11.06	15.88	14.40	11.91	9.94	10.06	8.58	7.75
31....	15.67	14.10	12.33	10.70	15.77	13.74	11.36	9.36	9.70	8.22	7.24

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

KANSAS CITY—Continued.

Week ending—	Beef steers. Medium and heavyweight (1,100 pounds up). Choice and prime.	Good.	Medium.	Common.	Lightweight (1,100 pounds down). Choice and prime.	Good.	Medium.	Common.	Butcher cattle. Heifers, common to choice.	Cows, common to choice.	Bulls, bologna and beef.
1920.											
Aug. 7	$15.67	$13.99	$12.14	$10.59	$15.77	$13.61	$11.09	$9.00	$9.30	$7.84	$6.95
14	16.00	14.34	12.47	10.98	16.09	13.99	11.39	9.32	9.57	8.08	6.99
21	16.08	14.30	12.33	10.84	16.12	13.87	11.21	9.24	9.73	8.20	7.00
28	16.05	14.20	12.28	10.73	16.06	13.67	10.99	8.98	9.51	8.01	6.87
Sept. 4	16.51	14.77	12.78	11.12	16.56	14.18	11.44	9.34	9.71	8.22	6.80
11	16.71	15.16	13.23	11.51	16.71	14.59	11.83	9.65	9.72	8.22	6.79
18	16.77	15.13	13.00	11.25	16.77	14.50	11.51	9.26	9.70	8.21	6.50
25	16.80	14.83	12.43	10.57	16.76	14.11	10.83	8.70	9.74	8.27	6.50
Oct. 2	16.79	14.66	12.09	10.17	16.66	13.82	10.43	8.27	9.50	8.00	6.43
9	16.61	14.34	11.69	9.93	16.42	13.49	10.08	7.98	9.09	7.59	6.13
16	16.94	15.13	12.88	10.63	16.73	14.38	11.38	8.75	9.08	7.50	6.13
23	16.76	14.96	12.67	10.43	16.60	14.24	11.28	8.65	8.72	7.05	5.68
30	16.47	14.70	12.32	10.20	16.30	14.21	11.22	8.60	9.23	7.54	5.86
Nov. 6	16.18	14.40	11.96	9.92	15.96	13.92	10.95	8.41	9.51	7.83	6.20
13	15.64	13.77	11.30	9.34	15.45	13.22	10.32	8.03	8.96	7.33	6.03
20	14.93	13.05	10.62	8.66	14.76	12.45	9.60	7.45	8.29	6.63	5.43
27	14.58	12.72	10.36	8.55	14.36	12.09	9.37	7.39	8.37	6.84	5.63
Dec. 4	13.56	11.64	9.35	7.75	13.21	10.97	8.21	6.50	7.60	6.19	5.28
11	13.52	11.66	9.48	8.08	13.27	11.00	8.32	6.72	7.85	6.49	5.50
18	13.00	11.05	8.87	7.58	12.62	10.29	7.85	6.45	7.21	5.78	4.95
25	12.77	11.01	8.91	7.61	12.39	10.19	7.96	6.59	7.11	5.60	4.88
1921.											
Jan. 1	12.22	10.49	8.73	7.65	11.84	9.81	7.92	6.69	7.06	5.56	5.15

Week ending—	Canners and cutters. Cows and heifers.	Canner steers.	Veal calves. Light to medium weight, medium to choice.	Heavyweight, common to choice.	Feeder steers. Heavy (1,000 lbs. up), common to choice.	Medium (800–1,000 lbs.), common to choice.	Light (800 lbs. down), common to choice.	Stock cattle. Steers, common to choice.	Cows and heifers, common to choice.	Calves. Good and choice.	Common and medium.
1919.											
Mar. 22	$6.12	$8.88	$13.23	$10.68	$13.88	$13.09	$12.09	$11.22	$8.43	$11.56	$7.88
29	6.16	8.88	13.05	10.43	14.11	13.36	12.31	11.49	8.53	11.59	8.03
Apr. 5	5.76	8.88	12.58	10.15	14.17	13.40	12.37	11.56	8.47	11.68	8.11
12	5.58	9.38	12.65	10.30	14.25	13.38	12.68	11.70	8.75	11.88	8.25
19	5.58	9.38	12.90	10.38	14.25	13.38	12.68	11.70	8.75	11.88	8.25
26	5.78	9.38	12.65	10.28	14.36	13.49	12.74	11.79	8.86	11.88	8.25
May 3	5.77	9.30	11.60	9.55	14.43	13.58	12.93	11.83	8.91	11.83	8.25
10	5.93	9.14	11.50	9.50	14.39	13.55	12.96	11.86	8.93	11.88	8.25
17	6.00	9.04	11.83	9.63	14.16	13.28	12.73	11.57	8.94	11.83	8.23
24	6.20	9.00	12.63	10.15	13.98	13.11	12.58	11.25	8.97	11.63	8.10
31	6.10	8.59	13.22	10.50	13.35	12.54	12.09	10.61	8.59	11.22	7.81
June 7	5.90	8.14	13.00	10.28	13.06	12.20	11.77	10.26	8.45	10.95	7.45
14	6.00	8.27	13.28	10.53	13.19	12.35	11.91	10.37	8.68	10.88	7.38
21	5.83	8.28	13.93	11.08	12.91	12.27	11.87	10.36	8.80	10.83	7.38
28	5.75	7.94	13.98	10.85	12.06	11.56	11.25	9.69	8.37	10.55	7.28
July 5	5.92	8.01	14.50	11.34	11.89	11.59	11.31	9.71	8.34	10.50	7.34
12	6.34	8.57	15.58	12.43	11.99	11.75	11.48	10.03	8.63	10.68	7.68
19	6.02	8.60	15.10	11.43	12.08	11.83	11.53	9.99	8.44	10.63	7.53
26	5.72	8.45	13.55	9.43	12.14	11.77	11.50	9.79	8.03	9.58	6.88
Aug. 2	5.54	7.80	13.13	9.00	12.12	11.75	11.39	9.39	7.87	9.38	6.88
9	5.68	7.70	13.85	9.60	11.94	11.64	11.15	8.90	7.68	9.30	6.88
16	6.00	8.06	15.95	11.20	12.20	11.79	11.24	9.13	7.91	9.63	7.23
23	5.64	7.63	15.65	10.60	12.32	11.82	11.25	9.17	7.86	9.68	7.33
30	5.72	7.60	14.25	9.45	12.28	11.72	11.12	9.06	7.67	9.45	7.15
Sept. 6	5.68	7.40	14.08	9.23	11.86	11.32	10.82	8.80	7.43	9.25	6.88
13	5.64	7.25	15.65	10.48	11.64	11.04	10.55	8.61	7.48	9.43	6.93
20	5.40	6.84	15.43	9.18	11.13	10.42	9.94	8.04	7.35	8.90	6.65
27	5.29	6.85	15.98	9.00	11.54	10.67	10.08	7.96	7.14	9.08	6.60
Oct. 4	5.65	7.13	16.45	9.58	11.78	10.90	10.27	8.04	7.29	9.70	7.00
11	5.65	7.13	15.43	8.34	11.58	10.70	9.95	7.72	6.95	9.15	6.63
18	5.72	6.76	14.30	7.80	11.35	10.35	9.86	7.73	7.21	8.99	6.47
25	5.90	6.66	14.60	8.29	11.47	10.37	9.81	7.79	7.10	8.91	6.53

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

KANSAS CITY—Continued.

Week ending—	Canners and cutters.		Veal calves.		Feeder steers.			Stock cattle.			
	Cows and heifers.	Canner steers.	Light to medium weight, medium to choice.	Heavyweight, common to choice.	Heavy (1,000 lbs. up), common to choice.	Medium (800–1,000 lbs.), common to choice.	Light (800 lbs. down), common to choice.	Steers, common to choice.	Cows and heifers, common to choice.	Calves. Good and choice.	Calves. Common and medium.
1919.											
Nov. 1....	$5.75	$6.80	$14.58	$8.20	$11.34	$10.40	$9.72	$7.74	$7.06	$8.90	$6.38
8....	5.67	6.73	14.83	8.85	11.36	10.43	9.73	7.85	6.99	9.33	6.70
15....	5.61	6.68	15.13	9.30	11.36	10.54	9.77	8.12	6.88	9.73	6.98
22....	5.73	6.75	15.30	9.50	11.26	10.50	9.77	8.25	6.91	9.70	7.03
29....	5.78	6.75	14.34	8.50	11.05	10.40	9.75	8.24	6.93	9.16	6.81
Dec. 6....	5.91	6.80	14.53	8.58	10.96	10.31	9.65	8.10	6.85	9.28	6.85
13....	5.50	6.48	14.88	8.60	10.72	10.05	9.38	7.75	6.51	9.10	6.73
20....	5.56	6.58	15.08	8.85	10.84	10.14	9.45	8.02	6.62	9.34	6.94
27....	5.80	6.81	14.28	8.28	10.84	10.13	9.51	8.07	6.79	9.22	6.72
1920.											
Jan. 3....	5.96	6.90	14.35	8.63	10.88	10.16	9.60	8.25	6.93	9.60	7.00
10....	5.94	6.88	14.20	8.48	10.92	10.17	9.61	8.29	7.00	9.63	7.00
17....	5.91	6.88	14.73	8.95	11.11	10.42	9.84	8.54	7.16	9.73	7.00
24....	5.86	6.88	15.05	9.08	11.12	10.43	9.88	8.70	7.25	9.95	7.10
31....	5.94	6.95	15.38	9.18	11.05	10.45	9.88	8.70	7.75	9.95	7.13
Feb. 7....	5.86	6.80	14.53	8.50	11.00	10.40	9.88	8.65	8.18	9.98	7.28
14....	5.99	6.75	14.13	8.25	10.98	10.29	9.80	8.65	8.30	10.00	7.38
21....	5.94	6.65	14.10	8.08	10.97	10.30	9.75	8.69	8.25	10.00	7.38
28....	5.60	6.43	13.65	7.98	10.64	10.04	9.60	8.60	8.25	9.95	7.20
Mar. 6....	5.58	6.05	13.70	8.38	10.72	10.23	9.91	8.69	8.18	9.93	7.18
13....	5.63	6.00	14.63	9.38	11.06	10.69	10.40	9.26	8.43	10.00	7.25
20....	5.57	6.00	14.50	9.13	11.00	10.75	10.38	9.16	8.50	10.00	7.25
27....	5.68	6.10	15.13	9.45	10.96	10.72	10.36	9.10	8.40	9.80	7.15
Apr. 3....	5.70	6.13	15.03	9.30	10.94	10.73	10.35	9.13	8.38	9.88	7.13
10....	5.79	6.13	14.76	9.09	10.89	10.68	10.28	8.99	8.38	10.07	7.13
17....	6.00	6.29	13.21	8.25	10.83	10.58	10.23	8.93	8.29	10.05	7.13
24....	5.87	6.38	14.50	8.63	10.75	10.45	10.20	8.88	8.13	9.80	7.13
May 1....	5.70	6.38	13.43	8.53	10.55	10.45	9.70	9.05	8.13	9.76	7.18
8....	5.68	6.30	11.00	8.05	10.58	10.28	9.66	9.14	8.05	9.74	7.13
15....	5.55	6.33	11.38	8.73	10.52	10.33	10.06	9.13	7.93	9.50	7.00
22....	5.68	6.38	11.43	9.40	10.58	10.35	10.15	9.18	7.50	9.50	7.00
29....	5.74	6.32	11.83	9.45	10.47	10.21	10.03	9.11	7.48	9.50	7.00
June 5....	5.78	6.53	11.93	9.30	10.20	9.90	9.73	8.83	7.20	9.33	7.15
12....	6.23	6.90	12.90	10.18	11.13	10.87	10.63	9.44	7.48	9.40	7.30
19....	5.80	6.78	11.73	9.55	11.27	11.06	10.83	9.18	7.48	8.95	6.95
26....	5.13	6.38	11.18	9.13	10.85	10.53	10.28	8.63	6.83	8.75	6.63
July 3....	4.58	5.70	10.78	8.68	10.81	10.47	10.21	8.41	6.53	8.75	6.60
10....	4.66	5.47	11.16	8.91	10.75	10.49	10.18	8.30	6.25	9.06	6.59
17....	4.83	5.65	11.00	8.80	10.82	10.57	10.19	8.32	6.40	9.25	6.75
24....	4.88	5.75	11.40	9.13	10.94	10.70	10.25	8.43	6.50	9.25	6.75
31....	4.65	5.53	12.98	10.33	10.75	10.50	10.01	8.24	6.38	9.70	7.10
Aug. 7....	4.40	5.28	11.40	8.63	10.38	9.99	9.51	7.52	5.73	9.23	6.53
14....	4.51	5.20	10.90	8.03	10.49	10.00	9.45	7.28	5.88	9.03	6.33
21....	4.59	5.25	10.85	8.00	10.67	10.18	9.57	7.38	5.88	9.05	6.30
28....	4.50	5.25	10.98	8.33	10.63	10.13	9.50	7.37	5.88	9.00	6.25
Sept. 4....	4.53	5.35	11.55	9.05	10.77	10.27	9.68	7.48	5.95	9.20	6.35
						Light and medium weight (750 to 1,000 pounds) common to choice.					
11....	4.56	5.44	12.44	9.69	11.13	$10.50		7.74	6.06	9.38	6.38
18....	4.45	5.18	12.25	9.00	11.25	10.63		7.68	6.03	9.45	6.38
25....	4.63	5.38	12.25	8.63	10.97	10.29		7.36	6.13	9.28	6.30
Oct. 2....	4.83	5.48	12.45	8.20	10.58	9.79		7.15	6.25	9.00	6.25
9....	4.55	5.25	12.95	7.95	10.30	9.66		7.13	5.93	9.15	6.35
16....	4.63	5.25	12.43	7.20	10.33	9.68		7.00	5.83	8.85	6.18
23....	4.28	5.03	11.40	6.48	10.28	9.54		7.00	5.63	8.75	6.13
30....	4.55	5.08	11.03	6.73	10.46	9.66		7.21	5.70	8.80	6.05
Nov. 6....	4.72	5.23	12.33	8.35	10.49	9.64		7.23	5.93	9.50	6.60
13....	4.16	4.98	11.70	7.53	9.93	9.00		6.63	5.51	8.80	6.23
20....	3.80	4.40	11.20	6.48	9.07	8.21		5.90	4.95	7.78	5.20
27....	4.16	4.75	11.63	6.88	8.99	8.14		6.03	5.26	7.91	5.28
Dec. 4....	3.79	4.45	11.15	6.00	8.25	7.49		5.59	4.85	7.20	4.85
11....	4.12	4.50	10.28	5.88	8.54	7.84		6.08	4.94	7.13	4.83
18....	3.65	4.03	8.36	5.18	8.58	7.88		6.13	4.99	7.00	4.63
25....	3.54	3.97	8.05	5.16	8.58	7.88		6.13	5.00	7.00	4.63
1921.											
Jan. 1....	3.53	4.15	9.83	6.65	8.36	7.64		5.98	4.90	7.28	4.98

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

OMAHA.

Week ending—	Beef steers.								Butcher cattle.			Canners and cutters.	
	Medium and heavyweight (1,100 pounds up).				Lightweight (1,100 pounds down).				Heifers, common to choice.	Cows, common to choice.	Bulls, bologna and beef.		
	Choice and prime.	Good.	Medium.	Common.	Choice and prime.	Good and medium.		Common.				Cows and heifers	Canner steers.
1919.													
May 3	$18.00	$16.15	$14.35	$13.1[illegible]	$16.08	$14.15		$11.45	$11.28	$10.45	$9.93	$6.18	$8.90
10	17.73	15.93	14.25	13.00	15.88	14.03		11.50	11.33	10.60	10.30	6.13	......
17	17.50	15.65	14.30	12.98	15.75	13.95		11.50	11.25	10.70	10.43	6.28	......
24	16.85	15.00	13.95	12.68	15.25	13.58		11.20	11.13	10.65	10.50	6.53	......
31	15.84	14.16	13.06	11.97	14.13	12.56		10.69	10.44	10.03	9.00	6.31	......
June 7	15.18	13.55	12.68	11.45	13.78	12.30		10.5	10.03	9.78	9.75	6.43	......
14	15.43	13.85	12.88	11.68	14.38	12.90		11.0	10.35	10.10	9.93	6.68	......
21	14.80	13.40	12.33	11.18	14.18	12.70		11.00	10.00	9.53	9.55	6.33	......
28	14.00	12.80	11.83	10.85	14.05	12.55		10.85	10.18	9.55	9.05	6.38	......
July 5	14.19	13.06	12.13	11.19	14.16	12.81		11.19	10.31	9.72	9.06	6.44	......
12	15.18	14.03	13.04	12.05	15.20	13.78		11.98	11.10	10.45	9.33	6.85	......
19	16.30	15.08	14.25	12.98	16.25	14.78		12.83	11.45	10.93	9.50	7.13	......
26	17.10	15.68	14.65	13.20	16.78	15.15		13.03	10.95	10.40	9.43	6.68	......
Aug. 2	16.65	15.15	14.15	12.90	16.28	14.73		12.69	10.63	9.95	9.38	6.23	......
9	16.90	15.35	14.08	12.73	16.20	14.35		12.35	10.68	9.95	9.40	6.30	......
16	17.79	16.15	14.35	12.85	16.98	14.83		12.68	10.90	10.18	9.75	6.63	......
23	17.15	15.73	13.95	12.50	16.68	14.53		12.60	10.98	10.03	9.23	6.40	......
30	16.48	14.70	12.70	10.93	16.55	13.93		11.68	10.13	9.63	8.55	6.28	......
Sept. 6	16.87	14.93	12.68	10.73	16.60	13.80		11.38	10.13	9.63	8.25	6.13	......
13	16.40	14.53	12.28	10.40	16.30	13.50		11.13	10.20	9.60	8.25	6.08	......
20	15.75	13.88	11.63	9.63	15.90	13.00		10.63	9.43	8.93	7.65	5.80	......
27	15.85	13.98	11.68	9.63	16.00	13.00		10.63	9.38	8.88	7.55	5.75	......
Oct. 4	16.15	14.23	11.85	9.73	16.28	13.23		10.68	9.45	8.90	7.58	5.83	......
11	16.38	14.38	11.98	9.88	16.50	13.38		10.75	9.50	9.00	7.63	5.88	......
18	16.33	14.23	11.85	9.70	16.45	13.20		10.48	9.35	8.73	7.50	5.78	......
25	16.65	14.53	12.15	9.55	16.98	13.55		10.15	10.23	9.48	7.38	5.85	......
Nov. 1	16.90	14.53	12.20	10.00	17.13	13.75		10.20	10.35	9.58	7.58	5.97	......
8	16.93	14.43	12.13	9.88	17.13	13.65		10.08	10.33	9.58	7.60	6.03	......
15	17.13	14.70	12.28	9.95	17.13	13.45		10.03	10.13	9.50	7.58	5.96	......
22	17.25	14.70	12.33	10.00	17.13	13.45		10.03	10.13	9.48	7.53	5.95	......
29	17.25	14.75	12.25	10.00	17.13	13.38		9.88	9.94	9.31	7.63	5.81	......
Dec. 6	17.20	14.65	12.15	9.90	17.08	13.28		9.83	9.73	9.10	7.45	5.65	......
13	17.23	14.63	12.13	9.93	17.00	13.25		9.83	9.63	9.08	7.45	5.58	......
20	16.88	14.25	11.88	9.85	16.88	13.15		9.78	9.70	9.18	7.83	5.33	......
27	17.47	14.94	12.56	10.44	17.34	14.06		10.53	10.22	9.81	8.13	5.84	......
1920.													
Jan. 3	17.35	14.85	12.48	10.48	17.23	13.98		10.60	10.00	9.73	8.00	5.78	......
10	17.55	15.05	12.85	10.90	17.35	14.20		10.90	10.28	10.03	8.53	6.03	......
17	17.45	14.95	12.85	10.95	17.20	14.20		10.90	10.35	10.10	8.63	6.13	......
24	16.93	14.50	12.63	10.75	16.75	13.93		10.63	10.25	10.00	8.50	6.23	......
31	16.18	14.23	12.50	10.65	15.90	13.18		10.28	10.18	9.80	8.60	6.35	7.25
						Good.	Medium.						
Feb. 7	14.60	13.18	11.73	10.20	14.43	$12.90	$11.20	9.58	9.43	9.00	8.28	6.03	7.10
14	14.35	12.88	11.50	10.00	14.23	12.63	11.00	9.38	9.20	8.88	8.15	5.88	7.00
21	14.28	12.78	11.40	9.90	14.15	12.53	10.90	9.23	9.03	8.78	8.03	5.83	6.95
28	13.68	12.30	11.05	9.55	13.55	12.05	10.65	9.00	8.88	8.43	7.75	5.35	6.75
Mar. 6	14.03	12.70	11.45	10.00	13.88	12.50	11.08	9.48	9.23	8.75	7.75	5.10	6.75
13	14.30	13.05	11.95	10.63	14.08	12.75	11.38	9.93	9.70	9.35	8.25	5.60	6.95
20	13.88	12.75	11.75	10.48	13.80	12.55	11.18	9.93	9.63	9.30	8.43	5.50	7.10
27	13.88	12.75	11.75	10.38	13.75	12.50	11.13	9.88	9.63	9.25	8.38	5.50	7.00
Apr. 3	13.88	12.85	11.85	10.53	13.75	12.[illegible]	11.28	10.08	9.58	9.20	8.38	5.50	7.00
10	13.81	12.81	11.78	10.59	13.69	12.53	11.28	10.16	9.50	9.13	8.38	5.50	7.00
17	14.19	13.19	12.09	10.75	14.06	13.09	11.63	10.19	9.69	9.25	8.38	5.41	7.00
24	13.35	12.35	11.35	10.30	13.25	12.35	11.35	10.03	9.80	9.30	8.35	5.63	7.05
May 1	12.95	11.95	10.85	9.88	12.95	11.85	10.88	9.63	9.38	8.88	8.35	5.38	6.75
8	12.85	11.80	10.78	9.83	13.05	12.00	10.85	9.30	9.45	8.95	8.50	5.48	6.75
15	13.05	12.13	11.28	10.35	13.35	12.35	11.28	9.85	9.98	9.30	8.55	5.60	6.75
22	12.53	11.65	10.85	10.10	12.85	12.00	10.88	9.50	9.90	9.30	8.60	5.75	7.00
29	12.25	11.50	10.63	9.88	12.78	11.98	10.95	9.70	10.00	9.25	8.50	5.65	6.75
June 5	13.13	12.33	11.53	10.73	13.50	12.73	11.80	10.50	10.25	9.35	8.80	5.98	7.05
12	15.18	14.38	13.48	12.63	15.20	14.33	13.30	12.03	11.21	10.43	9.40	6.70	8.00
19	15.88	14.85	13.80	12.78	15.71	14.40	12.93	11.55	11.18	10.38	9.63	6.43	7.95
26	16.10	14.93	13.60	12.55	16.10	14.68	12.93	11.38	10.83	10.08	9.53	5.65	7.30
July 3	15.98	14.85	13.53	12.33	16.10	14.73	13.10	11.08	10.20	9.35	8.58	4.83	6.23
10	16.13	15.00	13.38	12.00	16.25	14.88	13.13	10.88	10.47	9.34	8.50	4.84	6.13
17	16.25	15.25	13.45	11.90	16.38	15.08	13.28	10.90	10.58	9.50	8.50	5.33	6.18
24	16.22	15.20	13.33	11.55	16.38	15.00	13.13	10.70	10.40	9.38	8.50	5.25	6.05
31	15.88	14.75	12.78	10.80	16.14	14.75	12.78	10.40	9.93	9.03	8.33	5.03	6.00

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

OMAHA—Continued.

Week ending—	Beef steers.								Butcher cattle.			Canners and cutters.	
	Medium and heavyweight (1,100 pounds up).				Lightweight (1,100 pounds down).				Heifers, common to choice.	Cows, common to choice.	Bulls, bologna and beef.		
	Choice and prime.	Good.	Medium.	Common.	Choice and prime.	Good.	Medium.	Common.				Cows and heifers.	Canner steers.
1920.													
Aug. 7	$15.88	$14.75	$12.80	$10.73	$16.13	$14.75	$12.75	$10.38	$9.63	$8.63	$8.23	$4.63	$5.50
14	15.88	14.85	13.15	11.23	16.13	14.85	12.95	10.73	9.88	8.88	8.68	4.93	5.80
21	16.30	14.98	13.23	11.23	16.38	15.18	13.35	10.85	9.83	8.90	8.73	5.00	5.80
28	16.25	14.88	13.13	11.03	16.38	15.13	13.15	10.55	9.45	8.38	8.35	4.58	5.55
Sept. 4	16.29	14.88	13.13	11.13	16.52	15.13	13.25	10.75	9.50	8.63	8.45	4.75	5.63
11	16.55	15.18	13.28	11.18	16.75	15.38	13.45	10.80	9.75	8.68	8.50	4.85	5.73
18	16.80	15.50	13.53	11.05	16.93	15.50	13.53	10.68	9.95	8.58	8.25	4.70	5.88
25	17.00	15.70	13.58	11.00	17.10	15.70	13.45	10.48	9.80	8.43	8.18	4.63	5.88
Oct. 2	16.90	15.33	13.13	10.75	16.90	15.33	12.55	9.68	9.28	8.15	8.00	4.53	5.80
9	16.75	15.13	12.93	10.50	16.75	15.03	12.28	9.45	9.18	8.05	7.93	4.55	5.55
16	16.83	15.28	13.08	10.50	16.83	15.15	12.40	9.45	9.33	8.13	8.00	4.63	5.50
23	16.43	14.93	12.60	10.08	16.38	14.73	11.90	9.08	8.78	7.63	7.65	4.20	5.25
30	16.38	14.68	12.00	9.60	16.38	14.43	11.15	8.40	8.75	7.63	6.93	4.23	5.13
Nov. 6	16.53	14.88	12.18	9.75	16.53	14.63	11.18	8.30	9.08	8.08	7.23	4.85	5.70
13	15.68	13.75	11.48	9.50	15.43	13.25	10.35	8.00	8.80	7.68	7.25	4.40	5.23
20	14.73	12.78	10.45	8.55	14.48	12.20	9.25	7.05	7.98	6.95	6.30	3.73	4.40
27	14.44	12.56	10.19	8.19	14.19	11.94	8.94	6.88	7.81	6.81	6.06	3.78	4.19
Dec. 4	14.03	12.30	9.98	7.93	13.75	11.60	8.85	7.00	7.73	6.70	6.10	3.75	4.25
11	13.58	11.90	9.65	7.83	13.20	11.28	8.83	7.00	7.83	6.73	6.00	4.08	4.45
18	12.98	11.20	8.98	7.43	12.68	10.58	8.15	6.63	7.33	6.15	5.50	3.68	4.15
25	12.98	11.50	9.38	7.73	12.73	10.88	8.50	6.95	7.43	6.28	5.55	3.95	4.25
1921.													
Jan. 1	12.40	10.83	8.83	7.28	11.90	10.20	8.10	6.68	7.15	6.23	5.60	3.98	4.35

Week ending—	Veal calves.		Feeder steers.			Stock cattle.				Western range cattle.		
								Calves.		Beef steers.		
	Light to medium weight, medium to choice.	Heavyweight, common to choice.	Heavy (1,000 pounds up), common to choice.	Medium (800 to 1,000 pounds) common to choice.	Light (800 pounds down), common to choice.	Steers, common to choice.	Cows and heifers, common to choice.	Good and choice.	Common and medium.	Good and choice.	Common and medium.	Cows and heifers, medium to choice.
1919.												
May 3	$12.65	$9.88	$14.20	$13.35	$12.65	$10.35	$9.00	$11.05	$9.00	......	......	......
10	12.45	9.60	14.00	13.25	12.40	10.50	9.00	11.38	9.10	......	......	......
17	12.50	9.50	14.00	13.25	12.38	10.50	9.00	11.38	9.25	......	......	......
24	12.50	9.50	13.55	12.93	12.08	10.50	8.90	11.23	9.15	......	......	......
31	12.88	9.94	12.97	12.38	11.81	10.25	8.44	10.81	8.78	......	......	......
June 7	12.53	9.70	12.20	11.68	11.18	9.78	8.00	10.50	8.50	......	......	......
14	12.88	10.03	12.43	11.85	11.13	9.83	8.23	10.73	8.65	......	......	......
21	12.95	10.13	12.35	11.70	11.23	10.05	8.15	10.58	8.53	......	......	......
28	13.75	1[illegible].88	12.10	11.43	10.98	10.00	7.85	10.38	8.38	......	......	......
July 5	14.50	1[illegible].44	12.13	11.38	10.88	10.00	7.75	10.38	8.38	$11.83	$10.42	$9.92
12	15.50	12.25	12.25	11.50	11.00	10.13	7.78	10.40	8.43	12.35	10.55	9.75
19	15.55	12.[illegible]5	12.53	11.73	11.20	10.35	7.88	10.43	8.60	13.28	10.85	9.93
26	13.45	10.[illegible]0	12.10	11.35	10.46	9.80	7.68	9.68	8.23	13.28	10.38	8.83
Aug. 2	12.68	9.7[illegible]	12.10	11.35	10.15	9.50	7.40	9.38	8.13	13.15	10.25	8.75
9	12.75	9.75	12.23	11.48	10.03	9.25	7.45	9.38	8.13	13.42	10.53	8.83
16	13.05	9.95	12.65	11.70	10.00	9.25	7.63	9.38	8.13	14.18	11.18	9.10
23	13.63	10.45	12.35	11.53	9.73	9.20	7.50	9.53	8.13	14.30	11.38	9.15
30	13.13	10.13	11.48	10.30	8.90	8.63	7.50	9.23	7.75	13.38	10.15	8.75
Sept. 6	13.13	10.13	11.40	10.08	8.78	8.58	7.50	9.38	7.75	13.43	10.00	9.05
13	13.00	10.00	10.93	9.70	8.68	8.50	7.50	9.28	7.65	13.50	9.95	9.08
20	12.50	9.63	10.23	8.70	8.25	8.00	6.93	8.63	7.00	12.90	9.50	8.50
27	12.60	9.43	10.78	9.15	8.68	8.20	7.13	8.78	7.15	13.20	9.58	8.58
Oct. 4	12.75	9.50	11.00	9.43	8.95	8.60	7.13	9.35	7.73	13.60	9.98	8.65
11	12.60	9.20	11.00	9.53	9.15	8.75	7.13	9.63	7.88	13.63	10.00	8.75
18	12.08	8.53	10.70	9.40	8.83	8.43	7.05	9.53	7.68	13.30	9.78	8.58
25	13.35	8.95	11.03	9.98	9.35	8.78	7.25	9.88	7.88	13.58	9.93	9.20
Nov. 1	13.38	9.00	11.08	10.03	9.20	8.73	7.25	9.88	7.88	13.60	9.95	9.05
8	13.53	9.10	10.93	9.93	9.03	8.53	7.20	9.78	7.88	13.50	9.78	9.00
15	13.75	9.25	10.88	10.03	9.34	8.85	7.13	9.83	7.88	13.65	9.70	8.98
22	13.75	9.25	10.88	9.93	9.29	8.95	7.08	9.88	7.80	13.55	9.55	8.95
29	13.75	9.25	10.78	9.78	9.16	8.88	7.00	9.88	7.75	13.38	9.38	8.81

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

OMAHA—Continued.

Week ending—	Veal calves.		Feeder steers.			Stock cattle.				Western range cattle.		
								Calves.		Beef steers.		
	Light to medium weight, medium to choice.	Heavyweight, common to choice.	Heavy (1,000 pounds up), common to choice.	Medium (800 to 1,000 pounds) common to choice.	Light (800 pounds down), common to choice.	Steers, common to choice.	Cows and heifers, common to choice.	Good and choice.	Common and medium.	Good and choice.	Common and medium.	Cows and heifers, medium to choice.
1919.												
Dec. 6	$13.75	$9.05	$10.75	$9.75	$9.13	$8.83	$6.90	$9.88	$7.73	$13.38	$9.38	$8.73
13	13.75	8.75	10.75	9.75	9.13	8.75	6.65	9.73	7.60	......	......	......
20	13.75	8.75	10.75	9.75	9.13	8.75	6.50	9.50	7.38	......	......	......
27	13.75	9.13	11.00	10.00	9.38	9.00	6.75	9.84	7.81	......	......	......
1920.												
Jan. 3	13.75	9.25	11.05	10.05	9.43	9.05	6.75	9.93	7.88	......	......	......
10	13.88	9.30	11.60	10.43	9.85	9.48	6.95	10.33	8.10	......	......	......
17	14.25	9.50	11.75	10.63	10.00	9.63	7.13	10.25	8.25	......	......	......
24	14.25	9.50	11.75	10.63	10.00	9.63	7.13	10.35	8.30	......	......	......
31	14.65	9.90	11.58	10.55	9.93	9.55	7.33	10.75	8.55	......	......	......
Feb. 7	14.75	9.90	10.73	10.10	9.58	9.05	7.33	10.45	8.45	......	......	......
14	14.75	10.00	10.45	10.00	9.50	8.88	7.05	10.50	8.50	......	......	......
21	14.85	10.05	10.28	9.95	9.50	8.83	7.00	10.30	8.30	......	......	......
28	14.85	9.85	9.93	9.70	9.30	8.55	6.88	9.60	7.60	......	......	......
Mar. 6	14.75	9.95	10.15	9.80	9.43	8.83	6.90	9.63	7.63	......	......	......
13	14.90	10.00	10.58	10.25	9.88	9.08	7.13	9.75	7.75	......	......	......
20	15.00	10.00	10.63	10.38	10.00	9.13	7.33	9.75	7.75	......	......	......
27	15.08	10.00	10.63	10.40	10.00	9.13	7.63	9.75	7.75	......	......	......
Apr. 3	15.33	10.03	10.63	10.38	10.00	9.13	7.63	9.75	7.75	......	......	......
10	15.50	10.06	10.47	10.28	9.97	9.09	7.59	9.75	7.81	......	......	......
17	13.75	9.06	10.25	10.00	9.88	9.00	7.38	9.75	7.75	......	......	......
24	14.10	8.93	10.40	10.10	9.88	9.00	7.38	9.75	7.75	......	......	......
May 1	13.40	8.65	10.37	10.10	9.88	9.00	7.30	9.75	7.75	......	......	......
8	12.35	8.30	10.08	9.88	9.65	8.68	7.03	9.55	7.30	......	......	......
15	11.35	8.00	10.58	10.23	9.98	8.88	7.13	9.50	6.95	......	......	......
22	11.50	8.50	10.65	10.30	10.05	8.88	7.48	9.50	7.50	......	......	......
29	12.33	9.40	10.63	10.38	10.13	8.88	7.38	9.50	7.50	......	......	......
June 5	12.53	9.50	10.63	10.38	10.13	8.93	7.38	9.50	7.53	......	......	......
12	13.18	10.15	11.08	10.83	10.58	9.48	7.65	9.90	8.10	......	......	......
19	13.90	10.70	10.93	10.68	10.40	9.40	7.50	10.00	8.25	......	......	......
26	13.10	9.80	10.33	10.13	9.90	9.03	6.93	9.38	7.55	......	......	......
July 3	11.65	8.40	10.13	9.70	9.25	8.58	6.75	8.55	6.75	......	......	......
10	11.63	8.25	10.13	9.63	9.13	8.53	6.75	8.50	6.75	......	......	......
17	12.00	8.50	10.25	9.88	9.33	8.63	6.75	8.63	6.75	......	......	......
24	11.80	8.30	10.50	9.98	9.25	8.63	6.75	8.50	6.65	......	......	......
31	11.98	8.45	10.40	9.90	9.15	8.53	6.78	8.35	6.75	......	......	......
Aug. 7	11.90	8.60	10.38	9.93	9.00	8.38	6.48	8.00	6.00	11.55	8.85	7.63
14	12.15	8.75	10.63	10.00	9.08	8.25	6.53	8.00	6.00	11.60	8.95	7.93
21	10.93	7.90	10.68	9.98	9.05	8.18	6.73	8.00	6.00	11.38	8.85	7.85
28	9.83	7.28	10.75	9.83	8.80	7.90	5.78	8.13	5.50	10.73	8.10	7.40
Sept. 4	10.73	7.65	11.25	10.13	9.13	8.00	6.25	8.63	5.85	11.23	8.43	7.75
11	11.03	7.73	11.35	9.93	....	8.20	6.25	8.73	6.20	12.13	9.05	7.75
				Light and medium weight (750 to 1,000 pounds), common to choice.								
18	11.50	7.75	11.00	$9.58		8.13	6.13	8.50	6.25	12.63	9.50	7.70
25	11.50	7.75	11.08	9.50		8.13	6.13	8.50	6.25	12.63	9.50	7.58
Oct. 2	11.40	7.75	10.48	9.33		7.90	6.03	8.08	5.80	12.18	9.00	7.15
9	11.25	7.75	10.13	9.13		7.73	5.88	7.75	5.63	12.05	8.78	7.05
16	11.25	7.75	10.03	9.28		7.83	6.03	7.90	5.70	12.08	8.83	7.28
23	11.00	7.35	9.63	8.98		7.40	5.85	7.48	5.45	11.60	8.38	6.93
30	11.00	7.53	9.75	9.15		7.30	5.75	7.38	5.38	11.60	8.30	6.70
Nov. 6	11.80	8.23	10.23	9.58		7.75	6.20	7.93	5.80	11.83	8.75	7.48
13	12.25	8.50	10.00	9.38		7.70	6.03	8.23	5.88	11.63	8.63	7.05
20	11.60	7.55	8.85	8.18		6.53	5.10	7.18	4.90	10.63	7.68	6.33
27	11.59	6.97	8.69	7.94		6.13	4.97	6.75	4.59	10.22	7.44	6.31
Dec. 4	11.63	7.00	8.60	7.73		6.00	5.00	6.75	4.63	10.00	7.38	6.25
11	11.10	6.93	8.55	7.68		6.10	5.00	6.75	4.63	9.70	7.30	6.33
18	9.50	6.08	8.23	7.48		6.03	4.98	6.55	4.50	8.88	6.78	5.93
25	9.00	6.00	8.25	7.50		6.25	4.88	6.50	4.50	8.58	6.58	5.78
1921.												
Jan. 1	9.00	6.10	8.20	7.45		6.28	4.88	6.53	4.58	8.21	6.21	5.46

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

EAST ST. LOUIS.

Week ending—	Beef steers. Medium and heavyweight (1,100 pounds up). Choice and prime.	Good.	Medium.	Common.	Lightweight (1,100 pounds down). Choice and prime.	Good and medium. (1920, from Feb.: Good.)	(1920, from Feb.: Medium.)	Common.	Butcher cattle. Heifers, common to choice.	Cows, common to choice.	Bulls, bologna and beef.
1919.											
May 3	....	....	....	....	....	....		....	....	....	....
10	....	$15.88	$14.66	$13.38	....	$14.33		$11.33	$12.25	$10.50	$9.85
17	....	15.61	14.36	13.16	....	14.23		11.23	12.61	9.88	9.65
24	....	15.36	14.21	13.02	....	13.97		11.20	12.25	10.08	9.53
31	....	14.78	13.47	12.31	....	13.38		10.75	11.66	9.41	9.28
June 7	....	13.75	12.75	11.50	....	12.80		10.35	11.05	8.95	8.60
14	....	14.15	13.28	11.75	$15.25	13.43		10.93	11.80	9.08	8.88
21	$15.25	14.25	12.90	11.53	....	13.23		10.90	11.68	9.13	9.00
28	....	14.03	12.53	11.28	....	12.90		10.65	11.35	9.20	9.00
July 5	....	13.75	12.17	11.00	....	12.54		10.54	11.17	9.17	8.67
12	....	14.23	12.93	11.60	16.00	13.38		11.08	11.55	9.79	9.33
19	16.10	15.01	13.50	12.05	....	13.98		11.25	11.78	10.23	9.23
26	16.90	15.93	13.83	11.75	17.00	14.43		11.25	11.05	9.68	8.80
Aug. 2	17.85	16.20	13.80	11.75	18.25	14.60		11.25	11.18	9.89	8.75
9	17.70	16.47	14.18	11.95	....	14.75		11.35	11.68	10.25	8.80
16	18.25	16.53	13.93	11.75	18.00	14.98		11.35	11.63	9.98	8.70
23	17.98	16.05	13.28	11.08	17.48	14.45		10.73	11.03	9.30	8.33
30	17.86	15.68	12.85	10.83	17.38	14.00		10.40	11.13	9.28	8.40
Sept. 6	17.50	15.20	12.34	10.59	17.30	13.63		9.84	11.13	9.06	8.13
13	17.35	15.13	12.25	10.38	17.35	13.60		9.68	11.63	9.13	8.23
20	16.95	14.63	11.78	9.95	17.03	13.30		9.15	11.35	8.53	8.10
27	16.70	14.75	12.20	10.23	16.88	13.68		10.03	11.68	9.00	8.55
Oct. 4	16.65	14.68	12.05	9.80	16.68	13.18		9.25	11.70	8.95	8.53
11	16.78	14.85	12.18	9.75	16.73	13.18		9.13	11.63	8.85	8.50
18	16.98	15.00	12.25	9.75	16.95	13.25		9.13	11.55	8.93	8.58
25	17.30	15.15	12.33	9.75	17.08	13.25		9.13	11.50	9.13	8.63
Nov. 1	17.50	15.25	12.33	9.70	17.13	13.20		9.13	11.50	8.95	8.55
8	17.68	15.33	12.25	9.53	17.28	12.98		9.13	11.45	9.00	8.45
15	18.40	15.85	12.40	9.60	18.08	13.78		9.28	11.25	9.10	8.05
22	18.63	16.13	12.63	9.75	18.38	14.00		9.50	11.25	9.15	8.00
29	18.63	16.28	13.09	10.34	18.38	14.19		9.84	11.56	9.31	8.06
Dec. 6	18.63	16.28	13.05	10.50	18.38	14.23		9.83	11.68	9.40	8.13
13	18.85	15.88	12.70	10.28	18.75	14.13		9.58	11.40	9.30	8.13
20	18.68	15.35	12.13	9.65	18.83	13.70		9.13	11.30	9.28	8.03
27	18.50	15.34	12.53	9.81	18.75	13.78		9.44	11.41	9.59	8.19
1920.											
Jan. 3	....	15.06	12.44	9.56	....	13.66		9.28	11.50	9.75	8.25
10	17.00	14.65	12.08	9.63	17.00	13.58		9.38	11.50	9.75	8.35
17	16.85	14.38	11.88	9.88	16.85	13.50		9.50	11.50	9.65	8.38
24	16.65	14.38	11.88	9.88	16.65	13.40		9.53	11.30	9.50	8.58
31	15.93	14.05	11.83	9.88	15.88	13.05		9.58	11.33	9.58	8.95
						Good.	Medium.				
Feb. 7	15.33	13.50	11.70	9.88	15.33	$13.50	$11.70	9.63	11.33	9.43	8.90
14	15.13	13.25	11.63	9.88	15.05	13.00	11.40	9.60	11.03	9.08	8.85
21	15.00	13.23	11.75	9.88	15.00	12.98	11.38	9.63	10.88	8.88	8.75
28	14.59	12.78	11.31	9.72	14.56	12.59	11.03	9.38	10.38	9.00	8.63
Mar. 6	14.25	12.55	11.20	9.68	14.15	12.48	11.08	9.35	10.45	9.03	8.50
13	14.48	13.08	11.58	10.03	14.48	13.08	11.58	9.78	11.18	9.65	8.50
20	14.23	12.80	11.35	10.05	14.23	12.80	11.35	9.80	11.18	9.48	8.75
27	14.08	12.80	11.40	10.08	13.95	12.63	11.25	9.75	10.83	9.25	8.75
Apr. 3	14.50	13.28	11.70	10.28	14.08	12.78	11.43	9.98	10.63	9.25	8.70
10	14.50	13.25	11.75	10.38	14.13	13.88	11.53	10.13	11.06	9.47	8.75
17	14.50	13.33	12.04	10.54	14.13	13.33	11.88	10.38	11.46	9.50	8.75
24	13.54	12.98	11.78	10.55	13.81	13.00	11.78	10.45	12.30	9.65	9.00
May 1	13.65	12.80	11.53	10.43	13.78	12.70	11.53	10.25	11.75	9.40	9.00
8	13.70	12.75	11.60	10.28	14.00	12.73	11.58	10.28	11.60	9.35	9.00
15	13.63	12.80	11.53	10.28	13.75	12.78	11.48	10.28	11.53	9.50	9.00
22	13.15	12.42	11.48	10.38	13.78	12.70	11.50	10.38	11.53	9.35	8.95
29	12.48	11.78	10.98	10.28	13.88	12.45	11.15	10.10	11.78	9.13	8.83
June 5	13.28	12.59	11.59	10.56	14.06	12.84	11.59	10.13	11.75	9.00	8.63
12	15.50	14.49	13.13	11.78	15.50	14.30	13.13	11.45	12.30	9.50	8.93
19	16.43	15.20	13.20	11.65	16.08	15.13	13.20	11.13	12.20	9.18	8.73
26	16.54	15.42	12.93	11.28	16.28	15.28	12.98	10.43	11.68	8.58	8.20
July 3	16.43	15.38	13.25	11.38	16.35	15.30	13.10	10.50	11.58	8.30	8.13
10	16.44	15.34	13.13	11.38	16.44	15.31	12.94	10.38	11.50	8.47	8.13
17	16.58	15.38	13.13	11.33	16.58	15.38	13.05	10.50	11.53	8.73	7.93
24	16.48	15.25	12.88	11.00	16.58	15.30	12.88	10.33	11.60	8.93	7.85
31	16.25	15.13	12.75	10.70	16.50	15.25	12.75	10.00	11.38	8.55	7.55

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

EAST ST. LOUIS—Continued.

Week ending—	Beef steers. Medium and heavyweight (1,100 pounds up). Choice and prime.	Beef steers. Medium and heavyweight (1,100 pounds up). Good.	Beef steers. Medium and heavyweight (1,100 pounds up). Medium.	Beef steers. Medium and heavyweight (1,100 pounds up). Common.	Beef steers. Lightweight (1,100 pounds down). Choice and prime.	Beef steers. Lightweight (1,100 pounds down). Good.	Beef steers. Lightweight (1,100 pounds down). Medium.	Beef steers. Lightweight (1,100 pounds down). Common.	Butcher cattle. Heifers, common to choice.	Butcher cattle. Cows, common to choice.	Butcher cattle. Bulls, bologna and beef.
1920.											
Aug. 7....	$15.98	$14.98	$12.73	$10.70	$16.38	$15.23	$12.70	$9.78	$11.10	$8.40	$7.25
14....	16.30	15.15	12.43	10.18	16.60	15.25	12.05	8.93	11.00	8.48	7.15
21....	16.50	15.18	12.38	10.18	16.75	15.25	12.00	8.88	11.00	8.60	7.00
28....	16.58	15.18	12.43	10.25	16.75	15.30	12.18	9.03	11.10	8.65	7.00
Sept. 4....	16.85	15.43	12.78	10.35	16.85	15.45	12.55	9.33	11.25	8.53	7.00
11....	17.00	15.75	13.13	10.38	17.00	15.75	12.88	9.34	11.22	8.25	6.88
18....	17.00	15.73	13.13	10.38	17.00	15.73	12.88	9.25	11.13	8.25	6.75
25....	17.00	15.58	12.95	10.33	17.00	15.58	12.50	9.10	11.05	8.05	6.95
Oct. 2....	17.00	15.45	12.43	9.78	17.00	15.45	11.93	8.40	11.00	8.08	6.98
9....	17.03	15.25	11.98	9.40	17.03	15.25	11.45	8.00	10.88	7.65	6.60
16....	17.38	15.58	12.13	9.38	17.38	15.58	11.63	7.86	10.63	7.38	6.38
23....	17.25	15.33	11.90	9.33	17.25	15.33	11.43	7.83	10.05	6.95	6.23
30....	17.25	15.35	12.13	9.75	17.25	15.38	11.75	8.38	10.35	7.38	6.48
Nov. 6....	17.03	15.28	12.25	9.85	17.03	15.28	11.88	8.60	10.70	7.83	7.10
13....	15.80	13.73	11.05	9.00	15.80	13.73	10.58	7.60	9.88	7.10	6.85
20....	15.03	12.98	10.53	8.63	14.88	12.68	9.70	7.23	9.18	6.75	6.60
27....	14.75	12.75	10.41	8.53	14.50	12.44	9.69	7.38	9.22	6.97	6.50
Dec. 4....	13.83	11.78	9.28	7.80	13.58	11.53	8.85	6.75	8.93	6.70	6.38
11....	13.13	11.08	8.83	7.48	12.88	10.83	8.28	6.48	8.63	6.38	6.08
18....	12.68	10.43	8.20	7.30	12.50	10.18	7.78	6.43	8.78	6.10	5.88
25....	12.65	10.50	8.38	7.45	12.53	10.30	8.10	6.63	8.90	6.08	5.68
1921.											
Jan. 1....	12.43	10.40	8.50	7.63	12.38	10.35	8.45	7.15	8.55	6.30	5.75

Week ending—	Canners and cutters. Cows and heifers.	Canners and cutters. Canner steers.	Veal calves. Light to medium weight, medium to choice.	Veal calves. Heavyweight, common to choice.	Feeder steers. Heavy (1,000 lbs. up), common to choice.	Feeder steers. Medium (800-1,000 lbs.), common to choice.	Feeder steers. Light (800 lbs. down), common to choice.	Stock cattle. Steers, common to choice.	Stock cattle. Cows and heifers, common to choice.	Stock cattle. Calves. Good and choice.	Stock cattle. Calves. Common and medium.
1919.											
May 3....	....	....	....	....	....	....	....	....	....	....	....
10....	$6.08	$7.00	$12.73	$10.15	$12.00	$11.25	$10.53	$9.88	$8.00	$9.63	$8.00
17....	6.18	7.05	12.70	10.25	12.00	11.40	10.91	10.13	8.28	9.76	8.10
24....	6.40	7.00	13.30	10.50	12.00	11.55	11.10	10.02	8.50	10.05	8.23
31....	6.44	7.28	13.97	11.50	12.08	11.26	10.83	10.18	8.40	9.60	8.03
June 7....	6.13	7.00	12.88	11.33	11.48	10.53	10.00	9.65	7.88	8.75	7.63
14....	6.55	7.50	13.88	12.20	11.63	10.55	10.03	9.68	8.15	9.05	7.75
21....	6.58	7.75	14.60	13.18	11.50	10.50	9.88	9.63	7.68	8.80	7.50
28....	6.88	7.75	15.18	13.93	....	10.25	9.63	9.30	7.63	8.75	7.50
July 5....	6.33	7.08	14.00	13.00	....	10.00	9.50	9.00	7.50	8.38	6.88
12....	7.10	8.45	14.70	13.53	....	10.08	9.50	9.08	8.30	9.00	7.48
19....	7.13	8.50	15.08	13.63	....	10.20	9.60	9.25	8.78	9.40	7.68
26....	5.98	8.20	14.18	12.55	....	10.23	9.25	8.95	8.35	8.83	7.30
Aug. 2....	6.20	8.00	14.85	11.70	....	10.25	9.00	8.75	8.25	8.85	7.25
9....	6.58	8.00	16.05	12.25	....	10.40	8.95	8.72	7.90	8.88	7.18
16....	6.53	7.95	17.88	13.45	....	10.38	8.75	8.66	7.45	8.55	6.88
23....	6.40	7.63	16.68	11.78	11.03	9.93	8.93	8.50	7.13	8.45	6.90
30....	6.32	7.48	16.98	11.43	11.13	10.38	9.13	8.63	7.40	8.95	7.00
Sept. 6....	5.88	7.18	17.63	11.65	11.13	10.38	9.13	8.63	7.38	9.25	7.00
13....	5.80	7.18	17.75	11.68	11.13	10.38	9.05	8.55	7.38	9.20	7.00
20....	5.30	6.60	16.85	10.85	10.75	9.75	8.75	8.44	6.88	9.00	7.00
27....	5.98	7.55	17.80	11.40	10.65	9.63	8.95	8.55	6.94	9.05	7.20
Oct. 4....	6.00	6.93	17.40	11.40	10.60	9.63	8.50	8.15	6.88	9.20	7.25
11....	5.88	6.65	16.35	11.50	10.80	9.63	8.50	8.13	6.78	9.15	7.20
18....	5.63	6.43	15.78	11.50	10.75	9.50	8.50	8.00	6.75	9.00	7.13
25....	5.70	6.50	15.73	11.50	10.50	9.50	8.50	8.25	6.75	9.00	7.13

TABLE 23.—*Cattle: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

EAST ST. LOUIS—Continued.

Week ending—	Canners and cutters.		Veal calves.		Feeder steers.			Stock cattle.			
										Calves.	
	Cows and heifers.	Canner steers.	Light to medium weight, medium to choice.	Heavy-weight, common to choice.	Heavy (1,000 lbs. up), common to choice.	Medium (800–1,000 lbs.), common to choice.	Light (800 lbs. down), common to choice.	Steers, common to choice.	Cows and heifers, common to choice.	Good and choice.	Common and medium.
1919.											
Nov. 1....	$5.73	$6.63	$16.15	$11.50	$10.50	$9.50	$8.50	$8.25	$6.75	$9.00	$7.13
8....	5.79	6.60	16.13	10.50	10.65	9.50	8.50	8.25	6.75	9.00	7.13
15....	5.78	6.63	15.80	10.50	10.75	9.55	8.50	8.25	6.75	9.00	7.13
22....	5.77	6.75	15.45	10.50	10.65	9.53	8.50	8.15	6.75	9.00	7.13
29....	6.00	7.06	14.72	10.47	10.69	9.50	8.50	8.19	6.81	9.06	7.19
Dec. 6....	6.07	7.25	14.75	10.25	10.75	9.68	8.50	8.38	7.00	9.13	7.25
13....	5.79	6.84	14.83	10.10	10.75	9.88	8.50	8.38	7.00	9.13	7.25
20....	5.63	6.25	14.13	9.35	10.75	9.88	8.50	8.38	7.00	9.13	7.15
27....	5.97	6.53	13.97	9.25	11.03	9.97	8.69	8.38	7.09	9.13	7.22
1920.											
Jan. 3....	6.09	6.63	13.34	10.13	10.91	9.88	8.75	8.38	7.13	9.13	7.25
10....	5.93	6.78	15.58	10.13	10.93	9.83	9.28	8.53	7.18	9.13	7.25
17....	5.89	6.75	15.65	10.08	10.75	9.75	10.00	8.75	7.25	9.13	7.25
24....	6.13	6.80	15.53	9.88	10.73	9.90	9.90	8.75	7.45	9.13	7.25
31....	6.60	7.10	16.20	9.88	10.88	10.25	9.75	8.75	7.50	9.13	7.25
Feb. 7....	6.58	7.03	15.40	9.80	10.88	10.25	9.75	8.75	7.50	9.38	7.60
14....	6.13	6.58	14.90	9.50	10.88	10.25	9.75	8.75	7.23	9.75	8.00
21....	6.00	6.23	14.88	9.50	10.73	10.00	9.65	8.75	6.88	9.75	8.00
28....	5.84	6.12	14.63	9.50	10.56	9.69	9.44	8.69	6.88	9.75	8.00
Mar. 6....	5.65	6.08	14.28	9.50	10.48	9.80	9.45	8.60	7.10	9.75	8.00
13....	5.80	6.20	14.45	9.50	10.63	10.25	9.75	8.80	7.35	9.75	8.00
20....	5.88	6.33	15.00	9.50	10.63	10.25	9.75	8.88	7.50	9.75	8.00
27....	5.93	6.25	15.20	9.50	10.67	10.27	9.75	8.85	7.50	9.75	8.00
Apr. 3....	6.08	6.38	14.35	9.50	10.60	10.20	9.75	8.75	7.50	9.75	8.00
10....	6.13	6.38	13.59	9.50	10.63	10.13	9.75	8.75	7.56	9.75	8.00
17....	6.13	6.38	16.25	9.50	10.63	10.13	9.75	8.75	7.75	9.75	8.00
24....	5.88	6.38	15.05	10.95	......	......	......	......	......	......	......
May 1....	5.88	6.38	13.13	10.05	10.10	9.90	9.55	8.65	7.30	9.75	8.00
8....	5.93	6.38	12.80	10.00	10.25	10.13	9.63	8.88	7.50	9.75	8.00
15....	5.88	6.38	12.75	10.00	10.25	10.08	9.53	8.78	7.60	9.75	8.00
22....	6.03	6.38	12.95	10.25	10.05	9.70	9.18	8.43	7.75	9.75	8.00
29....	6.13	6.35	12.63	10.25	9.55	9.15	8.68	7.93	7.35	9.65	8.00
June 5....	5.94	6.38	13.31	10.25	10.19	9.63	8.88	8.25	7.19	9.50	8.00
12....	6.18	6.63	13.80	10.55	10.40	9.95	9.20	9.00	7.45	9.50	8.00
19....	5.85	6.34	13.70	10.90	10.45	10.20	9.15	9.03	7.15	9.50	8.00
26....	5.15	5.73	12.05	9.75	10.50	10.25	9.00	8.65	6.55	9.50	8.00
July 3....	5.18	5.50	11.38	9.40	10.40	10.05	9.00	8.30	6.50	9.50	8.00
10....	5.06	5.50	11.66	9.00	10.25	9.63	8.75	8.00	6.38	9.50	8.00
17....	5.25	5.60	12.10	9.00	10.40	9.65	8.80	8.00	6.25	......	......
24....	5.33	5.75	12.73	9.10	10.50	9.75	9.00	8.00	6.30	......	......
31....	5.13	5.55	13.40	9.65	10.30	9.45	8.60	7.48	6.03	......	......
Aug. 7....	4.85	5.35	12.93	9.55	9.80	8.80	8.30	7.50	5.65	......	......
14....	4.95	5.30	11.68	8.75	9.50	8.50	8.00	7.40	5.63	......	......
21....	5.08	5.38	11.48	8.10	9.50	8.60	8.00	7.25	5.70	......	......
28....	5.13	5.38	12.25	8.20	9.50	8.75	8.00	7.35	5.75	......	......
Sept. 4....	4.83	5.38	13.70	8.20	9.50	8.75	8.00	7.50	5.75	......	......
						Light and medium (750–1,000 pounds), common to choice.					
11....	4.63	5.13	14.38	6.75	9.53	$9.00		7.69	5.53	......	......
18....	4.53	5.00	14.60	7.10	9.63	9.00		7.88	5.60	7.50	5.50
25....	4.69	5.18	14.73	7.60	9.63	9.00		7.88	5.70	7.25	5.40
Oct. 2....	4.59	5.20	14.80	7.90	9.63	8.90		7.58	5.70	7.05	5.25
9....	4.33	4.85	14.35	7.80	9.48	8.55		7.50	5.48	7.10	5.25
16....	4.28	4.63	14.00	7.40	9.25	8.35		7.40	5.20	7.25	5.25
23....	3.90	4.35	11.83	7.50	9.15	8.40		7.15	4.90	6.65	4.75
30....	4.32	4.23	11.65	7.50	9.05	8.35		7.20	5.25	6.75	5.00
Nov. 6....	4.59	4.43	12.18	8.30	9.23	8.60		7.58	5.38	6.60	5.00
13....	3.90	4.38	11.73	8.00	9.20	8.65		7.40	5.25	7.08	5.68
20....	3.75	4.30	12.10	8.00	8.98	8.28		6.85	4.93	7.15	5.58
27....	4.01	4.25	12.16	8.00	8.63	7.75		6.41	5.00	7.00	5.44
Dec. 4....	3.85	4.25	11.53	7.70	8.30	7.58		6.10	5.00	7.00	5.33
11....	3.75	4.25	9.75	7.15	8.00	7.50		6.13	5.05	7.00	5.28
18....	3.50	4.10	9.50	6.70	7.83	7.18		6.13	4.80	6.95	5.23
25....	3.64	3.98	9.35	6.75	7.75	7.00		6.13	4.68	6.75	5.00
1921.											
Jan. 1....	3.83	4.10	10.15	7.00	7.72	7.00		6.22	4.88	6.75	5.00

TABLE 24.—*Cattle: Weekly range of prices, per 100 pounds, good and medium beef steers, and butcher cattle.*

CHICAGO.

Week ending—	Beef steers.			Butcher cattle.		
	Medium and heavy-weight (1,100 pounds up).		Lightweight (1,100 pounds down).	Heifers.	Cows.	Bulls
	Good.	Medium.	Good and medium.	Common to choice.	Common to choice.	Bologna and beef.
1919.						
Mar. 22...	$15.50-18.65	$12.00-17.00	$12.00-17.15	$6.85-15.50	$6.85-15.25	$8.00-13.25
29...	15.50-18.50	13.00-16.50	12.00-16.75	7.25-15.50	6.85-15.25	8.00-13.00
Apr. 5...	15.75-18.50	13.75-16.75	13.00-17.00	7.60-15.75	7.40-15.50	8.75-13.00
12...	15.50-18.00	13.60-16.00	13.00-16.40	7.50-15.25	7.25-15.00	8.50-13.00
19...	15.50-18.25	13.75-16.15	13.00-16.75	7.65-15.75	7.50-15.50	8.50-13.25
26...	15.25-18.25	13.85-16.15	13.25-16.75	7.85-15.75	7.65-15.50	8.75-13.50
May 3...	15.00-18.00	13.60-15.75	13.00-16.35	7.60-15.00	7.50-14.75	8.50-13.25
10...	14.50-18.00	13.00-15.75	12.50-16.35	7.75-15.25	7.50-15.00	9.00-13.25
17...	14.50-17.00	13.00-15.50	12.50-16.00	7.75-15.25	7.50-15.00	9.00-13.25
24...	14.50-16.75	13.25-15.25	12.75-15.85	8.00-15.25	7.75-14.85	9.00-13.25
31...	13.40-16.15	12.40-14.85	12.00-15.40	7.60-14.75	7.35-14.50	8.50-13.25
June 7...	13.00-15.25	11.75-13.35	11.50-14.35	7.25-13.25	7.00-13.00	8.25-11.75
14...	13.00-15.25	12.15-13.50	11.50-14.25	7.25-13.35	7.00-13.00	8.50-12.15
21...	13.00-15.00	12.15-13.50	11.65-14.25	7.75-13.25	7.50-12.75	8.50-12.00
28...	13.00-15.00	12.25-13.50	12.00-14.35	7.75-13.50	7.40-12.75	7.50-11.75
July 5...	13.25-15.15	12.35-13.75	12.00-14.75	7.50-13.75	7.25-12.75	7.50-12.00
12...	14.00-16.25	13.25-14.50	12.50-15.75	7.75-15.00	7.35-13.25	8.75-13.00
19...	14.50-17.00	13.00-14.75	12.65-16.25	7.50-15.00	7.25-13.50	8.50-13.00
26...	14.35-17.00	12.50-14.75	12.00-16.25	7.00-14.50	6.75-13.50	7.75-12.50
Aug. 2...	13.75-16.85	12.00-14.50	11.75-16.00	7.00-14.50	6.75-13.75	8.00-12.50
9...	14.00-17.50	12.25-14 75	12.00-16.25	7.00-15.00	6.75-14.50	7.75-12.50
16...	14.25-17.75	12.50-15.50	12.25-17.50	7.50-15.50	7.25-15.75	8.25-13.50
23...	14.00-16.35	12.50-14.50	12.25-16.25	7.25-15.00	7.25-14.00	7.50-13.50
30...	13.50-16.35	11.50-14.25	11.50-16.25	6.75-15.00	6.50-13.50	6.25-12.50
Sept. 6...	13.50-16.25	11.50-13.75	11.50-16.25	6.75-14.75	6.50-13.50	6.00-11.75
13...	13.50-16.25	11.00-13.75	11.15-16.25	6.50-14.75	6.25-13.50	6.50-12.00
20...	13.00-15.50	10.75-13.50	10.75-16.25	6.50-14.75	6.25-13.50	6.50-11.75
27...	13.00-16.00	10.75-13.50	10.75-16.25	6.50-14.75	6.25-13.50	6.50-11.75
Oct. 4...	14 00-16.50	11.25-14.00	11.25-16.50	6.50-14.75	6.50-13.50	6.75-11.75
11...	14.00-16.75	11.00-14.25	11.00-16.50	6.50-14.75	6.00-13.50	6.00-11.50
18...	14.00-16.75	10.75-14.00	10.75-16.75	6.25-14.25	5.85-12.50	5.75-10.50
25...	13.75-17.00	10.75-14.25	10.75-16.75	6.25-14.50	6.25-13.00	6.25-11.50
Nov. 1...	13.50-16.75	10.50-13.50	10.25-16.75	6.50-14.50	6.40-13.00	6.00-11.00
8...	13.50-17.50	10.50-14.00	10.25-17.50	6.35-14.50	6.25-13.00	6.00-11.00
15...	14.25-18.40	10.85-14.75	10.75-18.25	6.60-15.00	6.50-13.50	6.50-11.00
22...	13.00-18.40	10.25-14.75	10.25-18.25	6.40-15.00	6.25-13.50	6.50-11.00
29...	13.50-18.65	10.50-14.25	10.50-18.40	6.40-15.00	6.25-13.50	6.50-11.50
Dec. 6...	13.50-18.75	10.75-14.25	10.25-18.40	6.40-15.00	5.50-13.65	6.75-11.50
13...	13.50-19.00	11.00-14.50	10.50-19.00	6.40-15.50	6.25-14.25	6.75-11.25
20...	13.00-18.40	10.50-13.50	10.00-18.25	6.25-15.00	6.00-13.75	6.75-11.50
27...	13.65-18.85	11.00-14.85	10.40-18.85	6.25-14.75	6.00-13.50	7.25-11.75

TABLE 24.—*Cattle: Weekly range of prices, per 100 pounds, good and medium beef steers, and butcher cattle*—Continued.

CHICAGO—Continued.

Week ending—	Beef steers.				Butcher cattle.		
	Medium and heavy-weight—(1,100 pounds up.)		Lightweight—(1,100 pounds down.)		Heifers.	Cows.	Bulls.
	Good.	Medium.	Good and medium.		Common to choice.	Common to choice.	Bologna and beef.
1920.							
Jan. 3.....	$14.00-18.75	$10.75-14.50	$10.75-18.65		$6.40-14.75	$6.25-13.50	$7.75-12.00
10.....	14.00-18.75	10.75-14.50	10.50-18.50		6.50-14.75	6.40-13.50	7.50-12.00
17.....	14.25-18.50	11.25-14.50	11.00-18.25		6.50-14.75	6.50-13.50	7.50-12.25
24.....	13.40-17.50	11.50-14.25	11.00-17.00		6.75-14.25	6.75-13.00	7.50-12.25
31.....	13.00-16.65	11.50-13.50	10.90-15.60		6.75-14.00	6.75-12.75	7.50-12.00
			Good.	Medium.			
Feb. 7...	12.65-15.35	11.25-12.85	$12.25-14.35	$10.60-12.50	6.50-13.50	6.50-12.15	7.25-11.25
14...	12.50-15.00	11.00-12.65	12.00-14.00	10.40-12.25	6.40-12.75	6.40-11.50	7.00-11.00
21...	12.25-14.75	11.50-12.90	11.85-14.00	10.85-12.50	6.40-13.00	6.40-11.75	7.00-11.00
28...	12.00-14.00	11.25-12.25	11.60-13.10	10.60-11.85	6.50-12.75	6.25-11.50	7.25-10.75
Mar. 6...	12.50-14.35	11.50-12.85	12.00-13.85	11.00-12.50	6.50-13.50	6.25-12.50	6.75-10.75
13...	12.50-14.50	11.65-13.00	12.50-14.00	11.50-12.75	7.35-13.75	7.10-12.75	6.75-11.00
20...	12.25-13.85	11.50-12.50	12.15-13.85	11.50-12.50	7.00-13.25	7.00-12.25	6.75-11.00
27...	12.15-13.75	11.25-12.50	12.00-13.75	11.00-12.50	7.40-13.25	7.40-12.00	7.50-11.00
Apr. 3...	12.25-13.65	11.25-12.50	12.25-13.65	11.00-12.40	7.75-13.50	7.75-12.00	7.75-11.00
10...	12.75-14.00	11.50-13.00	12.40-14.00	11.25-12.75	7.65-14.00	7.50-12.50	7.00-11.00
17...	12.60-14.60	11.40-13.65	12.65-14.65	11.25-13.75	7.35-14.65	7.25-12.85	6.50-11.25
24...	11.50-13.35	10.60-12.25	11.40-13.35	10.50-12.25	7.10-13.75	7.00-12.00	7.00-11.25
May 1...	11.65-13.50	10.75-12.60	11.60-13.50	10.65-12.50	7.25-14.25	7.15-12.75	7.35-11.50
8...	12.35-13.40	11.50-12.60	12.25-13.50	11.40-12.60	7.85-13.75	7.75-12.25	7.75-11.25
15...	12.10-13.25	11.50-12.50	12.25-13.35	11.35-12.50	8.00-13.75	7.75-12.00	7.50-11.00
22...	12.00-13.00	11.25-12.25	12.25-13.00	11.25-12.25	7.75-13.50	7.60-11.85	7.25-11.00
29...	12.00-12.90	11.15-12.25	12.25-13.25	11.15-12.50	7.75-13.50	7.60-11.00	7.50-11.00
June 5...	12.50-14.25	11.60-13.50	12.75-14.25	11.75-13.65	7.75-13.50	7.60-11.50	7.00-11.50
12...	13.85-16.25	12.75-15.50	13.85-16.00	12.75-15.25	8.25-14.75	8.00-12.75	7.00-12.25
19...	15.00-16.25	13.25-15.50	15.00-16.15	13.25-15.25	7.50-14.50	7.25-12.60	7.25-12.25
26...	14.75-16.50	12.90-15.65	14.75-16.40	13.00-15.50	7.00-15.00	7.00-13.00	7.00-12.50
July 3...	14.60-16.50	12.50-15.65	14.50-16.40	12.35-15.50	6.50-15.00	6.35-13.00	6.00-12.50
10...	15.10-16.40	12.75-15.50	14.75-16.40	12.60-15.00	6.50-14.75	6.35-12.75	6.00-12.00
17...	15.00-16.25	13.00-15.40	14.85-16.40	12.75-15.10	6.50-14.75	6.35-12.75	6.00-12.25
24...	15.00-16.10	13.00-15.00	14.85-16.25	12.75-14.85	6.50-14.90	6.50-12.75	6.25-12.25
31...	15.00-16.25	12.50-15.00	14.75-16.00	12.25-15.00	6.00-14.90	5.50-12.50	6.00-12.25
Aug. 7...	14.75-16.25	12.25-15.00	14.50-16.00	12.25-14.50	6.00-14.75	5.00-12.50	6.00-11.75
14...	15.00-16.25	12.25-15.00	14.50-16.25	12.25-14.50	6.00-15.00	5.00-12.50	6.00-12.00
21...	15.00-16.25	12.25-14.75	14.50-16.25	12.00-14.50	6.00-15.00	5.00-12.50	5.00-11.75
28...	15.00-16.65	12.00-15.00	14.50-16.50	12.00-14.50	6.00-15.00	5.75-12.75	5.00-11.50
Sept. 4...	15.00-16.75	12.25-14.75	14.25-16.50	12.00-14.25	6.50-15.00	6.00-12.75	5.00-11.50
11...	15.00-17.00	12.25-15.00	14.50-16.75	12.00-14.50	6.50-15.00	6.00-12.75	5.00-11.50
18...	15.50-17.00	12.50-15.00	15.00-16.75	12.25-14.50	6.50-15.00	6.25-12.75	5.50-11.50
25...	15.00-17.00	12.25-14.75	14.50-16.75	12.00-14.50	6.50-14.75	6.00-12.50	5.25-11.50
Oct. 2...	14.75-16.50	12.00-14.50	14.00-16.50	11.25-14.00	6.00-14.25	5.50-12.00	5.25-11.50
9...	14.75-17.00	12.00-15.00	14.00-17.00	11.25-14.50	6.00-13.50	5.50-11.25	5.25-11.00
16...	15.00-17.00	12.00-15.00	14.50-17.00	11.25-14.50	5.50-13.50	5.25-11.25	5.25-11.00
23...	14.75-17.00	12.00-15.25	14.50-16.75	11.25-14.50	5.25-13.00	4.75-11.00	5.00-10.75
30...	15.25-17.00	12.25-15.25	15.00-16.75	11.50-14.75	5.25-13.00	4.75-10.75	5.00-10.50
Nov. 6...	14.00-17.10	11.00-15.25	13.75-16.75	10.25-15.00	5.75-13.25	5.25-11.25	5.25-10.75
13...	13.50-16.00	10.25-14.00	13.25-16.00	9.75-13.50	5.00-13.00	4.60-11.25	5.00-10.50
20...	12.00-15.75	9.00-13.50	11.50-15.50	8.50-13.00	4.50-13.00	4.25-11.00	4.25-10.00
27...	12.40-15.75	9.25-13.15	11.65-15.50	8.50-12.35	4.50-12.50	4.35-10.50	4.35- 9.40
Dec. 4...	11.00-15.50	8.75-12.50	10.75-15.25	8.25-12.00	4.50-12.25	4.50-10.25	4.35- 9.25
11...	11.25-13.75	9.00-12.00	10.60-13.50	8.50-11.50	4.75-12.00	4.50-10.50	4.50- 9.25
18...	10.40-13.00	8.25-11.00	9.60-12.75	7.50-10.25	4.35-11.00	4.15- 9.50	4.60- 8.50
25...	10.40-13.50	8.25-11.50	9.60-13.25	7.50-10.75	4.50-10.75	4.25- 9.40	4.50- 8.25
1921.							
Jan. 1...	10.00-13.50	8.50-11.50	10.00-13.25	8.50-10.75	5.00-10.75	4.75- 9.40	4.75- 8.00

TABLE 25.—*Hogs: Monthly average and top price per 100 pounds, 1918 to 1920.*

CHICAGO.

Month.	Butcher hogs.		Packing hogs.		Light hogs.	Pigs.	Roughs.	Bulk of sales.	Top.
	Heavy.	Medium and light.	Heavy.	Medium and light.	Bacon, light mixed, and light lights.				
1918									
June	$16.55	$16.70	$16.10	$16.42	$16.79	$16.55	$15.67	$16.59	$17.35
July	17.99	18.14	17.24	17.55	18.15	17.18	16.74	17.80	19.40
August	19.36	19.69	18.22	18.52	19.61	18.24	17.67	18.95	20.30
September	19.93	20.15	19.07	19.27	20.11	18.72	18.39	....	20.95
October	18.42	18.37	17.00	17.42	18.06	15.89	16.38	....	19.95
November	17.98	17.95	17.02	17.36	17.51	14.56	15.97	....	18.60
December	17.70	17.62	17.04	17.32	17.22	14.60	16.23	17.52	18.00
1919									
January	17.78	17.68	16.97	17.31	17.25	14.77	16.25	17.59	18.00
February	17.85	17.72	16.98	17.39	17.37	15.58	16.41	17.66	18.15

Month.	Butcher, bacon, and shipper hogs.				Packing sows.		Pigs, 130 pounds down.	Stock pigs, 130 pounds down.	Bulk of sales.	Top.
	Heavy weight, 250 pounds up.	Medium weight, 200 to 250 pounds.	Light weight, 150 to 200 pounds.	Light lights, 130 to 150 pounds.	Smooth (250 pounds up).	Rough (200 pounds up).				
	Medium to choice.	Medium to choice.	Common to choice.	Common to choice.			Medium to choice.	Common to choice.		
1919.										
March	$19.28	$19.17	$18.75	$18.29	$18.46	$17.53	$16.95	....	$19.11	$19.95
April	20.52	20.41	20.16	19.38	19.70	18.87	18.01	....	20.40	21.10
May	20.75	20.66	20.49	19.76	20.06	19.53	18.80	....	20.66	21.55
June	20.54	20.49	20.43	19.43	19.96	19.45	17.93	....	20.50	21.60
July	22.00	22.04	22.02	21.24	21.09	20.22	19.79	....	21.98	23.60
August	20.38	20.61	20.66	19.76	18.79	17.82	17.98	....	....	23.50
September	17.55	17.97	18.21	17.53	16.11	15.34	16.62	....	....	20.85
October	14.57	14.72	14.69	14.27	13.70	13.19	13.86	....	14.36	17.20
November	14.24	14.31	14.25	13.99	13.71	13.28	13.80	....	14.24	15.50
December	13.75	13.81	13.72	13.44	13.23	12.67	12.96	....	13.74	14.60
1920.										
January	14.97	15.09	15.14	14.81	14.38	13.92	14.10	....	15.07	16.00
February	14.29	14.63	14.82	14.59	13.38	12.84	13.92	....	14.56	15.65
March	14.63	15.30	15.58	15.13	13.35	12.70	14.19	....	15.06	16.35
April	14.67	15.38	15.62	15.20	13.13	12.56	14.26	....	15.09	16.75
May	14.05	14.66	14.84	14.48	12.79	12.30	13.39	....	14.38	15.60
June	14.67	15.17	15.10	14.39	13.51	12.76	12.83	....	14.77	16.75
July	15.03	15.69	15.60	15.01	13.95	13.26	13.95	....	14.93	16.65
August	14.96	15.37	15.50	15.19	14.06	13.69	14.42	....	14.88	16.40
September	16.00	16.43	16.50	16.09	15.11	14.73	15.27	....	15.88	18.25
October	14.32	14.59	14.40	14.02	13.55	13.18	13.69	....	14.14	16.25
November	12.31	12.41	12.27	12.16	11.71	11.37	12.31	....	12.23	14.50
December	9.61	9.69	9.72	9.71	9.32	9.08	9.59	....	9.64	10.80

KANSAS CITY.

Month.	Heavy weight, 250 pounds up.	Medium weight, 200 to 250 pounds.	Light weight, 150 to 200 pounds.	Light lights, 130 to 150 pounds.	Smooth (250 pounds up).	Rough (200 pounds up).	Pigs, 130 pounds down.	Stock pigs, 130 pounds down.	Bulk of sales.	Top.
1919.										
April	$20.40	$20.18	$19.83	$19.31	$19.76	$19.21	$18.10	$17.70	$20.10	$21.00
May	20.61	20.34	20.04	19.53	20.02	19.46	16.36	18.79	20.28	21.10
June	20.57	20.45	20.19	19.89	20.00	19.61	....	19.02	20.37	21.35
July	22.26	22.21	22.10	21.78	21.67	21.22	....	20.01	22.14	23.40
August	21.28	20.98	20.79	20.41	19.55	18.99	....	18.81	20.80	23.20
September	17.42	17.67	17.52	17.09	15.91	15.19	....	15.78	17.65	20.10
October	14.48	14.60	14.47	14.26	13.28	12.78	....	13.83	14.48	16.70
November	14.35	14.42	14.32	14.08	13.60	13.22	....	13.26	14.38	15.60
December	13.83	13.85	13.65	13.33	12.98	12.66	....	12.11	13.78	15.00

Table 25.—*Hogs: Monthly average and top price per 100 pounds, 1918 to 1920*—Contd.

KANSAS CITY—Continued.

Month.	Butcher, bacon, and shipper hogs.				Packing sows.		Pigs, 130 pounds down.	Stock pigs, 130 pounds down.	Bulk of sales.	Top.
	Heavy weight, 250 pounds up.	Medium weight, 200 to 250 pounds.	Light weight, 150 to 200 pounds.	Light lights, 130 to 150 pounds.	Smooth (250 pounds up).	Rough (200 pounds up).				
	Medium to choice.	Medium to choice.	Common to choice.	Common to choice.			Medium to choice.	Common to choice		
1920.										
January	$14.96	$15.00	$14.86	$14.28	$14.25	$13.98	....	$14.08	$14.95	$16.00
February	14.02	14.27	14.27	....	13.07	12.82	....	13.15	14.16	15.40
March	14.29	14.93	15.29	....	12.52	12.04	....	14.04	14.68	16.10
April	13.88	14.38	14.69	....	12.31	11.74	....	13.46	14.22	16.00
May	13.90	14.25	14.33	....	12.42	11.99	....	12.18	14.16	14.90
June	14.77	14.81	14.52	....	13.27	12.85	....	12.01	14.69	16.15
July	15.33	15.50	15.38	....	13.83	13.32	....	13.34	15.36	16.15
August	14.88	15.24	15.22	....	13.55	13.01	$14.94	13.19	15.06	16.00
September	15.92	16.27	16.18	....	14.52	13.39	....	14.29	16.16	17.80
October	14.03	14.13	13.68	13.25	12.75	11.95	....	12.53	13.84	15.60
November	11.96	12.01	11.78	11.68	10.90	10.21	11.92	11.14	11.94	13.75
December	9.37	9.43	9.28	9.17	8.76	8.31	9.19	8.88	9.36	10.25
OMAHA.										
1919.										
May	$20.42	$20.31	$20.12	....	$20.30	$20.14	....	$18.58	$20.26	$20.80
June	20.33	20.38	20.27	$19.57	20.20	19.95	....	18.37	20.25	21.00
July	21.66	21.81	21.76	....	21.35	21.13	....	19.19	21.45	22.85
August	19.82	20.17	19.98	....	19.50	19.21	....	18.71	19.64	22.75
September	16.99	17.40	17.04	....	16.53	16.24	....	16.35	16.62	19.25
October	14.40	14.65	14.57	....	14.04	13.68	....	14.56	14.11	16.65
November	14.30	14.41	14.27	....	14.06	13.86	....	13.93	14.19	15.35
December	13.52	13.66	13.49	13.21	13.27	13.05	....	11.82	13.47	14.75
1920.										
January	14.77	14.81	14.68	14.47	14.59	14.43	....	12.54	14.68	15.45
February	13.99	14.14	14.05	13.90	13.71	13.30	....	13.21	13.97	15.15
March	13.81	14.65	14.77	14.35	13.12	12.53	....	12.64	14.24	15.55
April	13.80	14.48	14.65	14.37	13.07	12.66	....	13.45	14.00	15.50
May	13.67	14.06	14.23	13.84	13.11	12.71	....	12.68	13.79	15.00
June	14.06	14.42	14.52	....	13.52	13.13	....	11.47	14.06	16.00
July	14.51	15.03	14.93	....	14.00	13.67	....	12.32	14.30	15.90
August	14.37	14.77	14.80	....	13.88	13.61	....	12.84	14.21	15.80
September	15.46	15.87	15.95	....	15.06	14.82	....	13.78	15.41	17.60
October	13.69	13.94	13.99	....	13.32	13.12	....	12.90	13.59	15.75
November	11.88	12.04	11.95	....	11.64	11.38	....	11.32	11.81	13.60
December	9.32	9.46	9.30	....	8.99	8.71	....	8.49	9.27	10.25
EAST ST. LOUIS.										
1919.										
May	$20.62	$20.47	$20.07	$19.48	$19.02	$17.74	$16.35	$16.66	$20.41	$21.20
June	20.71	20.63	20.08	19.39	19.02	17.62	15.16	15.47	20.57	21.95
July	22.44	22.45	22.16	21.10	20.09	18.64	16.94	17.50	22.36	23.50
August	21.61	21.70	21.43	20.39	18.48	17.18	16.76	17.27	21.65	23.55
September	17.89	18.23	17.92	17.09	14.92	13.12	15.33	15.26	18.18	20.50
October	14.64	14.91	14.67	14.04	12.96	11.77	13.38	13.29	14.90	17.00
November	14.56	14.56	14.41	14.13	12.86	12.13	13.83	13.81	14.55	15.60
December	13.97	13.97	13.82	13.45	12.67	12.05	12.67	12.86	13.97	14.80
1920.										
January	15.17	15.24	15.18	14.93	13.79	13.22	13.25	13.24	15.24	16.45
February	14.46	14.95	15.16	14.95	12.94	12.54	13.56	12.77	14.88	16.00
March	14.63	15.56	15.90	15.59	12.73	12.39	13.88	13.50	15.70	16.60
April	14.70	15.63	16.00	15.21	11.98	11.65	13.07	11.93	15.66	17.50
May	14.16	14.73	14.90	14.36	11.93	11.63	13.13	11.93	14.79	16.00
June	14.94	15.28	15.16	14.45	12.64	12.32	12.66	12.16	15.32	16.65
July	15.77	16.15	16.15	15.57	13.14	12.86	13.68	13.57	16.19	16.70
August	14.92	15.65	15.72	15.33	13.11	12.86	13.81	13.58	15.70	16.75
September	16.05	16.59	16.79	16.34	14.34	13.61	15.13	14.51	16.74	18.25
October	14.41	14.72	14.53	14.11	13.12	12.74	13.84	12.62	14.48	16.40
November	12.32	12.48	12.31	12.21	11.14	10.90	12.18	11.70	12.38	14.75
December	9.75	9.87	9.82	9.83	8.61	8.35	9.84	9.41	9.86	11.25

TABLE 26.—*Hogs: Monthly and yearly average price per 100 pounds, Chicago, 1910 to 1920.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-year average.
January	$8.55	$7.95	$6.25	$7.45	$8.30	$6.90	$7.20	$10.90	$16.30	$17.60	$14.97	$10.22
February	9.05	7.40	6.20	8.15	8.60	6.80	8.20	12.45	16.65	17.65	14.55	10.52
March	10.55	6.85	7.10	8.90	8.70	6.75	9.65	14.80	17.10	19.10	14.94	11.31
April	9.90	6.25	7.80	9.05	8.65	7.30	9.75	15.75	17.45	20.40	14.79	11.55
May	9.55	6.00	7.65	8.55	8.45	7.60	9.85	15.90	17.45	20.60	14.28	11.44
June	9.45	6.25	7.50	8.65	8.20	7.60	9.70	15.50	16.60	20.40	14.68	11.32
July	8.75	6.70	7.65	9.05	8.70	7.75	9.80	15.20	17.75	21.85	14.84	11.64
August	8.35	7.30	8.25	8.35	9.00	6.90	10.30	16.90	19.00	20.00	14.74	11.74
September	8.90	6.90	8.45	8.30	8.85	7.25	10.70	18.20	19.65	17.45	15.88	11.87
October	8.50	6.45	8.75	8.20	7.65	7.90	9.80	17.15	17.70	14.35	14.17	10.97
November	7.60	6.30	7.75	7.75	7.50	6.65	9.60	17.40	17.70	14.20	11.83	10.39
December	7.65	6.40	7.40	7.70	7.10	6.40	9.95	16.85	17.55	13.60	9.55	10.01
Weighted average	8.90	6.70	7.55	8.35	8.30	7.10	9.60	15.10	17.45	17.85	13.91	10.98

[1] Prior to 1920 from Chicago Drovers' Journal.

TABLE 27.—*Hogs: Monthly and yearly top price per 100 pounds, Chicago, 1910 to 1920.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-year average.
January	$9.05	$8.30	$6.70	$7.80	$8.60	$7.40	$8.10	$12.00	$16.90	$18.00	$16.00	$10.80
February	10.00	7.90	6.57	8.70	8.90	7.25	8.90	13.55	17.70	18.15	15.65	11.21
March	11.20	7.35	7.95	9.62	9.00	7.05	10.10	15.55	18.15	19.95	16.35	12.02
April	11.00	6.90	8.20	9.70	8.95	7.90	10.10	16.50	18.10	21.10	16.75	12.29
May	9.85	6.50	8.05	8.85	8.67	7.95	10.35	16.65	18.30	21.55	15.60	12.03
June	9.80	6.72	7.80	9.00	8.52	7.95	10.15	16.17	17.35	21.60	16.75	11.98
July	9.60	7.55	8.50	9.62	9.30	8.12	10.25	16.30	19.40	23.60	16.65	12.63
August	9.70	7.95	9.00	9.40	10.20	8.05	11.55	20.00	20.30	23.50	16.40	13.28
September	10.10	7.80	9.27	9.65	9.75	8.50	11.60	19.70	20.95	20.85	18.25	13.31
October	9.65	6.90	9.42	9.10	9.05	8.95	10.55	19.65	19.95	17.20	16.25	12.42
November	8.70	6.72	8.30	8.30	8.25	7.75	10.35	18.10	18.60	15.50	14.50	11.37
December	8.10	6.60	7.85	8.15	7.75	7.10	10.80	17.75	18.00	14.60	10.80	10.68
For year	11.20	8.30	9.42	9.70	10.20	8.95	11.60	20.00	20.95	23.60	18.25	13.85

[1] Prior to June, 1918, from Chicago Drovers' Journal.

TABLE 28.—*Hogs: Monthly farm price per 100 pounds, United States, 1910 to 1920.*

Date.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
Jan. 15	$7.76	$7.44	$5.74	$6.77	$7.45	$6.57	$6.32	$9.16	$15.26	$15.69	$13.36	$9.23
Feb. 15	7.87	7.04	5.79	7.17	7.75	6.34	7.07	10.33	15.03	15.53	13.62	9.41
Mar. 15	8.93	6.74	5.94	7.62	7.80	6.33	7.86	12.32	15.58	16.13	13.59	9.89
Apr. 15	9.26	6.17	6.78	7.94	7.80	6.48	8.21	13.61	15.76	17.39	13.73	10.28
May 15	8.59	5.72	6.79	7.45	7.60	6.77	8.37	13.72	15.84	18.00	13.44	10.21
June 15	8.46	5.66	6.65	7.61	7.43	6.80	8.21	13.50	15.37	17.80	13.18	10.06
July 15	8.15	5.92	6.64	7.81	7.72	6.84	8.40	13.35	15.58	19.22	13.65	10.30
Aug. 15	7.78	6.54	7.11	7.79	8.11	6.61	8.61	14.24	16.89	19.30	13.59	10.60
Sept. 15	8.27	6.53	7.47	7.68	8.11	6.79	9.22	15.69	17.50	15.81	13.98	10.64
Oct. 15	8.08	6.09	7.70	7.60	7.43	7.18	8.67	16.15	16.50	13.88	13.57	10.26
Nov. 15	7.61	5.86	7.05	7.33	7.00	6.35	8.74	15.31	15.92	13.36	11.64	9.65
Dec. 15	7.16	5.72	6.89	7.16	6.67	6.02	8.76	15.73	15.82	12.66	8.90	9 23
Weighted average	8.12	6.29	6.64	7.44	7.51	6.56	8.11	13.41	15.82	16.04	12.85	9.89

TABLE 29.—*Hogs: Corn and hog ratios, based on average farm price per 100 pounds of live hogs, divided by average farm price of 1 bushel of corn, 1910 to 1920.*

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	12.2	15.3	9.1	13.6	10.8	9.5	9.8	9.9	11.2	11.1	9.3	11.1
February	12.0	14.4	8.8	13.9	11.3	8.6	10.5	10.5	10.3	11.3	9.2	11.0
March	13.6	13.7	8.6	14.4	11.2	8.4	11.4	11.5	10.1	11.2	8.9	11.2
April	14.4	12.1	9.0	14.4	10.9	8.5	11.5	10.3	10.2	11.1	8.4	11.0
May	13.3	10.7	8.4	12.7	10.3	8.7	11.4	8.8	10.3	10.8	7.6	10.3
June	12.9	9.8	8.1	12.3	9.9	8.7	11.0	8.3	10.0	10.2	7.1	9.8
July	12.2	9.4	8.3	12.1	10.1	8.7	10.9	7.4	9.9	10.5	7.8	9.8
August	11.7	9.9	9.1	11.1	10.3	8.5	10.6	7.7	10.1	10.2	8.5	9.8
September	13.0	9.9	10.1	10.2	10.3	9.2	11.1	9.0	10.8	9.3	10.1	10.3
October	14.2	9.3	12.0	10.4	10.0	10.8	10.4	10.1	11.0	9.7	13.0	11.0
November	15.1	9.3	13.2	10.5	10.4	10.6	10.1	11.2	11.5	9.2	15.0	11.5
December	14.9	9.2	14.1	10.3	10.2	10.1	9.8	12.0	11.3	9.2	13.2	11.3
Average	13.3	11.1	9.9	12.2	10.5	9.2	10.7	9.7	10.6	10.3	9.8	10.7

TABLE 30.—*Lard, pure: Monthly and yearly average price per 100 pounds, Chicago, 1910 to 1920.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	$12.43	$10.32	$9.24	$9.88	$10.89	$10.69	$10.32	$15.66	$24.39	$23.46	$25.99	$14.84
February	12.50	9.50	8.90	10.50	10.67	10.53	9.99	17.00	26.05	24.83	23.14	14.87
March	14.08	8.83	9.37	10.66	10.52	9.84	10.79	19.30	26.07	27.35	22.93	15.43
April	12.33	7.93	10.06	11.00	10.23	9.95	11.77	21.00	25.44	30.09	22.71	15.68
May	12.95	8.03	10.77	11.05	9.95	9.71	12.80	22.30	24.53	33.58	22.75	16.22
June	12.27	8.17	10.87	10.99	10.03	9.39	12.87	21.41	24.50	34.15	22.98	16.15
July	11.85	8.30	10.57	11.53	10.08	8.05	13.12	20.77	26.09	34.76	21.71	16.08
August	11.82	8.97	10.73	11.28	9.69	7.92	13.44	22.20	26.78	30.01	21.16	15.82
September	12.44	9.32	11.08	11.15	9.68	8.13	14.47	24.03	26.98	26.19	22.58	16.00
October	12.93	8.85	11.47	10.60	10.22	9.07	15.34	24.29	26.66	27.41	23.28	16.37
November	10.82	9.07	11.15	10.63	10.89	8.94	16.91	27.13	26.69	28.80	22.07	16.65
December	10.31	9.00	10.46	10.68	10.05	9.47	16.66	25.46	25.31	26.15	18.15	15.61
Average	12.23	8.86	10.39	10.83	10.24	9.31	13.21	21.71	25.79	28.90	22.45	15.81

[1] Prior to February, 1920, compiled from the National Provisioner.

TABLE 31.—*Hogs: Yearly receipts at principal markets and number on farms, 1900 to 1920.*

[In thousands of animals; i. e., 000 omitted.]

Year.	Receipts at principal markets.[1]										Number on farms Jan. 1.
	Chicago.	Kansas City.	Omaha.	St. Paul.	East St. Louis.	Fort Worth.	Denver.	Sioux City.	St. Joseph.	Total.	
1900	8,109	3,094	2,201	500	1,792	(2)	116	833	1,679	18,324	62,868
1901	8,290	3,716	2,414	617	1,924	(2)	109	960	2,105	20,135	56,982
1902	7,895	2,279	2,247	668	1,330	79	87	1,008	1,698	17,291	48,699
1903	7,326	1,969	2,231	760	1,568	151	147	1,008	1,701	16,861	46,923
1904	7,239	2,227	2,300	882	1,955	281	162	1,113	1,657	17,816	47,009
1905	7,726	2,508	2,294	855	2,026	463	191	1,299	1,900	19,262	47,321
1906	7,275	2,676	2,394	861	1,923	551	193	1,158	1,908	18,939	52,103
1907	7,201	2,924	2,254	867	2,065	488	241	1,289	1,923	19,252	54,794
1908	8,131	3,715	2,425	1,133	2,560	703	280	1,381	2,349	22,677	56,084
1909	6,619	3,093	2,135	725	2,473	868	242	1,077	1,694	18,926	54,147
1910	5,587	2,086	1,894	836	2,054	541	187	1,044	1,353	15,582	58,186
1911	7,103	3,168	2,367	911	3,108	556	220	1,349	1,922	20,704	65,620
1912	7,181	2,523	2,886	984	2,530	388	222	1,698	1,970	20,382	65,410
1913	7,571	2,568	2,543	1,257	2,584	404	247	1,533	1,869	20,576	61,178
1914	6,618	2,265	2,259	1,590	2,559	515	256	1,257	1,725	17,319	58,933
1915	7,652	2,531	2,643	2,155	2,592	464	344	1,761	1,698	23,565	64,618
1916	9,188	2,979	3,117	2,675	3,057	968	467	2,131	2,199	26,781	67,766
1917	7,169	2,277	2,797	1,928	2,706	1,062	352	2,149	1,920	22,360	67,503
1918	8,614	3,328	3,430	2,061	3,256	762	384	2,421	2,351	26,607	70,978
1919	8,672	3,141	3,179	2,190	3,651	588	368	2,322	2,126	26,237	74,584
1920	7,526	2,466	2,708	2,247	3,399	413	341	2,173	1,914	23,187	71,727

[1] Compiled from yearbooks of stockyard companies.
[2] Not in operation.

TABLE 32.—*Hogs: Combined monthly and yearly receipts at Chicago, Kansas City, Omaha, and East St. Louis, 1910 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-year average.
January	1,179	1,270	1,908	1,640	1,479	1,669	2,313	2,199	1,657	2,418	2,136	1,806
February	1,128	1,302	1,612	1,315	1,328	1,640	1,950	1,697	1,888	1,978	1,357	1,563
March	934	1,516	1,350	1,170	1,182	1,511	1,516	1,367	1,963	1,631	1,630	1,434
April	788	1,304	1,242	1,154	1,001	1,080	1,154	1,205	1,697	1,571	1,059	1,205
May	1,057	1,521	1,381	1,257	1,065	1,234	1,366	1,320	1,464	1,644	1,686	1,363
June	1,138	1,487	1,218	1,328	1,167	1,222	1,283	1,125	1,246	1,680	1,433	1,302
July	892	1,200	1,090	1,129	927	1,037	1,090	1,083	1,356	1,314	1,131	1,114
August	892	976	846	1,095	830	921	1,221	757	1,047	829	988	946
September	687	970	763	1,081	826	803	954	545	932	913	795	843
October	768	1,231	1,093	1,153	1,093	848	1,407	902	1,376	1,129	894	1,081
November	1,020	1,533	1,207	1,288	1,158	1,387	1,996	1,286	1,794	1,485	1,381	1,412
December	1,131	1,451	1,386	1,655	1,640	2,066	2,091	1,461	2,207	2,049	1,611	1,704
Total	11,614	15,761	15,096	15,265	13,696	15,418	18,341	14,947	18,627	18,641	16,101	15,773

[1] Prior to 1915 compiled from yearbooks of stockyard companies.

TABLE 33.—*Hogs: Monthly receipts at leading markets, 1910 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

CHICAGO.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-year average.
January	569	640	881	806	729	896	1,228	1,124	729	1,123	1,024	886
February	574	651	791	646	649	740	947	792	917	913	616	749
March	394	702	654	586	543	646	733	628	975	675	642	653
April	325	519	567	534	444	467	542	543	787	640	369	522
May	462	635	630	549	465	567	612	584	659	704	739	601
June	497	560	543	611	586	564	566	506	513	781	703	585
July	390	508	523	517	460	511	527	474	628	603	584	520
August	441	485	431	565	413	445	587	337	434	384	495	456
September	355	442	404	588	370	412	474	251	398	432	379	410
October	424	587	522	641	521	418	781	436	681	568	432	546
November	549	695	573	641	434	812	1,062	698	894	807	673	713
December	607	679	661	889	1,002	1,175	1,128	796	1,000	1,043	871	896
Total	5,587	7,103	7,180	7,573	6,616	7,653	9,187	7,169	8,615	8,673	7,527	7,5[illegible]5

KANSAS CITY.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-year average.
January	222	223	353	270	203	254	328	274	305	451	316	291
February	187	225	241	196	170	297	286	235	269	334	210	241
March	184	295	198	163	172	244	219	186	275	224	280	222
April	179	316	208	218	166	174	192	201	256	281	157	213
May	218	355	233	229	180	212	274	228	269	304	324	257
June	220	338	209	245	177	211	250	172	225	291	206	231
July	162	233	167	196	114	151	175	171	213	198	130	174
August	129	139	102	170	116	143	220	129	195	131	135	146
September	110	183	107	172	148	130	190	102	211	169	117	149
October	117	250	217	203	232	180	271	172	298	216	156	210
November	178	332	241	243	382	240	299	195	356	231	243	267
December	177	280	243	261	202	294	275	212	455	310	194	264
Total	2,083	3,169	2,519	2,566	2,262	2,530	2,979	2,277	3,327	3,140	2,468	2,665

[1] Prior to 1915, compiled from yearbooks of stockyard companies.

Table 33.—*Hogs: Monthly receipts at leading markets, 1910 to 1920*—Continued.

OMAHA.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-year average.
January	177	171	330	281	256	258	396	441	331	449	349	313
February	202	204	359	254	244	318	402	377	364	391	221	303
March	193	252	286	227	243	320	318	294	393	400	341	297
April	153	238	285	212	194	234	231	229	379	310	304	252
May	173	256	303	248	211	245	238	244	285	296	305	255
June	214	278	279	246	208	258	261	244	285	303	282	260
July	166	213	223	227	202	218	217	261	288	281	221	229
August	172	161	168	185	138	189	199	166	225	147	157	173
September	102	119	111	132	99	119	120	94	147	102	109	114
October	93	108	137	127	103	77	123	98	133	110	93	109
November	111	152	183	190	155	103	277	148	239	135	136	166
December	138	214	220	215	206	304	335	200	360	254	189	240
Total	1,894	2,366	2,884	2,544	2,259	2,643	3,117	2,796	3,429	3,178	2,707	2,711

EAST ST. LOUIS.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-year average.
January	211	236	344	283	291	261	361	360	292	395	447	316
February	165	222	221	219	265	285	315	293	338	340	310	270
March	163	267	212	194	224	301	246	259	320	332	367	262
April	131	231	182	190	197	205	189	232	275	340	229	218
May	204	275	215	231	209	210	242	264	251	340	318	251
June	207	311	187	226	196	189	206	203	223	305	242	227
July	174	246	177	189	151	157	171	177	227	232	196	191
August	150	191	145	175	163	144	215	125	193	167	201	170
September	120	226	141	189	209	142	170	98	176	210	190	170
October	134	286	217	182	237	173	232	196	264	235	213	215
November	182	354	210	214	187	232	358	245	305	312	329	266
December	209	278	262	290	230	293	353	253	392	442	357	305
Total	2,050	3,123	2,513	2,582	2,559	2,592	3,058	2,705	3,256	3,650	3,399	2,862

TABLE 34.—*Hogs: Yearly receipts, local slaughter and stocker and feeder shipments at public stockyards, 1915 to 1920.*[1]

Market.	Receipts.						Local slaughter.						Stocker and feeder shipments.				
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
Albany, N. Y.		26,160	50,400	4,510	2,338	2,290			3,414	817	1,542	1,593					
Amarillo, Tex.	10,982	25,967	18,753	10,855	2,250	6,739									42	293	901
Atlanta, Ga.			36,172	46,515	82,918	68,095			26,811	23,921	36,841	42,485			4,128	3,700	7,954
Augusta, Ga.			6,894	8,355	8,791	7,326			5,212	3,444	4,543	5,353		11	576	680	185
Baltimore, Md.	959,283	1,002,617	810,320	804,497	952,927	1,153,578	725,514	746,720	557,844	514,326	661,115	873,663					
Billings, Mont.		351	5,341	4,982	10,581	1,379		30	1,661	1,013	172	200		613	1,089	2,848	349
Birmingham, Ala		6,378	2,390	13,793	23,558	24,305		5,801	2,390	13,604	23,558	24,278	248		128		
Boston, Mass.	7,718	21,884	19,536	14,157	22,309	13,853											
Buffalo, N. Y.	1,805,744	1,692,583	1,114,050	1,300,758	1,351,940	1,493,981		783,885	488,202	617,038	730,017	630,864		2,262	604	95	12
Charleston, S. C.			17	128					17	128							
Chattanooga, Tenn.		15,804	14,454	13,033	14,320	11,012				7,412	12,806	11,012			1,947	715	
Cheyenne, Wyo.			9,022	595	2,655	9,521											
Chicago, Ill.	7,652,071	9,188,224	7,168,852	8,614,190	8,672,476	7,526,120	6,519,125	7,783,497	5,949,524	7,643,326	7,571,841	5,869,592		45,448	24,450	13,867	1,474
Cincinnati, Ohio	1,179,672	1,260,118	1,239,042	1,462,702	1,674,083	1,477,979	656,076	601,421	687,574	706,105	823,381	788,696			1,668	1,414	2,766
Cleveland, Ohio	976,761	969,941	898,129	1,313,575	1,083,765	1,011,657	826,379	776,454	578,460	850,205	729,016	609,602			308		
Columbia, S. C.		7,730	3,786	3,353	5,899	7,002		7,154	41	2,803	5,899	7,002					
Columbus, Ohio	68,920	63,106	55,419	65,425	52,182	69,362	4,981	17,812	11,879	6,907	4,365	13,609	99		1,160	606	1,240
Dallas, Tex.		100,918	87,189	61,639	45,416	56,324		100,918	87,189	61,639	44,680	56,324					
Dayton, Ohio	117,840	91,539	87,839	117,929	108,575	128,843	83,168	66,526	57,280	60,236	61,442	75,607			140		
Denver, Colo.	343,653	466,653	351,903	383,543	367,634	341,240	330,842	444,239	326,494	366,216	335,577	309,989	9,244	22,074	17,360	31,524	30,465
Detroit, Mich.	542,621	650,176	431,392	408,372	389,037	444,301		561,352	296,682	286,997	335,567	359,777	79	1,191	1,474	7,740	4,883
Dublin, Ga.			465	3,609	2,650	3,149			15	315		68			300	68	137
East St. Louis, Ill.	2,591,768	3,057,414	2,705,614	3,256,400	3,650,534	3,398,940	1,600,373	1,986,684	1,679,867	2,276,208	2,230,758	1,678,226	13,156	12,358	76,815	98,175	47,258
El Paso, Tex.	4,287	12,642	20,943	19,417	16,731	15,185			15,058	6,883	8,771	10,552		344	8,429	4,318	3,098
Emeryville, Calif.			18,322	5,311	10,129	16,152			18,322	5,310	10,129	16,152					
Erie, Pa.				78,389	42,562	60,643				15,387	16,490	15,088					
Evansville, Ind.		138,979	148,122	221,738	255,276	242,732		24,394	36,044	39,750	31,509	79,665		11,917	9,920	9,571	4,007
Fort Worth, Tex.	463,879	968,024	1,062,021	762,486	588,004	412,637	391,408	860,050	796,680	568,253	463,641	322,194		26,492	89,382	55,136	24,243
Fostoria, Ohio	68,432	76,030	66,586	96,350	78,582	98,841		703	27,344	12,690	10,249	9,703		2,018	5,067	3,287	1,362
Indianapolis, Ind.	2,435,319	2,575,611	2,350,730	2,749,976	2,936,493	2,896,894	1,495,711	1,511,221	1,326,216	1,394,252	1,434,319	1,359,477		34,908	45,369	41,361	16,628
Jacksonville, Fla.		11,679	15,913	72,099	78,461	100,239			15,137	67,550	66,005	72,270	1,480	378	2,862	1,141	1,485
Jersey City, N. J.	1,174,974	1,136,674	743,582	566,131	467,560	629,473	1,174,974	1,136,674	743,582	566,131	467,560	629,382					
Kansas City, Mo.	2,530,730	2,978,933	2,276,995	3,327,722	3,140,530	2,466,419	2,113,780	2,527,271	1,978,428	2,655,299	2,600,430	1,838,080	22,328	18,183	174,929	243,837	200,196
Knoxville, Tenn.	10,604	10,958	15,278	11,559	36,936	41,761	642	4,218	5,587	702	2,851	2,426		74	1,241	482	254
Lafayette, Ind.	97,691	118,850	123,201	185,949	198,554	203,852		57,412	38,499	32,505	36,567	40,026	108	5,165	1,304	3,073	5,288
Lancaster, Pa.	19,444	26,059	397,695	577,587	62,649	185,079				7,889	12,878	11,207					
Logansport, Ind.	21,410	13,055	10,252	15,421	15,848	22,943	345	752	411	62	1,297	1,617	354	521	314	182	322
Louisville, Ky.	392,656	738,512	680,380	757,912	750,285	428,125	129,299	167,897	132,378	137,930	172,741	155,870			16,788	27,586	10,704

Marion, Ohio				49,215	154,958	216,961				1,450	9,714	13,493			1,234	3,754	2,010
Memphis, Tenn.		719	401	3,152	11,369	30,346					2,312	1,264	15			227	3,914
Milwaukee, Wis.	583,071	535,692	410,613	504,944	584,556	553,975	556,121	529,189	394,114	462,849	534,063	509,330		3	400	438	
Mobile, Ala	5,537	7,113	3,943				4,285	3,863	1,790								
Montgomery, Ala.			10,035	47,897	170,875	109,025					2,927	4,517		447	640	22,411	15,236
Nashville, Tenn.		337,063	478,661	580,961	727,030	614,523		29,439	45,958	56,710	66,943	82,329	22,711		36,217	28,060	17,705
Nebraska City, Nebr.				273,906	297,904	310,608				263,762	271,418	258,427			118	68	
New Brighton, Minn.	3,557	2,909	8,249	3,728	3,135	7,197							295	4,215	825	1,877	3,484
New Orleans, La.		61,231	57,575	49,606	62,805	62,678		51,962	41,451	36,238	43,269	44,697		4,337	2,914	2,750	2,776
New York, N. Y.	363,205	348,871	552,127	650,708	677,413	755,243	363,205	348,871	552,127	650,708	677,379	755,243					
Norfolk, Va.				2,457													
Ogden, Utah			57,009	59,233	103,834	78,332			2,630	52,336	66,796	47,415		714	714	12,665	11,360
Oklahoma, Okla.	484,842	759,598	634,291	571,066	470,036	340,832	475,858	732,002	529,699	503,960	360,105	287,814	18,031	69,631	68,478	43,459	20,552
Omaha, Nebr.	2,642,973	3,116,820	2,796,596	3,429,533	3,179,116	2,708,482	2,012,250	2,391,177	2,001,006	2,549,938	2,530,833	1,998,376	25,891	73,236	12,921	8,253	6,570
Orangeburg, S.C.				9,101	1,834					8,998	1,864				162		
Pasco, Wash.				6,033	6,635	1,759				85	25	5			857		
Peoria, Ill.	281,122	370,019	262,438	394,581	390,243	353,602	125,109	131,715	95,744	143,426	153,207	135,502		967	4,410	372	2,594
Philadelphia, Pa.	168,428	227,031	219,074	273,142	344,791	481,155			202,018	263,739	328,781	456,682			652		
Pittsburgh, Pa.	1,090,800	877,749	1,745,868	1,808,080	1,778,726	2,439,067	155,400	154,673	289,529	278,787	278,902	412,911					
Portland, Oreg.	302,786	322,655	221,687	228,244	204,870	174,831	172,448	189,302	129,289	136,986	102,654	90,619	2,456	13,880	18,160	15,190	16,724
Pueblo, Colo.	5,058	18,887	16,652	22,653	23,747	13,621				142					214		269
Richmond, Va.	72,669	98,633	77,804	59,893	156,279	211,527	70,315	5,457	74,380	57,489	153,890	209,795			138	821	276
St. Joseph, Mo.	1,697,842	2,198,751	1,920,177	2,351,013	2,126,322	1,913,755	1,523,563	2,106,609	1,833,371	2,064,221	1,918,730	1,584,112	11,243	32,716	33,722	27,414	23,323
St. Louis, Mo.	350,247	392,017	340,032	331,133			337,108	346,457	294,699	301,371							
St. Paul, Minn.	2,155,201	2,674,547	1,927,952	2,061,390	2,189,716	2,246,948	1,370,329	1,499,454	1,068,477	1,306,582	1,317,338	1,904,869	22,576	231,631	172,569	103,240	161,439
Salt Lake City, Utah		58,800	42,166	45,015	52,870	34,487		1,408	30,862	39,084	38,859	25,387	878	4,875	1,241	3,525	2,947
San Antonio, Tex.	36,060	58,848	39,686	30,391	24,663	38,796			28,284	14,927	7,511	15,835	28,764	883	1,933	2,185	2,405
Seattle, Wash.		179,031	129,533	127,036	125,225	95,459		179,031	129,533	125,259	124,323	91,526			1,777	1,507	3,228
Sioux City, Ia.	1,730,818	2,131,113	2,149,115	2,421,166	2,321,551	2,172,637	1,189,202	1,307,031	1,257,383	1,510,632	1,410,826	1,295,790	7,715	108,941	41,004	33,009	27,933
Sioux Falls, S. Dak.			5,862	62,276	173,938	246,833			404	214	79	5,013		4,835	3,024	1,984	2,337
Spokane, Wash.	5,831	37,110	37,648	44,339	60,360	47,095	3,392	17,902	24,929	33,574	41,600	31,931		8,303	8,638	15,331	11,530
Tacoma, Wash.		38,100	18,759	31,576	30,108	34,993		38,100	18,759	29,740	31,098	33,746			96	287	
Toledo, Ohio	249,593	303,900	278,389	254,875	232,129	264,379		102,385	52,789	46,321	53,074	85,787			1,009	1,730	1,730
Washington, D. C.		81,773	57,652	55,604	71,719	101,674		81,773	55,001	54,032	71,439	100,912					
Wichita, Kans.	473,469	572,675	494,877	617,745	494,003	382,461	471,164	563,486	391,895	502,795	469,127	355,946	6,442	44,219	86,760	19,637	22,867
Total	36,212,531	43,265,224	38,041,879	44,862,634	44,469,258	42,121,255	24,893,375	30,984,381	25,440,363	30,440,608	30,017,643	26,760,920	194,103	787,790	988,621	901,893	728,419

[1] Complete information for 1915 and 1916, particularly on disposition of stock, is not obtainable from many of these markets.

TABLE 35.—*Hogs: Combined monthly and yearly receipts at public stockyards, 1915 to 1920.*

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1915....	3,959	3,449	3,199	2,487	2,768	2,874	2,368	2,024	1,966	2,457	3,728	4,934	36,213
1916....	5,309	4,233	3,489	2,852	3,332	3,054	2,524	2,634	2,386	3,640	4,873	4,939	43,265
1917....	5,084	3,933	3,369	2,961	3,264	2,791	2,563	1,853	1,615	2,676	3,941	3,992	38,042
1918....	4,444	4,486	4,424	3,696	3,345	2,979	3,099	2,467	2,376	3,399	4,594	5,554	44,863
1919....	5,855	4,412	3,643	3,648	3,831	3,773	2,974	2,095	2,397	3,121	3,740	4,980	44,469
1920....	5,262	3,422	3,940	3,024	4,210	3,709	2,811	2,491	2,391	2,789	3,872	4,200	42,121

See note on Table 34.

TABLE 36.—*Hogs: Combined monthly and yearly shipments from public stockyards, 1915 to 1920.*

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1915....	936	703	802	665	596	638	623	524	544	591	847	1,151	8,620
1916....	1,462	1,292	1,036	767	816	729	710	756	640	977	1,305	1,489	11,979
1917....	1,732	1,415	1,179	851	904	825	746	593	541	886	1,500	1,399	12,571
1918....	1,437	1,474	1,775	1,297	1,085	1,028	964	830	803	919	1,246	1,465	14,373
1919....	1,597	1,334	1,320	1,140	1,198	1,157	971	699	877	1,118	1,322	1,633	14,366
1920....	1,718	1,322	1,427	1,146	1,392	1,308	1,101	958	935	1,068	1,399	1,524	15,298

See note on Table 34.

TABLE 37.—*Hogs: Combined monthly and yearly local slaughter at public stockyards, 1915 to 1920.*

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1915....	2,713	2,570	2,270	1,648	1,952	2,031	1,578	1,335	1,258	1,624	2,519	3,395	24,893
1916....	3,806	2,905	2,432	2,056	2,493	2,322	1,801	1,861	1,729	2,635	3,528	3,416	30,984
1917....	3,338	2,528	2,209	2,103	2,361	1,968	1,804	1,259	1,051	1,796	2,422	2,600	25,440
1918....	2,993	2,982	2,644	2,384	2,261	1,953	2,109	1,586	1,554	2,434	3,320	4,221	30,441
1919....	4,236	3,057	2,344	2,498	2,635	2,603	1,989	1,390	1,512	2,018	2,393	3,343	30,018
1920....	3,529	2,094	2,496	1,861	2,790	2,421	1,716	1,530	1,452	1,726	2,465	2,681	26,761

See note on Table 34.

TABLE 38.—*Hogs: Combined monthly and yearly stocker and feeder shipments from public stockyards, 1916 to 1920.*

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1916....	10	17	17	11	14	11	9	15	27	25	19	18	194
1917....	29	28	49	30	28	21	15	25	28	86	319	130	788
1918....	49	64	95	74	76	53	45	116	116	118	103	79	989
1919....	51	47	88	127	98	52	44	50	74	111	91	69	902
1920....	90	85	107	76	66	43	27	36	47	60	54	37	728

See note on Table 34.

TABLE 39.—*Hogs: Monthly and yearly receipts, slaughter and stocker and feeder shipments at public stockyards, 1915 to 1920 (number of animals).*

CHICAGO, ILL.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
January...	896, 068	1, 227, 508	1, 124, 09[illegible]	729, 005	1, 123, 268	1, 024, 374	759, 314	1, 014, 626	791, 898	652, 818	1, 033, 685	811, 496	......	......	....	399	579	35
February .	739, 87[illegible]	947, 285	792, 210	917, 429	913, 36[illegible]	616, 079	638, 121	707, 620	584, 275	802, 529	733, 987	448, 293	......	......	....	2, 398	207	344
March.....	646, 150	733, 175	627, 825	975, 169	674, 559	641, 817	587, 327	588, 965	496, 602	712, 821	532, 502	478, 806	......	......	94	3, 847	280	197
April......	466, 704	541, 76[illegible]	542, 61[illegible]	785, 76[illegible]	640, 068	369, 231	413, 659	452, 725	477, 848	608, 418	580, 492	288, 790	......	......	1, 003	4, 4[illegible]7	2, 347	....
May.......	566, 521	612, 327	583, 537	658, 613	703, 780	739, 230	500, 569	555, 197	519, 886	559, 655	625, 733	579, 605	......	......	396	3, 088	1, 446	....
June......	563, 705	566, 212	506, 452	512, 529	780, 642	702, 671	483, 234	526, 888	456, 018	459, 709	680, 673	537, 762	......	......	576	925	907	....
July.......	510, 602	527, 246	47[illegible], 7[illegible]7	628, 245	603, 442	584, 220	389, 897	472, 137	426, 535	583, 607	506, 922	414, 116	......	......	16	553	485	429
August....	445, 258	587, 439	337, 190	4[illegible]4, 365	384, 068	494, 584	354, 690	510, 204	289, 580	380, 756	323, 978	382, 861	......	......	237	1, 092	334	342
September	412, 053	473, 990	250, 839	397, 693	431, 525	378, 755	307, 555	434, 050	221, 107	373, 314	395, 478	297, 892	......	......	1, 172	2, 114	1, 914	10
October...	418, 482	781, 023	435, 892	680, 835	567, 847	431, 915	409, 339	717, 106	383, 086	655, 236	534, 602	360, 062	......	......	7, 406	3, 268	4, 234	....
November	812, 127	1, 062, 254	698, 383	893, 755	806, 604	672, 596	712, 539	934, 091	595, 015	873, 558	737, 384	574, 724	......	......	26, 213	1, 821	858	....
December.	1, 174, 530	1, 128, 004	796, 082	999, 794	1, 043, 311	870, 650	962, 901	869, 890	707, 676	977, 905	886, 407	695, 185	......	......	8, 335	508	276	117
Total..	7, 652, 071	9, 188, 224	7, 168, 852	8, 614, 190	8, 672, 470	7, 526, 120	6, 519, 125	7, 783, 497	5, 949, 524	7, 643, 326	7, 571, 841	5, 869, 592	......	......	45, 448	24, 450	13, 867	1, 474

KANSAS CITY, MO.

Month.	Receipts 1915	Receipts 1916	Receipts 1917	Receipts 1918	Receipts 1919	Receipts 1920	Local slaughter 1915	Local slaughter 1916	Local slaughter 1917	Local slaughter 1918	Local slaughter 1919	Local slaughter 1920	Stocker and feeder 1915	Stocker and feeder 1916	Stocker and feeder 1917	Stocker and feeder 1918	Stocker and feeder 1919	Stocker and feeder 1920
January...	253, 560	327, 826	274, 218	304, 553	450, 706	315, 831	225, 680	299, 883	242, 112	293, 427	405, 129	254, 461	1, 078	613	127	4, 899	6, 804	28, 336
February .	296, 627	285, 474	234, 968	269, 181	334, 280	209, 779	266, 014	232, 581	198, 389	241, 832	280, 287	136, 913	557	95	574	6, 045	6, 558	21, 986
March.....	243, 976	219, 237	185, 851	275, 229	223, 6[illegible]6	279, 808	189, 511	153, 851	159, 006	210, 791	194, 141	193, 349	1, 923	5, 994	2, 217	8, 589	24, 633	28, 8[illegible]9
April......	174, 293	191, 722	201, 119	256, 421	280, 974	156, 911	126, 291	142, 233	172, 397	212, 179	237, 134	120, 812	5, 816	1, 240	2, 532	8, 070	31, 401	16, 527
May.......	212, 434	274, 151	228, 136	269, 021	304, 315	323, 564	171, 355	236, 417	194, 411	227, 853	261, 792	254, 122	2, 370	1, 071	1, 922	11, 318	17, 382	20, 114
June......	211, 236	250, 433	171, 713	225, 101	290, 752	205, 919	184, 435	221, 819	153, 328	184, 158	228, 151	166, 588	2, 866	1, 497	885	10, 892	10, 434	12, 761
July.......	151, 405	174, 971	170, 545	213, 110	197, 785	129, 801	122, 817	141, 216	145, 175	153, 289	150, 375	99, 563	4, 160	1, 861	633	9, 697	14, 610	8, 563
August....	142, 829	219, 589	128, 744	194, 703	131, 207	135, 461	107, 498	169, 932	107, 601	137, 736	95, 995	89, 726	1, 452	4, 443	1, 535	22, 038	15, 971	8, 388
September	129, 855	189, 843	101, 996	211, 205	169, 413	116, 770	88, 451	158, 148	81, 799	144, 301	125, 895	73, 914	4, 704	3, 568	971	34, 375	27, 672	15, 881
October...	180, 499	270, 653	172, 154	298, 146	216, 373	156, 138	139, 652	241, 632	159, 732	205, 346	171, 824	109, 979	2, 117	1, 303	653	33, 955	40, 041	19, 897
November	240, 304	299, 107	195, 054	355, 622	231, 470	242, 575	211, 850	273, 814	169, 761	278, 695	180, 971	184, 565	785	499	3, 945	15, 819	31, 031	10, 008
December.	293, 712	274, 927	212, 497	455, 430	309, 649	193, 862	280, 246	255, 745	194, 717	365, 692	268, 736	154, 088	606	144	2, 189	9, 232	17, 300	8, 926
Total..	2, 530, 730	2, 978, 933	2, 276, 995	3, 327, 722	3, 140, 530	2, 466, 419	2, 113, 780	2, 527, 271	1, 978, 428	2, 655, 299	2, 600, 430	1, 838, 080	28, 432	22, 328	18, 183	174, 929	243, 837	200, 196

TABLE 39.—*Hogs: Monthly and yearly receipts, slaughter and stocker and feeder shipments at public stockyards, 1915 to 1920 (number of animals)*—Contd.

OMAHA, NEBR.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
January	257, 751	393, 092	441, 104	330, 968	449, 319	349, 464	214, 083	318, 255	285, 456	291, 861	386, 302	272, 533	......	949	1, 628	525	1, 432	1, 843
February	317, 925	402, 153	377, 484	363, 513	390, 781	221, 290	272, 026	297, 628	236, 390	270, 189	317, 457	159, 627	......	5, 720	2, 786	1, 743	921	2, 473
March	320, 449	318, 189	294, 189	393, 347	399, 744	341, 404	234, 647	231, 726	193, 864	218, 757	280, 590	231, 547	......	3, 404	2, 292	1, 329	1, 213	477
April	234, 166	230, 714	229, 389	379, 218	309, 706	304, 466	151, 393	171, 332	171, 487	227, 331	227, 400	201, 266	......	1, 403	1, 636	916	1, 434	......
May	245, 226	237, 751	244, 315	284, 636	295, 758	304, 815	193, 368	197, 800	199, 102	206, 789	252, 815	241, 950	......	952	1, 948	947	418	......
June	258, 402	261, 312	244, 200	284, 860	302, 619	281, 549	200, 457	216, 584	195, 814	204, 835	238, 000	205, 437	......	857	1, 428	548	307	305
July	217, 669	216, 747	260, 536	287, 672	281, 499	221, 009	148, 510	183, 621	220, 293	204, 625	198, 700	149, 150	......	219	507	163	373	425
August	188, 743	199, 212	166, 303	225, 967	147, 371	156, 936	130, 105	147, 649	118, 689	142, 928	115, 550	108, 483	......	1, 853	3, 970	567	511	289
September	119, 257	120, 027	93, 614	147, 405	102, 458	108, 668	73, 535	94, 270	56, 624	95, 971	84, 825	75, 349	......	1, 313	2, 241	449	456	......
October	73, 547	122, 792	97, 558	133, 135	110, 276	92, 961	55, 604	88, 531	79, 662	121, 609	98, 582	72, 419	......	2, 290	7, 062	1, 151	492	100
November	103, 083	273, 638	147, 897	239, 499	135, 404	136, 449	83, 453	202, 632	90, 515	223, 891	117, 200	121, 705	......	3, 492	31, 186	2, 772	554	310
December	303, 775	335, 193	200, 007	360, 213	254, 181	189, 450	252, 078	238, 149	153, 110	332, 152	213, 412	158, 900	......	3, 439	16, 552	1, 811	142	348
Total	2, 642, 973	3, 116, 820	2, 796, 596	3, 429, 533	3, 179, 116	2, 708, 482	2, 012, 259	2, 391, 177	2, 001, 006	2, 540, 938	2, 530, 833	1, 998, 376	......	25, 891	73, 236	12, 921	8, 253	6, 570

EAST ST. LOUIS, ILL.

Month.	Receipts 1915	1916	1917	1918	1919	1920	Local slaughter 1915	1916	1917	1918	1919	1920	Stocker and feeder 1915	1916	1917	1918	1919	1920
January	261, 192	361, 117	360, 277	291, 606	395, 148	446, 852	146, 396	252, 008	201, 255	215, 784	298, 486	278, 271	285	357	......	1, 718	3, 551	4, 782
February	284, 876	314, 718	293, 012	338, 051	339, 620	310, 057	193, 464	176, 144	139, 753	262, 685	211, 347	101, 333	......	855	......	3, 877	6, 398	9, 524
March	301, 364	244, 575	259, 286	320, 226	331, 699	366, 989	142, 156	114, 979	118, 487	168, 457	170, 165	156, 877	183	702	......	11, 612	12, 941	8, 682
April	204, 965	189, 282	232, 137	275, 155	340, 322	228, 721	86, 508	97, 893	132, 755	175, 898	210, 520	86, 079	670	2, 545	......	6, 418	15, 568	6, 543
May	209, 606	242, 280	264, 355	251, 167	340, 036	318, 351	140, 436	176, 646	180, 836	162, 738	218, 092	229, 054	862	7, 811	......	5, 888	13, 581	5, 595
June	183, 983	205, 957	202, 701	223, 335	305, 495	241, 696	146, 033	168, 898	149, 428	132, 900	221, 660	125, 919	121	211	......	2, 489	5, 722	1, 618
July	156, 606	171, 454	176, 697	226, 621	232, 090	196, 466	111, 898	126, 996	116, 371	166, 288	152, 149	92, 688	627	509	691	1, 092	5, 394	814
August	144, 460	215, 048	125, 184	193, 006	166. 807	201, 215	103, 148	119, 807	72, 808	127, 884	113, 466	99, 419	185	10	......	7, 365	6, 621	1, 445
September	141, 503	170, 453	98, 130	175, 995	209, 871	189, 662	83, 256	94, 068	67, 306	116, 492	104, 252	88, 320	502	6	......	13, 944	9, 917	1, 213
October	173, 220	231, 734	195, 631	263, 783	235, 456	212, 914	108, 302	148, 401	131, 213	205, 591	99, 091	98, 658	332	150	......	13, 641	9, 981	3, 774
November	232, 425	357, 811	244, 757	305, 388	311, 761	328, 780	129, 113	259, 435	175, 450	232, 540	173, 620	167, 317	377	......	6, 323	5, 676	6, 405	1, 480
December	292, 568	352, 985	253, 447	392, 067	442, 229	357, 207	209, 663	251, 409	194, 205	308, 951	257, 910	154, 311	908	......	5, 344	3, 095	2, 096	1, 788
Total	2, 591, 768	3, 057, 414	2, 705, 614	3, 256, 400	3, 650, 534	3, 398, 940	1, 600, 373	1, 986, 684	1, 679, 867	2, 276, 208	2, 230, 758	1, 678, 226	5, 052	13, 156	12, 358	76, 815	98, 175	47, 258

ST. PAUL, MINN.

January...	268,915	411,272	265,215	246,118	289,726	293,937	149,607	187,430	137,691	135,250	188,911	234,709	1,965	2,133	7,078	12,582	11,003	16,079
February..	220,222	306,930	153,327	177,115	256,906	204,867	149,191	174,023	91,531	110,297	161,438	166,705	1,356	3,376	10,112	8,640	4,921	15,828
March.....	191,960	233,850	149,550	200,991	156,371	204,954	130,333	129,157	80,611	111,167	97,231	167,178	1,973	363	13,835	10,705	6,163	35,228
April......	139,258	171,927	124,798	167,397	154,978	171,962	96,131	114,003	69,752	97,250	89,151	141,674	897	160	8,902	12,743	5,492	14,367
May.......	181,743	227,009	147,632	162,639	187,131	228,866	126,954	136,666	88,170	99,714	111,166	191,482	1,077	553	8,548	12,039	6,553	10,420
June.......	166,630	171,399	127,691	119,721	183,927	203,890	119,748	104,351	87,509	73,576	105,313	204,0[illegible]8	869	3,994	5,708	7,961	4,584	6,533
July.......	131,465	135,001	100,731	119,156	163,173	131,468	98,038	78,294	68,825	74,166	96,567	125,547	527	108	1,936	3,966	2,766	2,386
August....	53,778	87,540	51,819	61,029	91,994	66,913	37,533	52,736	36,223	37,279	56,894	60,856	410	520	2,503	3,808	2,753	2,366
September	54,770	90,895	59,283	57,877	83,366	76,247	39,465	59,198	40,453	36,777	47,845	67,322	701	1,667	5,177	5,885	6,446	5,805
October...	122,593	226,311	186,464	167,255	145,627	177,835	83,363	143,390	105,792	105,881	77,550	163,252	1,348	3,531	31,540	18,489	19,397	15,281
November	257,247	325,879	315,683	269,351	209,893	252,69[illegible]	162,190	167,833	138,813	147,887	86,969	201,087	8,615	4,573	101,690	36,357	17,932	24,599
December.	366,620	286,534	245,759	312,741	266,624	233,310	177,776	152,373	122,107	277,338	198,303	181,039	131	1,598	34,602	39,394	15,230	12,547
Total..	2,155,201	2,674,547	1,927,952	2,061,390	2,189,716	2,216,948	1,370,329	1,499,454	1,068,477	1,306,582	1,317,338	1,904,869	19,869	22,576	231,631	172,569	103,240	161,439

FORT WORTH, TEX.

January...	55,062	84,470	151,643	100,256	145,272	59,949	48,772	76,063	134,828	74,633	136,416	46,446	......	......	....	7,132	1,176	3,061
February..	50,450	97,907	150,716	99,128	81,232	44,945	42,244	87,373	133,094	74,768	64,397	36,723	......	......	....	6,792	3,867	2,145
March.....	33,945	129,458	159,181	103,173	72,617	61,723	27,229	129,602	129,531	78,201	51,186	53,900	......	......	....	7,478	8,714	1,918
April......	33,839	87,366	107,548	63,173	66,687	38,958	27,033	80,457	92,185	42,546	44,419	33,054	......	......	....	8,265	16,704	3,032
May.......	36,422	86,342	69,752	39,412	36,954	37,470	32,506	74,659	60,399	27,041	25,739	27,781	......	......	....	8,166	8,020	1,531
June.......	27,265	61,279	39,284	19,335	28,407	24,486	21,955	56,841	27,450	13,444	22,053	18,372	......	......	....	5,753	2,318	1,039
July.......	17,301	52,043	39,111	31,107	27,007	13,928	12,273	42,603	23,654	16,668	21,330	9,1[illegible]7	......	......	....	4,541	2,258	621
August....	23,364	64,620	61,206	50,743	14,034	16,214	19,332	53,719	31,575	30,271	8,803	11,888	......	......	....	20,341	3,411	299
September	52,470	73,803	65,661	41,802	18,334	33,218	47,576	66,168	28,799	24,336	13,661	25,704	......	......	....	7,907	2,647	1,740
October...	52,029	67,851	60,859	39,066	21,825	27,005	46,800	57,705	32,916	28,489	16,787	18,814	......	......	....	5,395	2,183	4,142
November	40,336	75,322	86,704	63,868	30,718	33,188	31,626	61,338	48,440	53,579	21,458	24,897	......	......	19,780	5,238	1,922	2,872
December.	41,396	87,560	70,356	111,423	44,917	21,553	34,0[illegible]2	82,522	53,809	104,277	37,392	15,448	......	......	6,712	2,374	1,916	1,843
Total..	463,879	968,024	1,062,021	762,486	588,004	412,637	391,408	860,050	796,680	568,253	463,641	322,194	......	......	26,492	89,382	55,136	24,243

TABLE 39.—*Hogs: Monthly and yearly receipts, slaughter and stocker and feeder shipments at public stockyards, 1915 to 1920 (number of animals)*—Contd.

SIOUX CITY, IOWA.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
January	174,749	271,021	314,526	251,978	313,706	256,599	124,750	167,709	162,663	177,922	192,880	171,755	......	380	2,816	3,896	2,727	2,526
February	204,041	255,478	256,674	232,108	260,795	189,224	132,252	119,297	140,548	151,526	160,790	118,882	......	1,793	2,279	1,603	1,372	2,923
March	200,358	191,376	196,299	300,371	224,446	223,583	119,447	88,732	113,404	140,847	120,760	124,402	178	515	3,056	2,988	2,806	2,756
April	115,932	161,255	154,421	227,858	194,980	217,067	75,867	94,689	95,139	115,066	114,735	124,894	727	432	2,816	2,939	2,861	3,195
May	141,640	150,066	169,422	200,240	234,726	232,066	98,158	94,205	107,880	114,279	134,209	140,665	392	140	2,628	5,441	3,011	2,736
June	185,496	161,756	187,313	208,514	245,858	232,324	122,781	106,248	120,781	133,799	141,134	135,057	343	528	1,531	2,266	413	2,310
July	176,139	150,021	216,962	231,982	236,935	203,480	111,381	92,237	113,796	124,884	122,696	100,325	722	315	593	733	1,206	1,509
August	114,334	123,657	103,399	150,658	127,311	129,604	72,912	72,997	67,371	85,619	75,093	74,715	......	......	1,638	1,761	2,136	3,174
September	64,802	74,968	66,235	109,540	89,541	99,147	42,026	62,229	49,521	72,553	55,134	50,427	173	......	2,243	4,505	3,514	1,941
October	51,402	99,596	104,828	114,977	91,994	104,635	41,666	83,002	74,213	89,639	72,084	66,308	271	......	11,377	4,785	5,518	1,729
November	103,338	212,556	202,992	157,168	106,292	132,775	91,006	158,873	94,361	128,297	81,256	93,456	962	332	67,198	4,696	4,578	1,526
December	228,587	279,363	176,044	235,772	194,967	152,133	156,956	166,813	117,706	176,201	140,055	94,904	2,293	3,280	10,766	5,391	2,867	1,608
Total	1,760,818	2,131,113	2,149,115	2,421,166	2,321,551	2,172,637	1,189,202	1,307,031	1,257,383	1,510,632	1,410,826	1,295,790	6,061	7,715	108,941	41,004	33,009	27,933

JERSEY CITY, N. J.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
January	139,849	162,453	126,705	59,716	66,818	67,368	139,849	162,453	126,705	59,716	66,818	67,318	......	......	......	......	......	......
February	81,057	117,120	73,999	50,205	46,994	50,253	81,057	117,120	73,999	50,205	46,994	50,253	......	......	......	......	......	......
March	92,285	90,873	62,630	44,039	24,409	52,220	92,285	90,873	62,630	44,039	24,409	52,220	......	......	......	......	......	......
April	103,228	104,703	69,036	49,523	45,060	64,238	103,228	104,703	69,036	49,523	45,060	64,238	......	......	......	......	......	......
May	80,115	77,369	52,445	35,304	32,343	55,196	80,115	77,369	52,445	35,304	32,343	55,196	......	......	......	......	......	......
June	72,102	70,293	50,920	32,766	29,605	37,887	72,102	70,293	50,920	32,766	29,605	37,850	......	......	......	......	......	......
July	79,454	67,447	41,237	39,388	31,205	42,421	79,454	67,447	41,237	39,388	31,205	42,421	......	......	......	......	......	......
August	64,448	56,308	41,375	23,388	23,429	35,549	64,448	56,308	41,375	23,388	23,429	35,549	......	......	......	......	......	......
September	90,708	74,488	39,333	27,644	30,317	57,109	90,708	74,488	39,333	27,644	30,317	57,109	......	......	......	......	......	......
October	93,138	91,867	63,274	32,666	44,467	45,794	93,138	91,867	63,274	32,666	44,467	45,790	......	......	......	......	......	......
November	124,070	106,479	70,314	65,051	47,472	58,339	124,070	106,479	70,314	65,051	47,472	58,339	......	......	......	......	......	......
December	154,520	117,274	52,314	106,441	45,441	63,099	154,520	117,274	52,314	106,441	45,441	63,099	......	......	......	......	......	......
Total	1,174,974	1,136,674	743,582	566,131	467,560	629,473	1,174,974	1,136,674	743,582	566,131	467,560	629,382	......	......	......	......	......	......

ST. JOSEPH, MO.

January...	159,772	254,799	242,425	235,837	368,416	273,576	137,292	234,153	235,004	218,034	323,839	241,716	716	1,251	2,558	3,194	2,133	4,518
February	184,774	209,632	230,430	234,260	219,605	129,512	170,785	199,902	192,593	205,561	197,871	107,950	179	441	1,643	1,550	5,330	1,766
March.....	151,19	156,972	160,056	204,414	150,981	193,723	123,030	150,524	157,270	167,490	129,019	162,180	359	752	1,433	4,693	343	3,075
April......	109,072	120,592	153,211	170,116	152,996	163,884	89,263	119,550	147,552	146,036	140,451	106,405	693	816	847	4,424	3,853	1,710
May.......	130,412	177,163	177,301	155,732	170,417	224,369	116,853	175,413	175,140	143,099	153,203	177,037	1,595	1,150	538	505	1,674	864
June......	143,152	184,929	162,547	139,602	193,017	182,748	128,204	181,434	157,927	129,325	181,227	152,843	1,032	532	523	396	1,423	1,967
July.......	109,895	137,223	171,995	166,507	152,626	136,044	100,041	126,693	168,994	141,080	133,633	113,439	522	185	712	800	1,501	1,065
August....	101,706	147,705	130,404	155,306	96,392	115,620	91,630	137,045	121,747	123,333	87,094	104,111	779	842	1,575	1,240	545	591
September	88,404	92,364	93,218	130,192	88,724	88,963	81,593	83,532	82,705	109,952	80,526	80,273	43	1,709	2,409	1,717	2,339	2,060
October...	91,509	161,96	117,550	187,145	111,225	90,019	81,878	158,492	107,426	172,276	106,323	75,412	549	86	1,992	5,02	2,266	3,987
November	160,141	260,909	151,966	256,593	143,911	143,603	147,539	254,863	134,532	215,464	135,523	127,193	743	1,025	10,269	5,764	4,059	804
December.	267,812	294,494	165,071	315,259	267,512	161,634	255,400	279,993	152,511	287,516	239,899	135,493	1,321	1,629	8,217	4,418	1,940	916
Total.	1,697,842	2,198,75[illegible]	1,920,177	2,351,013	2,126,322	1,913,755	1,523,563	2,106,609	1,833,371	2,064,221	1,918,730	1,584,112	8,536	11,243	32,716	33,722	27,414	23,323

INDIANAPOLIS, IND.

January...	231,193	230,869	259,429	303,411	366,606	336,185	172,984	194,610	170,703	120,033	193,416	181,707	......	......	......	1,149	1,348	1,635
February	179,317	174,354	157,263	339,543	194,316	173,076	105,204	109,362	96,836	126,325	120,802	110,167	......	......	......	1,590	1,442	1,101
March.....	169,485	126,717	126,333	226,240	171,767	159,130	87,540	71,625	84,363	93,194	87,466	104,494	......	......	......	6,814	2,333	890
April......	152,427	116,187	144,735	181,50[illegible]	204,704	136,975	82,672	76,004	98,964	105,031	127,196	73,992	......	......	......	4,88[illegible]	4,035	2,384
May.......	163,70	168,453	218,930	175,854	250,503	253,854	109,059	101,947	131,269	91,552	153,263	140,292	......	......	......	3,677	7,60	2,954
June......	232,66[illegible]	187,16	227,016	217,437	232,361	253,556	153,466	96,523	109,66[illegible]	95,150	143,872	133,800	......	......	3,404	7,385	7,037	3,376
July.......	172,03	185,720	2 8,60[illegible]	213,4 2	2 4,792	223,659	10 ,963	83,603	109,436	115,847	114,604	89,325	......	......	1,515	2,334	2,365	469
August....	155,424	204,500	161,555	156,307	180,623	227,113	89,933	97,002	77,873	75,992	92,097	84,404	......	......	1,922	1,933	1,998	560
September	131,720	166,459	127,833	135,164	182,244	206,6[illegible]2	69,357	103,751	53,902	77,261	97,097	79,223	......	......	1,067	3,360	2,593	1,007
October...	138,733	235,549	157,0 5	2 7,553	218,364	219,744	123,426	146,292	104,955	130,305	67,640	8 ,435	......	......	2,973	5,395	5,862	556
November	290,124	353,033	249,022	254,055	231,746	316,550	192,476	210,405	146,346	174,040	72,716	124,204	......	......	13,636	2,405	1,502	529
December.	318,441	376,549	312,924	329,436	338,057	385,440	217,576	220,032	141,855	184,514	159,150	155,934	......	......	6,709	469	2,791	1,167
Total.	2,435,319	2,575,611	2,350,730	2,749,976	2,936,493	2,896,894	1,495,711	1,511,221	1,326,216	1,394,252	1,434,319	1,359,477	......	......	34,903	45,369	41,361	16,628

TABLE 39.—*Hogs: Monthly and yearly receipts, slaughter and stocker and feeder shipments at public stockyards, 1915 to 1920 (number of animals)*—Contd.

BUFFALO, N. Y.[1]

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
January	215,035	236,470	133,789	120,430	131,953	150,576		119,308	55,762	45,971	76,663	74,177						
February	119,731	136,375	93,920	106,906	118,614	119,666		57,417	33,438	50,457	69,516	45,525					19	
March	94,909	107,597	85,839	114,090	104,604	145,320		41,401	37,222	49,504	56,467	67,955				287	6	
April	112,697	112,152	80,504	115,262	98,650	98,763		53,053	41,181	40,306	57,157	42,456				116	6	
May	135,441	125,877	91,351	81,960	115,045	107,066		39,889	47,306	34,203	56,352	53,916			345		25	12
June	132,717	123,252	85,732	74,560	107,033	107,385		67,917	35,536	34,311	61,410	42,054			1,629	55	6	
July	115,926	100,865	75,366	63,833	66,257	81,392		50,443	38,263	29,800	36,057	36,713			288	28		
August	120,232	85,769	33,429	56,615	88,963	91,613		40,951	16,838	22,753	47,381	43,447				35	14	
September	102,935	93,536	56,238	90,505	100,677	110,635		42,180	20,376	48,888	44,314	46,957				54	19	
October	172,615	178,791	93,591	122,439	144,938	133,044		85,026	40,322	60,835	71,828	46,885				5		
November	249,896	202,199	136,951	167,159	134,429	163,394		98,854	69,726	92,266	70,895	58,390				6		
December	233,600	189,650	132,290	186,924	140,772	177,127		87,416	52,177	107,734	81,977	72,389				18		
Total	1,805,744	1,692,533	1,114,050	1,300,733	1,351,940	1,493,931		783,885	488,202	617,038	730,017	630,861			2,262	604	95	12

PITTSBURGH, PA.

Month.	Receipts 1915	1916	1917	1918	1919	1920	Local slaughter 1915	1916	1917	1918	1919	1920	Stocker and feeder 1915	1916	1917	1918	1919	1920
January	121,960	119,536	245,567	216,065	165,922	255,417	15,440	9,920	38,718	12,846	32,438	44,126						
February	76,960	55,210	206,306	218,722	158,235	171,271	9,680	13,000	27,911	28,233	29,927	28,253						
March	83,320	41,029	157,930	171,003	152,972	165,827	16,320	13,209	21,133	30,088	26,901	32,472						
April	79,840	47,325	122,507	125,817	134,726	132,771	22,080	13,525	21,527	26,013	23,114	29,720						
May	67,040	63,588	132,643	130,576	135,472	233,102	9,440	23,608	25,046	20,595	22,004	32,959						
June	62,480	71,310	123,039	115,109	123,633	236,229	8,000	12,750	21,784	20,935	19,973	30,195						
July	71,520	62,718	111,796	106,046	105,548	174,154	16,080	5,578	18,354	19,359	15,157	26,118						
August	57,280	47,808	74,921	88,162	81,231	153,920	6,160	8,268	14,289	17,502	19,179	27,509						
September	65,840	53,397	83,290	119,831	129,093	177,479	7,840	13,157	15,544	17,173	25,265	26,234						
October	93,800	98,498	110,055	132,048	165,087	206,957	8,880	23,278	17,408	21,736	25,860	35,333						
November	140,480	109,500	171,520	182,218	203,453	260,193	20,800	11,300	25,135	31,812	8,209	44,388						
December	157,280	99,750	201,311	202,483	223,349	266,747	15,680	7,080	39,680	32,495	30,875	55,554						
Total	1,090,800	877,749	1,745,868	1,808,030	1,778,726	2,439,067	156,400	154,673	289,529	278,787	278,902	412,911						

DENVER, COLO.

January...	32,171	48,096	57,017	45,122	64,513	44,762	31,471	49,152	56,731	42,016	60,707	39,812	......	359	2,196	1,962	2,892	5,258
February.	37,953	56,081	44,234	41,847	40,905	35,285	37,793	55,240	42,258	40,348	37,681	29,665	......	213	1,827	1,672	2,245	3,944
March.....	33,834	57,378	39,152	43,710	34,369	48,238	33,683	54,295	36,110	40,989	33,834	44,950	......		2,453	3,668	2,116	3,338
April......	21,293	33,959	33,772	40,237	39,457	32,774	21,212	33,559	30,993	38,094	35,717	30,685	......	......	1,176	1,377	2,861	2,968
May.......	28,335	45,163	33,661	34,901	40,920	37,624	25,087	43,853	31,486	34,065	37,470	33,429	......	75	1,604	1,391	3,129	2,949
June......	29,356	35,565	27.052	27,412	30,509	31,182	30,248	35,792	26,763	26,587	29,722	31,116	......	132	1,011	625	2,112	907
July.......	20,640	25,223	19,776	21,402	24,816	18,886	19,442	24,194	17,774	20,366	22,695	17,237	......	472	1,323	1,198	1,828	1,813
August....	15,026	24,696	12,900	17,905	16,094	15,967	14,157	22,897	11,774	17,581	15,739	14,074	......	789	969	473	1,248	1,898
September	20,782	24,484	10,354	17,158	13,477	13,583	19,698	23,793	9,398	16,222	12,249	12,086	......	251	1,146	624	1,161	1,361
October...	33,009	32,175	18,369	24,291	15,213	15,619	29,845	28,094	14,576	22,112	12,281	13,823	......	2,722	1,862	1,794	2,938	1,357
November	32,640	40,157	26,407	31,606	18,171	25,776	31,421	35,768	22,870	30,988	14,780	23,320	......	2,457	3,161	1,385	3,554	2,491
December.	38,614	43,676	29,209	37,952	29,130	21,544	36,785	37,602	25,761	36,848	22,702	19,792	......	1,774	3,343	1,191	5,530	2,181
Total..	343,653	466,653	351,903	383,543	367,634	341,240	330,842	444,239	326,494	366,216	335,577	309,989	......	9,244	22,074	17,360	31,524	30,465

CINCINNATI, OHIO.

January...	119,822	131,499	117,684	106,441	211,128	168,618	71,391	80,540	68,102	60,170	88,064	91,469	......	......	......	......	......	......
February.	73,527	89,095	100,069	104,699	140,105	114,219	53,117	55,447	63,410	51,497	63,170	64,411	......	......	......	......	105	83
March.....	102,048	82,631	94,621	123,972	141,658	132,283	60,875	57,385	63,535	74,704	64,797	73,531	......	......	......	289	......	229
April......	87,408	93,760	94,862	110,303	138,983	113,765	57,251	62,265	60,463	54,577	61,893	63,802	......	......	......	615	......	234
May.......	88,014	108,741	117,803	113,346	158,765	144,709	47,743	58,620	70,285	60,689	69,035	75,395	......	......	......	498	114	557
June......	92,431	92,913	106,675	116,975	128,082	118,891	45,558	21,357	58,351	57,286	79,630	66,801	......	......	......	73	41	80
July.......	80,991	65,060	70,244	116,805	90,328	86,230	43,093	4,291	37,900	51,536	57,641	45,835	......	......	......	50	427	131
August....	77,486	69,645	66,625	103,576	77,102	94,454	41,717	24,939	44,625	48,320	50,077	50,385	......	......	......	143	394	59
September	75,282	82,225	64,095	193,040	105,208	80,523	36,425	37,509	37,490	46,208	50,039	43,380	......	......	......	......	188	1,268
October...	111,131	140,250	109,099	124,3[illegible]5	153,236	109,065	46,167	58,087	56,217	60,486	75,608	49,389	......	......	......	......	145	6
November	125,808	159,389	165,495	177,003	152,275	154,443	66,397	72,368	66,102	70,448	75,339	70,867	......	......	......	......	......	119
December.	145,724	144,909	131,770	162,177	176,213	160,779	86,342	68,613	61,094	70,184	88,088	93,431	......	......	......	......	......	......
Total..	1,179,672	1,260,118	1,239,042	1,462,702	1,674,083	1,477,979	656,076	601,421	687,574	706,105	823,381	788,696	......	......	......	1,668	1,414	2,766

[1] Disposition for 1915 not obtainable.

TABLE 39.—*Hogs: Monthly and yearly receipts, slaughter and stocker and feeder shipments at public stockyards, 1915 to 1920 (number of animals)*—Contd.

OKLAHOMA, OKLA.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
January	49,794	51,658	66,959	52,027	91,335	27,902	48,612	51,443	64,034	45,318	58,191	29,692	......	......	4,183	2,763	4,366	2,323
February	49,776	64,972	62,958	37,734	67,690	21,782	49,333	63,848	58,770	32,010	54,380	16,502	......	......	4,086	4,137	4,023	3,338
March	54,912	84,736	81,255	54,352	48,652	40,406	54,464	81,808	58,809	45,148	37,019	26,522	......	2,619	11,145	6,796	1,903	5,203
April	34,212	69,570	68,260	49,198	55,596	33,016	32,134	67,564	62,075	37,520	41,736	25,933	......	......	2,555	5,593	15,028	2,580
May	38,106	90,883	63,583	41,000	46,396	54,298	38,024	87,672	63,986	39,904	36,745	47,345	......	......	2,134	3,506	5,397	1,311
June	29,066	55,523	32,868	25,272	28,923	30,664	28,965	54,598	28,147	23,239	18,929	28,779	......	565	1,720	1,177	2,526	854
July	12,188	36,999	30,034	32,607	13,730	13,323	11,728	34,344	19,561	21,666	11,418	11,298	......	2,171	3,920	4,618	1,259	633
August	12,459	47,555	28,866	45,815	14,901	13,246	11,870	43,284	17,028	31,053	11,884	10,021	......	4,033	5,792	10,980	2,590	647
September	52,082	79,271	47,359	54,706	31,213	34,890	51,762	75,415	33,815	41,226	28,273	35,767	......	3,305	6,299	16,362	1,436	1,546
October	56,249	67,263	55,586	45,627	22,890	28,836	55,478	65,528	48,293	40,833	23,754	25,004	......	1,509	10,627	6,691	822	1,192
November	46,659	58,475	53,657	53,790	18,448	25,600	45,711	56,215	40,041	47,647	14,422	22,896	......	2,178	11,728	3,780	1,190	453
December	49,939	52,693	42,896	77,938	30,292	16,899	47,777	50,283	35,140	98,366	23,354	17,055	......	1,651	5,442	2,075	2,919	472
Total	484,482	759,598	634,291	571,066	470,066	340,862	475,858	732,002	529,699	503,960	360,105	287,814	......	18,031	69,631	68,478	43,459	20,552

CLEVELAND, OHIO.

Month.	Receipts.						Local slaughter.						Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
January	98,193	117,904	97,854	154,855	107,451	153,793	98,193	85,744	59,181	84,135	73,888	95,125	......	......	......	......	......	......
February	81,289	73,254	61,509	168,976	75,662	64,217	81,289	59,812	37,467	85,401	52,686	40,952	......	......	......	......	......	......
March	95,735	61,427	78,782	85,098	75,422	77,217	95,735	48,947	49,469	41,282	45,109	42,900	......	......	......	107	......	......
April	56,807	61,077	66,304	92,743	79,883	63,740	44,082	48,410	40,083	61,101	52,696	45,769	......	......	......	......	......	......
May	70,789	71,511	81,819	88,152	91,311	87,447	52,175	53,816	59,307	60,819	65,203	37,154	......	......	......	......	......	......
June	92,663	75,627	65,815	89,229	100,205	106,625	65,022	53,176	41,000	57,186	73,809	58,616	......	......	......	......	......	......
July	54,959	52,603	49,217	82,213	49,411	54,737	46,443	41,105	32,379	51,460	28,494	32,220	......	......	......	......	......	......
August	44,320	54,135	33,066	52,820	51,799	68,839	38,067	43,438	20,344	22,520	27,338	37,098	......	......	......	......	......	......
September	40,681	60,196	34,676	51,763	67,229	73,477	35,921	51,524	20,141	29,865	40,121	45,926	......	......	......	201	......	......
October	83,125	103,735	83,565	97,772	113,308	71,520	67,906	90,730	52,219	75,051	79,208	47,336	......	......	......	......	......	......
November	122,451	115,480	121,834	152,672	116,923	85,815	95,209	96,247	81,997	121,317	89,075	51,163	......	......	......	......	......	......
December	135,738	122,992	123,658	197,282	155,161	104,200	106,337	103,505	84,870	160,068	101,389	75,343	......	......	......	......	......	......
Total	976,761	969,941	898,129	1,313,575	1,083,765	1,011,657	826,379	776,454	578,460	850,205	729,016	609,602	......	......	......	308	......	......

TABLE 40.—*Hogs: Monthly average weight, 1910 to 1920.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
CHICAGO.												
January	210	226	212	226	216	223	195	199	216	228	239	217
February	213	230	217	230	224	224	204	204	231	232	239	223
March	218	239	218	240	233	231	214	209	238	230	244	229
April	227	241	227	242	233	233	219	213	242	230	248	232
May	239	242	232	242	236	233	220	217	238	232	245	234
June	242	236	235	244	237	231	226	225	235	233	243	235
July	246	233	239	243	244	238	231	232	243	242	252	240
August	255	239	240	233	248	246	232	233	243	251	258	243
September	259	224	235	222	242	235	223	237	247	254	258	239
October	253	212	226	209	229	204	210	212	233	237	247	225
November	232	208	222	207	218	187	195	209	226	226	234	215
December	224	213	223	213	226	190	193	211	223	224	230	215
KANSAS CITY.												
January	205	226	189	213	183	201	204	189	218	200	223	205
February	202	225	199	212	193	204	199	189	221	201	227	207
March	208	225	193	213	200	201	203	192	213	191	229	206
April	209	223	205	216	195	204	204	191	218	194	228	208
May	210	213	203	208	197	204	202	193	213	193	211	204
June	209	197	203	206	193	197	202	196	208	194	213	202
July	206	188	205	202	196	199	204	190	206	194	221	201
August	206	201	204	193	192	202	188	180	191	193	226	198
September	217	195	199	190	192	198	181	183	172	181	222	194
October	213	185	198	185	191	192	171	195	173	175	216	190
November	217	182	206	178	186	194	172	198	185	187	218	193
December	223	182	205	178	188	203	183	206	194	189	225	198
OMAHA.												
January	229	245	217	234	224	241	216	218	240	229	242	230
February	226	243	222	220	232	238	216	223	243	235	242	232
March	231	254	222	238	238	244	224	226	249	236	250	237
April	235	255	231	241	242	252	228	229	242	245	251	241
May	249	254	233	244	247	256	232	233	246	238	247	244
June	249	245	234	245	250	248	236	239	248	244	247	244
July	250	242	232	247	255	249	243	245	261	245	256	248
August	259	253	238	244	261	264	247	245	260	255	263	254
September	278	265	241	249	268	274	249	256	264	275	272	263
October	284	265	235	233	265	265	249	257	264	281	271	261
November	274	243	235	219	253	252	224	260	240	271	260	248
December	262	225	238	218	242	230	211	243	227	249	248	236
EAST ST. LOUIS.												
January	178	188	158	182	169	170	172	175	190	189	186	178
February	165	195	162	180	177	174	173	179	190	184	188	179
March	171	202	167	170	174	176	171	175	189	173	182	177
April	176	197	165	179	180	175	171	171	186	176	190	179
May	198	170	191	181	174	175	178	175	181	182	185	181
June	206	180	196	183	177	180	180	173	180	182	180	183
July	184	190	174	185	174	180	181	177	182	181	182	181
August	193	185	181	183	174	186	176	175	174	183	183	181
September	215	186	196	182	173	183	168	182	174	181	184	184
October	205	173	182	182	169	165	162	181	178	176	177	177
November	205	169	178	178	175	169	184	181	182	183	176	180
December	191	159	176	169	166	174	172	185	188	181	181	177

[1] Prior to 1920, compiled from yearbooks of the stockyard companies.

TABLE 41.—*Pork and pork products: Yearly exports and imports, United States, 1910 to 1920.*[1]

[In millions of lbs.; i. e., 000,000 omitted.]

Year.	Exports.								Imports.[2]		
	Pork.					Lard.	Neutral lard.	Total pork and pork products.	Fresh pork.	Bacon and hams.	Total pork, hams, and bacon.
	Fresh.	Canned.	Pickled.	Cured hams and shoulders.	Bacon.						
1910	1	4	42	131	128	369	10	685	....	....	....
1911	2	5	51	189	198	553	53	1,051	....	....	....
1912	3	5	54	176	192	495	58	983	....	....	....
1913	3	4	54	172	213	536	39	1,021	....	....	....
1914	1	3	37	142	184	438	22	827	19	8	27
1915	24	8	59	267	524	451	35	1,368	4	2	6
1916	55	7	55	287	593	427	27	1,451	1	....	1
1917	49	6	39	243	578	373	10	1,298	3	....	3
1918	12	5	37	537	1,105	539	6	2,251	2	2	4
1919	27	6	34	597	1,190	761	23	2,633	3	3	6
1920	38	2	39	185	637	612	23	1,536	2	1	3

[1] Compiled from Monthly Summary of Foreign Commerce.
[2] Imports of pork prior to 1914 are not available.

TABLE 42.—*Pork;*[1] *Monthly and yearly exports of pork and pork products combined, United States, 1910 to 1920.*[2]

[In millions of lbs.; i. e., 000,000 omitted.]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	75	75	93	92	102	106	133	199	93	198	137	118
February	67	79	102	107	74	119	162	123	114	236	147	121
March	61	85	105	97	70	169	120	168	308	341	185	155
April	34	87	86	83	61	114	134	138	286	348	88	133
May	42	101	93	84	66	89	118	127	281	181	134	122
June	51	97	66	76	67	122	112	103	169	400	137	127
July	60	84	72	82	53	95	77	46	253	241	94	105
August	67	82	77	83	54	90	93	71	171	180	68	94
September	57	107	73	74	59	100	106	80	115	118	103	91
October	49	80	65	77	73	113	95	54	132	118	123	89
November	50	77	66	80	74	108	111	99	123	132	133	96
December	72	97	80	86	74	143	157	90	206	145	187	122
Total	685	1,051	983	1,021	827	1,368	1,451	1,298	2,251	2,638	1,536	1,373

[1] These figures include exports of fresh, canned, and pickled pork, cured hams and shoulders, bacon, lard, and neutral lard.
[2] Compiled from Monthly Summary of Foreign Commerce.

TABLE 43.—*Pork: Monthly and yearly exports of principal pork products, United States, 1910 to 1920.*[1]

[In millions of lbs.; i. e., 000,000 omitted.]

BACON.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	16	13	18	20	21	27	50	92	54	103	78	45
February	11	11	17	20	17	37	64	52	51	115	76	43
March	11	11	17	21	14	67	42	68	156	151	75	58
April	6	16	18	17	13	42	54	57	127	142	24	47
May	6	17	16	14	12	34	58	61	142	68	50	43
June	8	19	11	14	11	43	38	51	87	172	61	47
July	11	17	16	17	11	39	30	19	120	118	32	39
August	14	19	19	20	14	38	44	28	69	84	23	34
September	13	25	15	16	17	43	49	35	42	57	41	32
October	9	16	14	18	14	53	41	29	58	56	50	33
November	9	16	14	17	19	46	49	44	73	65	58	37
December	14	18	17	19	21	55	74	42	126	59	69	47
Total	128	198	192	213	184	524	593	578	1,105	1,190	637	505

LARD.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	40	41	45	44	56	56	34	65	21	38	39	44
February	39	48	54	61	36	56	41	40	32	69	37	47
March	32	55	55	49	38	67	37	59	69	97	69	57
April	17	49	40	42	30	38	39	46	54	87	41	44
May	26	55	45	49	35	22	49	31	80	55	56	46
June	30	45	32	42	38	31	46	24	29	114	45	43
July	32	35	33	40	25	22	26	9	68	68	47	37
August	34	35	33	41	25	25	23	23	52	49	31	34
September	27	54	43	37	29	29	33	22	33	37	46	35
October	25	43	35	39	48	28	21	10	46	41	54	35
November	28	41	36	43	42	31	32	31	27	42	57	37
December	39	52	44	49	36	46	46	13	38	64	90	47
Total	369	553	495	536	438	451	427	373	549	761	612	506

CURED HAMS AND SHOULDERS.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	14	13	18	15	17	18	24	27	17	55	14	21
February	12	14	17	14	15	18	34	19	29	49	24	22
March	13	12	15	16	12	26	24	26	78	86	31	31
April	8	13	18	16	13	18	28	22	93	110	16	32
May	8	17	21	14	13	24	31	23	51	49	18	24
June	10	21	15	13	13	40	18	21	48	97	21	29
July	12	20	17	17	12	28	15	12	55	47	8	22
August	14	20	15	15	9	21	20	14	46	40	9	20
September	11	18	10	13	9	18	17	17	36	18	9	16
October	9	12	10	13	8	19	26	10	25	13	9	14
November	9	13	10	13	10	15	24	22	20	17	11	15
December	11	16	10	13	11	22	26	30	39	16	15	19
Total	131	189	176	172	142	267	287	243	537	597	185	265

PICKLED PORK.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	5	5	5	6	4	3	8	5	2	2	4	4
February	4	3	5	5	3	4	7	3	2	2	4	4
March	4	3	5	5	3	3	5	6	4	2	3	4
April	3	4	5	4	3	7	5	3	5	3	3	4
May	2	4	5	4	3	7	5	5	4	2	4	4
June	2	5	4	5	3	5	3	3	2	3	4	4
July	4	6	4	4	4	5	3	1	5	2	3	4
August	3	4	5	4	4	4	5	3	3	2	2	4
September	4	4	5	4	3	6	4	2	3	3	3	4
October	4	4	4	4	2	6	4	3	2	4	3	4
November	3	4	4	5	2	4	3	2	3	5	3	3
December	4	5	3	4	3	5	3	3	2	4	3	4
Total	42	51	54	54	37	59	55	39	37	34	39	47

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 44.—*Pork:*[1] *Yearly exports, United States, 1910 to 1920.*[2]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	Year ending June 30—					
	1910	1911	1912	1913	1914	1915
Belgium	7,777	12,915	20,017	15,560	9,454	12,351
Denmark	115	165	659	55	5	31,244
France	217	2,012	10,155	3,039	606	54,164
Germany	756	1,862	2,327	4,581	1,006	639
Italy	2,114	6,707	8,443	11,839	9,749	1,694
Netherlands	1,316	4,750	7,651	7,919	1,992	11,421
Norway	1,134	5,009	5,253	4,501	6,012	11,728
Sweden	152	2,382	2,751	1,920	3,478	19,557
United Kingdom	276,528	263,776	336,498	290,739	288,122	393,543
Canada	12,567	13,901	21,677	23,755	28,158	20,131
Panama	2,864	3,233	3,420	3,537	3,529	2,619
Mexico	1,555	1,050	1,494	1,195	556	453
Newfoundland and Labrador	4,671	5,669	6,980	6,129	8,391	5,567
Cuba	16,004	17,588	20,070	21,927	23,706	24,291
Other countries	16,412	24,460	29,882	24,198	26,367	15,245
Total	344,182	365,479	477,277	420,894	411,131	604,647

Exported to—	Year ending June 30—			Calendar years.		
	1916	1917	1918	1918	1919	1920
Belgium	63,968	65,383	68,670	73,322	123,247	42,752
Denmark	7,087	59	....	....	44,717	6,651
France	64,865	105,752	95,494	131,881	285,268	53,290
Germany	....	....	....	....	61,446	81,866
Italy	12,782	20,046	75,909	105,773	113,796	22,106
Netherlands	13,462	11,172	....	....	122,255	63,449
Norway	23,800	10,077	25	....	33,811	7,624
Sweden	15,514	1,065	....	1,682	55,397	17,483
United Kingdom	637,737	597,395	918,040	1,273,266	852,856	483,330
Canada	93,090	166,482	82,341	51,594	72,052	47,048
Panama	3,030	1,983	818	383	668	543
Mexico	1,101	1,309	683	997	1,030	1,154
Newfoundland and Labrador	8,183	7,619	3,842	7,192	5,741	5,026
Cuba	33,344	32,712	39,664	34,911	32,950	42,389
Other countries	20,133	16,080	9,186	14,572	48,542	26,045
Total	998,096	1,037,134	1,294,672	1,695,573	1,853,776	900,757

[1] Includes fresh, canned, and pickled pork, bacon, hams and shoulders.
[2] Compiled from Monthly Summary of Foreign Commerce.

TABLE 45.—*Pork, fresh, chilled, and frozen: Yearly exports, by principal countries.*

[In thousands of pounds; i. e., 000 omitted.]

Exported by—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Argentina	2	....	....	....	736	1,969	2,965	1,684	2,269	9,914
Australia	741	1,641	898	215	49	3	33	263	840	....
Belgium	3,266	3,936	2,332	1,927	....	....	....	....	....	....
Brazil	....	....	....	....	....	....	....	....	....	1,852
British South Africa	....	15	48	14	19	42	55	....	55	122
Denmark	1,337	3,461	14,316	4,342	2,682	33,443	29,919	15,983	79	....
France	6,573	1,187	1,296	1,492	1,286	105	105	720	338	995
Netherlands	52,112	64,465	55,424	79,111	109,901	97,887	34,694	6,475	....	8,593
New Zealand	1,229	1,222	128	282	165	713	688	1,655	69	....
Russia	7,067	5,988	9,091	8,276	5,869	4,453	1,011	....	....	....
Sweden	489	....	14,125	4,780	7,662	18,274	20,461	7,443	1	9,146
United States	927	2,232	2,608	3,183	1,251	24,230	55,112	49,373	11,633	26,777
Uruguay	....	....	....	....	....	....	....	26	....	....

TABLE 46.—*Pork: Yearly imports, United States.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Imported from—	Year ending June 30.					Calendar year.		
	1914	1915	1916	1917	1918	1918	1919	1920
Austria-Hungary	21	5						
Germany	222	64						
Italy	27	12						1
Netherlands	178	57	2					
Russia in Europe	21	18						
United Kingdom	224	115	61	14				96
Canada	5,917	23,416	2,595	1,819	2,059	3,526	4,936	1,723
Argentina		51	152	1			372	462
China			6		37	49	3	
Australia		41			3	2	110	3
Other countries	24	14	21	7	9	8	5	11
Total	6,634	23,793	2,837	1,841	2,108	3,585	5,426	2,296

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 47.—*Pork, fresh, chilled, and frozen: Yearly imports, by principal countries.*

[In thousands of pounds; i. e., 000 omitted.]

Imported by—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Austria-Hungary	7	3,885	6,964	2,404						
Belgium	932	459	38	27						63
Canada	251	645	496	380	64	9,063	57,533	101,223	1,564	44,937
Cuba	148	107	88	123	186	216	107	158	316	
Denmark	134	1,263	1,830	1,794	4,654	714				
France	54	15,187	10,794	3,208	2,189	91	2,184	9,848	10,222	18,889
Germany	8,211	3,129	29,123	35,875						
Netherlands	42	49	2,321	101	47	60	2	6	1	10
Sweden			1	4	2	11	43	902	12	66,154
Switzerland	3,926	14,606	22,172	12,606	7,545	55	4	1	2	67
United Kingdom	53,750	50,728	35,027	55,358	96,455	30,162	32,847	18,015	11,150	15,253
United States				259	18,952	3,498	955	2,580	1,722	2,779

TABLE 48.—*Lard: Yearly exports, United States, by countries of destination.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Belgium	11,482	24,049	19,925	18,695	7,491	38,549	88,927	110,400	116,784	155,802	55,021
France	866	24,767	22,620	10,312	17,092	28,491	43,592	50,123	35,842	96,297	48,756
Germany	104,815	170,165	150,107	174,844	66,873					39,495	127,836
Italy	2,040	6,392	2,861	7,565	4,657	4,414	2,196	5,543	1,145	2,463	23,154
Netherlands	20,342	42,202	40,402	38,314	31,068	20,576	20,937	7,304		68,597	91,298
United Kingdom	155,946	182,120	168,607	182,614	162,784	177,235	178,895	133,731	309,987	219,307	128,772
Canada	8,141	6,524	9,579	16,653	9,274	7,289	3,778	5,303	2,479	5,091	12,730
Mexico	7,495	9,848	8,815	4,729	2,988	6,465	10,364	12,304	15,452	7,134	17,302
Cuba	35,231	40,212	32,978	49,046	47,166	52,976	51,634	33,989	46,009	44,767	65,721
Other countries	22,474	46,121	39,199	33,408	85,623	115,291	26,336	14,024	21,120	121,949	41,660
Total	368,832	552,430	495,093	536,180	438,016	451,286	426,659	372,721	548,818	760,902	612,250

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 49.—*Hogs: Weekly average and top prices per 100 pounds, 1918 to 1920.*

CHICAGO.

Week ending—	Butcher hogs.		Packing hogs.		Light hogs; bacon, light mixed, and light lights.	Pigs.	Roughs.	Bulk of sales.	Top.
	Heavy.	Medium and light.	Heavy.	Medium and light.					
1918.									
June 8	$16.59	$16.88	$16.31	$16.68	$17.06	$16.70	$16.78	$16.73	$17.35
15	16.45	16.59	16.10	16.33	16.69	16.55	15.64	16.50	16.95
22	16.48	16.61	15.96	16.29	16.68	16.43	15.59	16.53	17.00
29	16.63	16.73	16.04	16.36	16.73	16.51	15.66	16.58	17.15
July 6	16.77	16.90	16.20	16.52	16.89	16.34	15.79	16.74	17.15
13	17.28	17.43	16.67	16.99	17.40	16.58	16.13	17.19	18.10
20	18.16	18.28	17.44	17.72	18.30	17.23	16.83	17.91	18.85
27	18.64	18.82	17.78	18.10	18.85	17.63	17.33	18.41	19.25
Aug. 3	19.09	19.28	18.10	18.43	19.31	18.10	17.61	18.77	19.80
10	19.39	19.72	18.33	18.65	19.68	18.20	17.83	19.05	20.05
17	19.25	19.55	18.10	18.43	19.50	18.19	17.61	18.89	20.15
24	19.39	19.68	18.18	18.50	19.57	18.18	17.63	18.96	20.10
31	19.39	19.80	18.26	18.48	19.67	18.38	17.61	18.89	20.30
Sept. 7	19.57	19.87	18.58	18.82	19.76	18.57	17.91	....	20.40
14	20.22	20.43	19.48	19.60	20.40	18.94	18.71	....	20.90
21	20.29	20.48	19.53	19.70	20.48	19.01	18.82	....	20.95
28	19.64	19.80	18.68	18.95	19.78	18.35	18.12	....	20.40
Oct. 5	19.38	19.41	18.37	18.64	19.16	17.56	17.85	....	20.00
12	18.58	18.53	17.51	17.83	18.18	16.48	17.12	....	19.25
19	18.43	18.34	16.81	17.27	18.07	15.83	16.29	....	18.75
26	17.39	17.29	15.04	15.70	16.92	14.04	14.30	....	18.00
Nov. 2	18.33	18.29	17.25	17.66	17.95	15.52	16.35	....	18.85
9	18.20	18.19	17.03	17.47	17.73	15.04	16.00	....	18.60
16	17.86	17.85	16.91	17.29	17.54	14.80	15.73	....	18.10
23	17.85	17.80	16.95	17.29	17.30	13.88	15.83	....	18.10
30	18.00	17.94	17.18	17.37	17.45	14.50	16.32	....	18.40
Dec. 7	17.71	17.66	17.06	17.26	17.32	14.77	16.42	....	17.90
14	17.72	17.64	17.06	17.33	17.30	14.85	16.33	17.53	17.90
21	17.62	17.54	16.97	17.27	17.05	14.42	16.05	17.47	17.70
28	17.73	17.65	17.06	17.42	17.20	14.35	16.11	17.57	17.90
1919.									
Jan. 4	17.88	17.78	17.17	17.54	17.38	15.33	16.29	17.68	18.00
11	17.79	17.72	17.15	17.48	17.41	16.40	16.33	17.63	18.00
18	17.74	17.65	16.97	17.28	17.23	14.56	16.25	17.58	18.00
25	17.78	17.67	16.81	17.16	17.20	13.77	16.24	17.57	18.00
Feb. 1	17.70	17.58	16.76	17.11	17.02	13.79	16.13	17.51	17.85
8	17.89	17.74	16.87	17.31	17.31	15.17	16.29	17.63	18.00
15	18.00	17.91	17.06	17.55	17.66	16.35	16.52	17.84	18.15
22	17.82	17.69	17.04	17.39	17.35	15.62	16.44	17.63	18.00
Mar. 1	17.69	17.55	16.95	17.30	17.15	15.19	16.39	17.52	17.85
8	18.40	18.30	17.52	17.97	18.01	16.17	16.99	18.24	18.95

Week ending—	Butcher, bacon, and shipper hogs.				Packing sows.		Pigs (130 lbs. down), medium to choice.	Stock pigs (130 lbs. down), common to choice.	Bulk of sales.	Top.
	Heavy weight (250 lbs. up), medium to choice.	Medium weight (200 to 250 lbs.), medium to choice.	Light weight (150 to 200 lbs.), common to choice.	Light lights (130 to 150 lbs.), common to choice.	Smooth (250 lbs. up).	Rough (200 lbs. up).				
1919.										
Mar. 15	$19.45	$19.35	$19.04	$18.86	$18.46	$17.63	$17.44	....	$19.26	$19.95
22	19.69	19.57	19.24	18.11	18.73	17.75	17.10	....	19.53	19.90
29	19.59	19.45	19.19	18.21	18.64	17.74	17.08	....	19.42	19.75
Apr. 5	20.08	19.97	19.78	18.97	19.28	18.31	17.79	....	19.98	20.75
12	20.43	20.37	20.12	19.40	19.54	18.79	18.19	....	20.29	20.65
19	20.58	20.49	20.19	19.49	19.75	18.94	18.12	....	20.47	20.90
26	20.95	20.81	20.55	19.68	20.09	19.25	18.02	$18.25	20.84	21.10
May 3	20.57	20.41	20.16	19.34	19.85	19.08	17.92	....	20.43	20.90
10	20.98	20.85	20.65	19.70	20.23	19.53	18.69	....	20.86	21.55
17	20.83	20.72	20.55	19.85	20.06	19.48	18.86	....	20.73	21.10
24	20.85	20.77	20.63	19.99	20.30	19.81	19.13	....	20.78	21.30
31	20.33	20.28	20.11	19.51	19.64	19.25	18.50	....	20.26	20.70

TABLE 49.—*Hogs: Weekly average and top prices per 100 pounds, 1918 to 1920*—Contd.

CHICAGO—Continued.

Week ending—	Butcher, bacon, and shipper hogs.				Packing sows.		Pigs (130 lbs. down), medium to choice.	Stock pigs (130 lbs. down), common to choice.	Bulk of sales.	Top.
	Heavy weight (250 lbs. up), medium to choice.	Medium weight (200 to 250 lbs.), medium to choice.	Light weight (150 to 200 lbs.), common to choice.	Light lights (130 to 150 lbs.), common to choice.	Smooth (250 lbs. up).	Rough (200 lbs. up).				
1919.										
June 7	$20.19	$20.15	$19.99	$19.24	$19.75	$19.35	$18.15	....	$20.15	$20.65
14	20.49	20.46	20.34	19.33	19.99	19.56	17.85	....	20.46	21.25
21	20.60	20.61	20.53	19.42	20.00	19.48	17.88	....	20.58	21.60
28	20.88	20.74	20.85	19.71	20.11	19.41	17.85	....	20.81	21.60
July 5	21.46	21.42	21.48	20.32	20.76	19.86	18.75	....	21.38	22.25
12	22.23	22.20	22.25	21.26	21.39	20.74	19.33	....	22.03	23.00
19	21.84	21.83	21.83	21.22	20.83	19.95	20.00	....	22.13	22.95
26	22.42	22.49	22.38	21.76	21.50	20.61	20.56	....	22.25	23.50
Aug. 2	22.07	22.24	22.16	21.63	20.97	19.96	20.29	....	22.13	23.60
9	21.38	21.51	21.41	20.33	19.83	18.73	18.52	....	....	22.85
16	21.28	21.43	21.36	19.99	19.74	18.77	17.73	....	....	23.50
23	19.97	20.18	20.20	19.55	18.31	17.33	17.81	....	....	21.85
30	18.89	19.31	19.67	19.16	17.27	16.44	17.85	....	....	21.65
Sept. 6	18.61	19.15	19.65	19.06	16.83	15.98	17.67	....	....	20.85
13	17.43	17.98	18.22	17.73	15.77	14.94	17.13	....	....	20.35
20	17.05	17.43	17.55	16.69	15.79	15.02	16.00	....	....	18.50
27	17.11	17.30	17.42	16.64	16.06	15.40	15.67	....	....	18.40
Oct. 4	15.93	16.24	16.37	15.97	14.72	14.15	15.44	....	15.71	17.75
11	15.25	15.51	15.58	15.04	14.11	13.54	14.67	$15.25	15.01	17.20
18	14.71	14.81	14.62	14.14	13.96	13.35	13.75	....	14.45	15.60
25	13.21	13.22	13.10	12.71	12.51	12.06	12.33	....	12.96	14.70
Nov. 1	13.77	13.80	13.80	13.50	13.22	12.84	13.13	....	13.68	14.60
8	14.85	14.93	14.86	14.50	14.38	14.00	14.24	....	14.84	15.45
15	14.58	14.62	14.59	14.46	14.14	13.79	14.47	....	14.57	15.50
22	14.15	14.21	14.15	13.93	13.57	13.03	13.79	....	14.15	14.85
29	13.39	13.48	13.38	13.05	12.76	12.28	12.68	....	13.41	14.50
Dec. 6	13.94	13.99	13.91	13.55	13.37	12.75	13.09	....	13.93	14.60
13	12.90	12.97	12.88	12.63	12.38	11.88	12.17	....	12.90	13.50
20	13.91	13.93	13.88	13.58	13.35	12.82	13.08	....	13.91	14.45
27	13.61	13.67	13.57	13.31	13.12	12.53	12.84	....	13.60	14.00
1920.										
Jan. 3	14.38	14.44	14.36	14.11	13.93	13.35	13.63	....	14.37	14.95
10	14.66	14.73	14.71	14.43	14.19	13.73	13.94	....	14.68	15.25
17	14.84	14.91	14.97	14.64	14.24	13.75	13.96	....	14.89	15.50
24	15.18	15.33	15.38	15.00	14.57	14.07	14.20	....	15.31	15.75
31	15.21	15.38	15.48	15.15	14.51	14.13	14.29	....	15.38	16.00
Feb. 7	14.47	14.71	14.77	14.53	13.77	13.38	13.85	....	14.69	15.65
14	14.55	14.88	15.07	14.83	13.76	13.20	14.04	....	14.83	15.65
21	14.05	14.39	14.69	14.41	13.06	12.43	13.86	....	14.33	15.50
28	14.08	14.53	14.75	14.58	12.91	12.36	13.93	....	14.39	15.35
Mar. 6	14.50	14.99	15.20	14.83	13.31	12.61	13.96	....	14.87	15.60
13	14.53	15.18	15.48	14.93	13.25	12.53	13.97	....	15.01	16.00
20	14.65	15.43	15.78	15.18	13.17	12.50	14.09	....	15.13	16.30
27	14.50	15.27	15.58	15.20	13.39	12.78	14.41	....	14.99	16.35
Apr. 3	15.00	15.61	15.84	15.52	13.65	13.07	14.54	....	15.31	16.30
10	15.00	15.66	15.83	15.22	13.33	12.85	14.02	....	15.43	16.75
17	14.98	15.45	15.56	15.10	13.33	12.74	14.02	....	15.26	16.30
24	14.66	15.48	15.85	15.49	13.16	12.53	14.80	....	15.11	16.75
May 1	14.03	14.91	15.25	14.98	12.68	12.12	14.21	....	14.55	15.70
8	13.96	14.85	15.18	14.98	12.63	12.21	14.22	....	14.48	15.60
15	14.15	14.76	14.96	14.73	12.84	12.45	13.88	....	14.48	15.60
22	13.82	14.33	14.47	14.02	12.60	12.06	12.75	....	14.08	14.85
29	14.28	14.70	14.73	14.19	13.09	12.48	12.69	....	14.47	15.15
June 5	13.95	14.41	14.37	13.81	12.80	12.10	12.17	....	14.16	14.90
12	14.29	14.68	14.63	13.72	13.12	12.34	11.96	....	14.38	15.35
19	14.88	15.30	15.25	14.52	13.78	13.05	13.00	....	14.92	15.85
26	15.16	15.68	15.58	14.90	14.02	13.28	13.42	....	15.15	16.20
July 3	15.09	15.78	15.65	15.02	13.81	13.05	13.60	....	15.25	16.75
10	15.01	15.78	15.64	14.91	13.78	13.02	13.40	....	14.89	16.40
17	15.00	15.63	15.49	14.85	13.98	13.28	13.69	....	14.81	16.35
24	15.36	16.01	15.80	15.16	14.29	13.55	14.20	....	15.29	16.65
31	14.74	15.33	15.48	15.11	13.76	13.20	14.52	....	14.74	16.25
Aug. 7	14.96	15.54	15.75	15.52	13.83	13.40	14.92	....	14.92	16.40
14	15.02	15.40	15.54	15.35	14.14	13.76	14.76	....	14.94	16.35
21	15.09	15.42	15.49	15.06	14.33	13.99	14.22	....	15.00	16.10
28	14.75	15.11	15.22	14.81	13.92	13.59	13.76	....	14.64	15.85

TABLE 49.—*Hogs: Weekly average and top prices per 100 pounds, 1918 to 1920*—Contd.

CHICAGO—Continued.

Week ending—	Butcher, bacon, and shipper hogs. Heavy weight (250 lbs. up), medium to choice.	Butcher, bacon, and shipper hogs. Medium weight (200 to 250 lbs.), medium to choice.	Butcher, bacon, and shipper hogs. Light weight (150 to 200 lbs.), common to choice.	Butcher, bacon, and shipper hogs. Light lights (130 to 150 lbs.), common to choice.	Packing sows. Smooth (250 lbs. up).	Packing sows. Rough (200 lbs. up).	Pigs (130 lbs. down), medium to choice.	Stock pigs (130 lbs. down), common to choice.	Bulk of sales.	Top.
1920.										
Sept. 4	$15.13	$15.59	$15.72	$15.35	$14.26	$13.94	$14.49	....	$15.06	$16.25
11	15.56	16.04	16.14	15.73	14.55	14.19	14.85	....	15.45	16.85
18	16.70	17.12	17.18	16.78	15.83	15.41	16.00	....	16.50	18.00
25	16.83	17.25	17.30	17.00	16.00	15.58	16.40	....	16.72	18.25
Oct. 2	15.80	16.17	16.12	15.58	14.92	14.53	14.63	....	15.69	17.85
9	15.30	15.62	15.48	14.83	14.39	13.95	14.10	....	15.09	16.25
16	15.30	15.65	15.50	15.07	14.44	14.04	14.72	....	15.08	16.10
23	13.88	14.10	13.88	13.55	13.18	12.85	13.20	....	13.72	15.75
30	12.78	12.99	12.75	12.61	12.17	11.88	12.75	....	12.65	13.50
Nov. 6	13.80	13.90	13.74	13.55	13.04	12.70	13.88	....	13.64	14.50
13	13.07	13.20	13.07	12.91	12.41	12.06	12.97	....	12.95	14.20
20	12.26	12.33	12.23	12.17	11.72	11.38	12.23	....	12.18	13.25
27	10.12	10.19	10.05	10.00	9.65	9.34	10.15	....	10.13	11.40
Dec. 4	10.25	10.32	10.24	10.11	9.81	9.48	9.98	....	10.22	10.65
11	9.78	9.81	9.77	9.60	9.56	9.30	9.20	....	9.75	10.40
18	9.09	9.14	9.17	9.20	8.93	8.76	9.03	....	9.11	9.65
25	9.33	9.43	9.55	9.64	9.15	8.99	9.64	....	9.41	10.35
1921.										
Jan. 1	9.58	9.74	9.86	9.98	9.13	8.89	10.10	....	9.73	10.80

KANSAS CITY.

Week ending—	Heavy weight	Medium weight	Light weight	Light lights	Smooth	Rough	Pigs	Stock pigs	Bulk of sales.	Top.
1919.										
Mar. 22	$19.29	$19.05	$18.59	$17.77	$19.92	$17.83	$17.21	$15.58	$18.83	$19.60
29	19.55	19.21	18.74	18.27	18.73	18.25	17.88	16.37	19.05	19.75
Apr. 5	19.93	19.79	19.40	19.03	19.27	18.77	18.62	17.37	19.68	20.15
12	20.38	20.18	19.80	19.34	19.81	19.25	18.67	17.50	20.16	20.70
19	20.55	20.28	19.90	19.43	19.90	19.29	18.84	17.59	20.17	21.00
26	20.63	20.48	20.15	19.45	19.92	19.40	17.98	18.17	20.40	20.95
May 3	20.47	20.18	19.90	19.31	19.88	19.33	16.38	17.85	20.10	21.00
10	20.68	20.41	20.00	19.48	20.11	19.48	16.42	18.54	20.28	20.95
17	20.65	20.36	20.09	19.50	20.02	19.38	16.33	18.54	20.34	20.80
24	20.74	20.48	20.20	19.56	20.14	19.63	16.40	18.93	20.41	21.10
31	20.36	20.12	19.85	19.58	19.80	19.35	16.28	19.13	20.09	20.55
June 7	20.47	20.19	19.93	19.55	19.88	19.48	16.40	18.64	20.13	20.75
14	20.52	20.46	20.25	19.99	19.98	19.54	....	18.60	20.[illegible]2	21.00
21	20.40	20.28	19.88	19.63	19.84	19.40	....	19.18	20.18	21.15
28	20.89	20.85	20.71	20.39	20.31	20.02	....	19.65	20.76	21.35
July 5	21.26	21.24	21.15	20.95	20.85	20.32	....	20.19	21.20	21.75
12	22.08	22.06	21.98	21.73	21.55	21.00	....	19.78	22.00	22.35
19	22.11	22.04	21.86	21.54	21.54	21.10	....	19.73	21.91	22.45
26	22.86	22.83	22.71	22.22	22.04	21.85	....	19.88	22.76	23.15
Aug. 2	22.99	22.90	22.78	22.48	22.38	21.83	....	20.45	22.81	23.40
9	21.97	21.79	21.62	21.31	20.58	20.05	....	19.10	21.53	23.15
16	22.54	22.03	21.62	21.45	20.52	20.25	....	20.16	21.85	23.15
23	20.71	20.47	20.24	19.78	19.18	18.43	....	17.85	20.33	21.40
30	19.88	19.62	19.68	19.11	17.90	17.23	....	18.13	19.49	21.45
Sept. 6	18.79	18.96	18.86	18.30	16.60	15.76	....	16.70	19.12	20.10
13	16.97	17.30	17.12	16.80	15.53	14.98	....	15.77	17.21	19.50
20	16.76	17.05	16.87	16.42	15.23	14.53	....	14.87	16.96	17.50
27	17.16	17.36	17.21	16.82	16.27	15.48	....	15.78	17.30	17.75
Oct. 4	16.05	16.33	16.24	15.98	15.15	14.44	....	15.23	16.29	17.50
11	15.57	15.63	15.50	15.38	13.83	13.40	....	14.79	15.50	16.70
18	14.39	14.47	14.33	14.25	13.05	12.50	....	13.58	14.28	15.70
25	12.80	12.89	12.73	12.46	11.96	11.63	....	12.70	12.76	14.20
Nov. 1	13.58	13.69	13.55	13.23	12.40	11.93	....	12.85	13.57	14.25
8	14.88	14.94	14.82	14.52	14.19	13.83	....	13.65	14.92	15.60
15	14.50	14.61	14.50	14.25	13.82	13.42	....	13.44	14.57	15.50
22	14.33	14.37	14.32	14.19	13.58	13.10	....	13.49	14.35	14.90
29	13.69	13.76	13.62	13.37	12.79	12.54	....	12.47	13.68	14.55
Dec. 6	14.13	14.18	13.99	13.92	13.53	13.23	....	11.83	14.03	15.00
13	13.37	13.38	13.19	12.86	12.46	12.17	....	11.46	13.32	14.00
20	13.67	13.65	13.50	13.03	12.48	12.15	....	11.88	13.63	14.10
27	13.63	13.68	13.50	13.09	12.85	12.55	....	12.33	13.62	14.50

TABLE 49.—*Hogs: Weekly average and top prices per 100 pounds, 1918 to 1920*—Contd.

KANSAS CITY—Continued.

Week ending—	Butcher, bacon, and shipper hogs.				Packing sows.		Pigs (130 lbs. down), medium to choice.	Stock pigs (130 lbs. down), common to choice.	Bulk of sales.	Top
	Heavy weight (250 lbs. up), medium to choice.	Medium weight (200 to 250 lbs.), medium to choice.	Light weight (150 to 200 lbs.), common to choice.	Light lights (130 to 150 lbs.), common to choice.	Smooth (250 lbs. up).	Rough (200 lbs. up).				
1920.										
Jan. 3	$14.33	$14.35	$14.08	$13.74	$13.59	$13.21	....	$13.04	$14.29	$14.75
10	14.67	14.68	14.48	14.05	14.03	13.73	....	13.00	14.63	15.10
17	14.85	14.88	14.69	14.41	14.21	13.85	....	14.13	14.82	15.35
24	15.25	15.30	15.17	14.38	14.38	14.25	....	14.55	15.27	15.65
31	15.05	15.13	15.08	....	14.38	14.10	....	14.64	15.08	16.00
Feb. 7	14.45	14.54	14.44	14.15	13.34	13.30	....	13.87	14.44	15.40
14	14.39	14.61	14.55	....	13.55	13.23	....	13.43	14.54	15.00
21	13.64	13.92	13.98	....	12.77	12.50	....	12.68	13.80	14.75
28	13.59	14.01	14.12	14.15	12.63	12.25	....	12.60	13.87	14.75
Mar. 6	14.16	14.46	14.65	....	12.83	12.44	....	13.48	14.45	15.20
13	14.13	14.80	15.08	15.00	12.71	12.21	....	13.86	14.57	15.50
20	14.40	15.15	15.49	14.88	12.28	11.80	....	14.03	14.83	16.00
27	14.38	15.14	15.72	....	12.48	11.98	....	14.43	14.84	16.10
Apr. 3	14.37	15.09	15.53	....	12.28	11.78	....	14.40	14.69	16.00
10	13.96	14.49	15.02	....	12.19	11.60	....	13.55	14.45	16.00
17	13.85	14.31	14.53	....	12.27	11.71	....	13.15	14.10	15.35
24	13.81	14.44	14.68	....	12.27	11.69	....	13.80	14.17	15.50
May 1	13.90	14.27	14.54	....	12.50	11.94	....	13.35	14.15	15.00
8	13.63	14.18	14.40	....	12.31	11.83	....	12.65	14.09	14.75
15	13.94	14.31	14.47	....	12.38	11.88	....	12.29	14.23	14.90
22	13.88	14.16	14.21	13.48	12.31	11.98	....	12.28	14.05	14.60
29	14.13	14.35	14.23	....	12.67	12.25	....	11.50	14.26	14.80
June 5	13.88	14.01	13.68	....	12.33	11.88	....	11.10	13.81	14.30
12	14.31	14.32	13.95	....	12.81	12.29	....	11.50	14.19	14.80
19	14.97	15.00	14.74	....	13.29	12.92	....	12.53	14.88	15.25
26	15.23	15.24	15.03	....	13.83	13.50	....	12.46	15.20	15.85
July 3	15.47	15.50	15.20	....	14.08	13.67	....	12.48	15.36	16.15
10	15.31	15.57	15.35	....	13.63	13.19	....	12.82	15.33	16.00
17	15.25	15.41	15.25	....	13.77	13.25	....	13.48	15.24	16.00
24	15.62	15.72	15.56	....	14.08	13.52	....	13.46	15.67	16.15
31	15.12	15.31	15.36	....	13.83	13.33	....	13.58	15.18	15.90
Aug. 7	15.10	15.41	15.41	....	13.58	13.17	....	13.37	15.26	15.80
14	14.96	15.32	15.23	....	13.39	12.83	....	12.93	15.04	16.00
21	14.94	15.24	15.25	15.05	13.78	13.15	$15.00	13.10	15.09	15.65
28	14.50	14.97	15.00	....	13.43	12.90	14.88	13.35	14.83	15.35
Sept. 4	14.95	15.45	15.50	....	13.65	12.83	15.05	13.75	15.21	15.75
11	15.46	15.95	15.99	....	14.15	13.00	....	14.43	15.86	16.50
18	16.47	16.82	16.83	....	15.14	13.93	....	14.96	16.80	17.50
25	16.72	16.98	16.82	....	15.23	13.87	....	14.83	16.89	17.80
Oct. 2	16.00	16.17	15.78	....	14.41	13.32	....	13.48	16.02	17.35
9	14.88	14.96	14.45	....	13.38	12.60	....	12.80	14.53	15.60
16	14.83	14.96	14.50	14.33	13.31	12.55	....	13.00	14.70	15.40
23	13.81	13.95	12.55	13.36	12.75	11.93	....	12.61	13.67	15.00
30	12.58	12.65	12.23	12.05	11.53	10.73	....	11.71	12.46	13.25
Nov. 6	13.13	13.16	12.76	12.70	12.00	11.08	13.43	12.21	13.06	13.75
13	12.74	12.81	12.61	12.47	11.52	10.67	12.94	11.99	12.78	13.60
20	11.96	12.01	11.87	11.76	10.84	10.28	11.83	11.29	11.93	12.85
27	10.02	10.06	9.88	9.79	9.25	8.80	9.48	9.08	9.99	11.25
Dec. 4	9.71	9.80	9.54	9.44	9.07	8.54	9.36	9.15	9.77	10.10
11	9.73	9.77	9.61	9.51	9.10	8.65	9.52	9.27	9.70	10.15
18	8.85	8.89	8.75	8.53	8.23	7.80	8.65	8.25	8.77	9.65
25	9.18	9.23	9.18	9.03	8.56	8.06	8.98	8.70	9.14	9.75
1921.										
Jan. 1	9.36	9.44	9.32	9.36	8.85	8.48	9.46	9.04	9.40	10.25

TABLE 49.—*Hogs: Weekly average and top prices per 100 pounds, 1918 to 1920*—Contd.

OMAHA.

Week ending—	Butcher, bacon, and shipper hogs.				Packing sows.		Stock pigs (130 lbs. down), common to choice.	Bulk of sales.	Top.
	Heavyweight (250 lbs. up), medium to choice.	Medium weight (200 to 250 lbs.), medium to choice.	Light weight (150 to 200 lbs.), common to choice.	Light lights (130 to 150 lbs.), common to choice.	Smooth (250 lbs. up).	Rough (200 lbs. up).			
1919.									
May 3	$20.40	$20.27	$20.00	....	$20.30	$20.11	$17.98	$20.20	$20.70
10	20.52	20.36	20.08	....	20.42	20.28	18.50	20.34	20.75
17	20.52	20.36	20.18	....	20.40	20.26	18.58	20.35	20.75
24	20.61	20.54	20.38	....	20.51	20.32	18.77	20.46	20.80
31	20.02	19.96	19.84	$19.48	19.87	19.68	18.45	19.89	20.35
June 7	19.91	19.90	19.76	19.40	19.79	19.56	18.17	19.82	20.10
14	20.37	20.37	20.24	19.74	20.23	19.90	18.33	20.28	20.90
21	20.49	20.56	20.44	....	20.36	20.13	18.42	20.43	21.00
28	20.54	20.67	20.63	....	20.43	20.21	18.54	20.47	20.90
July 5	21.01	21.12	21.14	....	20.81	20.60	18.63	20.86	21.85
12	21.70	21.84	21.88	....	21.38	21.24	19.00	21.53	22.25
19	21.54	21.70	21.73	....	21.23	21.07	19.00	21.35	22.25
26	22.23	22.35	22.15	....	21.85	21.58	19.42	21.94	22.85
Aug. 2	21.84	22.05	21.92	....	21.47	21.18	19.88	21.58	22.75
9	20.56	21.05	20.85	....	20.33	20.00	19.04	20.46	22.25
16	20.71	21.11	20.91	....	20.49	20.23	19.19	20.60	22.35
23	19.63	19.90	19.80	....	19.33	19.05	18.67	19.45	20.80
30	18.37	18.63	18.36	....	17.85	17.56	17.92	18.03	20.50
Sept. 6	17.90	18.68	17.98	....	17.27	17.00	17.38	17.45	19.25
13	16.80	17.17	16.80	....	16.33	16.00	16.25	16.40	19.25
20	16.58	16.81	16.53	....	16.21	15.92	15.75	16.34	17.25
27	16.66	16.92	16.85	....	16.29	16.03	16.00	16.29	17.50
Oct. 4	15.91	16.13	16.03	....	15.54	15.17	15.19	15.52	17.00
11	15.20	15.47	15.43	....	14.74	14.30	14.73	14.78	16.55
18	14.34	14.70	14.57	....	13.90	13.53	14.85	14.02	15.50
25	12.80	13.04	12.98	....	12.49	12.08	13.40	12.58	14.10
Nov. 1	13.76	13.90	13.83	....	13.52	13.30	14.65	13.66	14.30
8	14.73	14.86	14.75	....	14.50	14.31	14.35	14.60	15.35
15	14.81	14.92	14.75	....	14.59	14.41	14.50	14.68	15.35
22	14.31	14.37	14.25	....	14.13	13.95	14.08	14.20	14.75
29	13.33	13.49	13.31	....	13.01	12.76	12.80	13.27	14.30
Dec. 6	13.75	14.03	13.74	....	13.36	13.06	12.25	13.68	14.75
13	13.17	13.32	13.16	....	12.93	12.68	11.71	13.16	13.60
20	13.39	13.53	13.35	13.01	13.18	13.00	11.46	13.38	13.80
27	13.35	13.45	13.28	12.95	13.13	12.91	11.78	13.29	13.80
1920.									
Jan. 3	13.93	13.99	13.90	13.68	13.76	13.60	11.90	13.86	14.40
10	14.53	14.60	14.42	14.25	14.37	14.20	11.81	14.45	14.80
17	14.56	14.59	14.48	14.28	14.37	14.23	12.23	14.48	15.00
24	14.98	15.03	14.93	14.71	14.83	14.68	12.88	14.92	15.30
31	15.00	15.03	14.87	14.64	14.79	14.62	13.25	14.88	15.45
Feb. 7	14.37	14.45	14.22	14.03	14.03	13.67	13.63	14.19	15.15
14	14.39	14.50	14.44	14.26	14.21	13.99	13.48	14.37	14.90
21	13.64	13.83	13.77	13.70	13.39	12.85	13.28	13.69	14.25
28	13.55	13.77	13.76	13.60	13.22	12.67	12.46	13.62	14.25
Mar. 6	14.00	14.32	14.22	13.77	13.68	13.25	12.19	14.09	14.90
13	14.04	14.60	14.65	14.35	13.63	13.22	12.71	14.38	15.25
20	13.38	14.70	14.97	14.56	12.63	11.73	12.44	14.15	15.55
27	13.71	14.83	15.00	14.50	12.81	12.15	12.83	14.24	15.35
Apr. 3	13.94	14.81	15.03	14.56	12.83	12.29	13.04	14.33	15.50
10	13.15	13.98	14.38	14.08	12.25	11.67	13.15	13.50	15.50
17	13.94	14.64	14.74	14.45	13.25	12.83	13.65	14.26	15.15
24	14.08	14.74	14.79	14.52	13.38	13.02	13.75	14.15	15.30
May 1	14.02	14.55	14.70	14.42	13.38	13.13	13.25	14.10	15.25
8	13.81	14.40	14.57	14.25	13.15	12.81	13.08	13.98	14.85
15	13.57	14.03	14.22	14.04	12.88	12.35	12.75	13.70	14.80
22	13.63	13.91	14.06	13.65	13.21	12.83	12.63	13.71	14.50
29	13.65	13.91	14.06	13.40	13.19	12.85	12.25	13.75	14.50
June 5	13.28	13.53	13.58	13.03	12.88	12.54	11.21	13.28	14.00
12	13.78	13.99	14.04	13.38	13.21	12.75	11.00	13.73	15.00
19	14.39	14.67	14.78	....	13.85	13.37	11.00	14.37	15.25
26	14.42	14.95	15.15	....	13.82	13.44	11.96	14.46	15.75
July 3	14.43	14.94	15.03	....	13.85	13.56	12.16	14.48	16.00
10	14.58	15.09	15.08	....	14.04	13.65	11.75	14.36	15.90
17	14.45	14.94	14.79	....	13.98	13.61	12.13	14.21	15.50
24	14.69	15.24	15.13	....	14.19	13.88	12.63	14.53	15.90
31	14.30	14.86	14.73	....	13.79	13.55	12.76	14.11	15.75
Aug. 7	14.33	14.93	14.86	....	13.69	13.39	12.81	14.13	15.80
14	14.41	14.84	14.87	....	13.96	13.68	12.81	14.33	15.50
21	14.40	14.77	14.85	....	13.97	13.73	12.90	14.30	15.50
28	14.35	14.55	14.61	....	13.89	13.64	12.83	14.09	15.00

TABLE 49.—*Hogs: Weekly average and top prices per 100 pounds, 1918 to 1920*—Contd.

OMAHA—Continued.

Week ending—	Butcher, bacon, and shipper hogs. Heavyweight (250 lbs. up), medium to choice.	Medium weight (200 to 250 lbs.), medium to choice.	Light weight (150 to 200 lbs.), common to choice.	Light lights (130 to 150 lbs.), common to choice.	Packing sows. Smooth (250 lbs. up).	Rough (200 lbs. up).	Stock pigs (130 lbs. down), common to choice.	Bulk of sales.	Top.
1920.									
Sept. 4	$14.53	$14.93	$14.97	....	$14.25	$14.02	$13.25	$14.47	$15.35
11	14.92	15.38	15.43	....	14.58	14.37	13.44	14.91	16.25
18	16.15	16.56	16.68	....	15.57	15.30	13.92	16.02	17.35
25	16.36	16.78	16.87	....	15.99	15.78	14.42	16.37	17.60
Oct. 2	15.35	15.72	15.81	....	14.91	14.64	13.86	15.26	17.00
9	14.72	15.03	15.15	....	14.38	14.19	13.71	14.69	15.75
16	14.23	14.48	14.54	....	13.85	13.63	13.33	14.10	15.10
23	13.26	13.49	13.51	....	12.87	12.65	12.56	13.10	14.40
30	12.55	12.76	12.77	....	12.17	12.00	12.00	12.45	13.25
Nov. 6	13.11	13.24	13.21	....	12.92	12.69	12.65	13.03	13.60
13	12.66	12.80	12.73	....	12.45	12.18	12.15	12.56	13.40
20	11.88	12.11	11.98	....	11.61	11.31	11.19	11.83	12.80
27	9.85	10.02	9.89	....	9.56	9.35	9.30	9.80	11.15
Dec. 4	9.77	9.94	9.74	....	9.43	9.10	8.69	9.71	10.25
11	9.57	9.73	9.54	....	9.27	9.00	8.56	9.55	10.10
18	8.69	8.83	8.70	....	8.35	8.00	8.23	8.64	9.60
25	9.35	9.48	9.35	....	9.02	8.77	8.70	9.30	10.25
1921.									
Jan. 1	9.22	9.33	9.19	....	8.90	8.66	8.29	9.16	10.15

EAST ST. LOUIS.

Week ending—	Butcher, bacon, and shipper hogs. Heavy weight (250 lbs. up), medium to choice.	Medium weight (200 to 250 lbs.), medium to choice.	Light weight (150 to 200 lbs.), common to choice.	Light lights (130 to 150 lbs.), common to choice.	Packing sows. Smooth (250 lbs. up).	Rough (200 lbs. up).	Pigs (130 lbs. down), medium to choice.	Stock pigs (130 lbs. down), common to choice.	Bulk of sales.	Top.
1919.										
May 3	$20.42	$20.23	$19.54	$18.88	$18.63	$17.38	$16.38	$16.63	$20.24	$26.65
10	20.71	20.48	20.12	19.58	19.15	17.73	16.92	16.90	20.51	21.10
17	20.71	20.54	20.22	19.65	19.06	18.02	16.98	16.92	20.47	21.10
24	20.70	20.59	20.15	19.52	19.04	17.79	15.93	16.50	20.45	21.20
31	20.36	20.25	19.78	19.15	18.83	17.40	15.55	16.33	20.21	21.00
June 7	20.25	20.12	19.65	18.97	18.75	17.40	15.41	16.25	20.09	20.75
14	20.65	20.46	20.02	19.33	18.96	17.54	14.90	15.21	20.38	21.40
21	20.68	20.55	19.99	19.47	19.08	17.65	14.94	14.96	20.55	21.50
28	21.26	21.38	20.66	19.77	19.29	17.90	15.40	....	21.25	21.95
July 5	21.52	21.66	21.07	19.94	19.38	18.09	15.50	17.00	21.53	22.35
12	22.28	22.31	21.84	21.04	20.00	18.52	16.71	17.17	22.26	22.75
19	22.42	22.35	22.17	20.95	19.95	18.45	17.15	17.40	22.22	22.75
26	22.99	22.93	22.84	21.87	20.54	19.04	17.92	17.92	22.84	23.50
Aug. 2	23.01	23.01	22.89	21.71	20.58	19.08	17.44	18.00	22.97	23.55
9	22.55	22.41	22.15	20.69	19.75	18.50	16.25	17.33	22.38	23.00
16	22.35	22.52	22.11	20.85	19.17	17.92	16.46	17.80	22.43	23.50
23	21.19	21.40	21.18	20.46	18.08	16.83	17.19	17.05	21.32	22.35
30	20.35	20.46	20.29	19.54	16.92	15.46	17.13	16.88	20.48	21.85
Sept. 6	19.29	19.65	19.28	18.60	16.04	14.02	16.60	16.58	19.65	20.50
13	17.42	17.83	17.68	17.06	14.68	12.67	15.46	15.17	17.76	19.90
20	17.47	17.88	17.50	16.31	14.42	12.79	14.35	14.42	17.77	18.30
27	17.37	17.55	17.23	16.38	14.52	13.00	14.90	14.85	17.53	18.45
Oct. 4	16.22	16.64	16.25	15.71	14.10	12.71	14.90	14.67	16.72	17.70
11	15.31	15.76	15.54	14.81	13.60	12.35	14.06	13.58	15.68	17.00
18	14.67	14.90	14.75	14.17	13.10	11.67	13.54	13.33	14.87	15.70
25	13.05	13.11	12.94	12.27	11.67	10.63	11.65	11.81	13.12	14.15
Nov. 1	13.97	14.14	13.89	13.22	12.33	11.50	12.75	13.06	14.10	14.75
8	15.08	15.10	14.99	14.73	12.85	12.08	14.31	14.41	15.10	15.60
15	14.89	14.83	14.67	14.44	13.14	12.33	14.17	14.30	14.84	15.60

TABLE 49.—*Hogs: Weekly average and top prices per 100 pounds, 1918 to 1920*—Contd.

EAST ST. LOUIS—Continued.

Week ending—	Butcher, bacon, and shipper hogs. Heavy weight (250 lbs. up), medium to choice.	Medium weight (200 to 250 lbs.), medium to choice.	Light weight (150 to 200 lbs.), common to choice.	Light lights (130 to 150 lbs.), common to choice.	Packing sows. Smooth (250 lbs. up).	Rough (200 lbs. up).	Pigs (130 lbs. down), medium to choice.	Stock pigs (130 lbs. down), common to choice.	Bulk of sales.	Top.
1919.										
Nov. 22	$14.41	$14.46	$14.34	$14.02	$13.08	$12.52	$13.97	$13.97	$14.43	$15.10
29	13.87	13.84	13.64	13.34	12.38	11.58	12.85	12.55	13.81	14.50
Dec. 6	14.13	14.12	13.84	13.11	12.52	11.75	12.16	12.38	14.09	14.75
13	13.40	13.36	13.23	12.76	12.31	11.58	12.02	12.27	13.33	14.00
20	14.02	13.98	13.88	13.56	12.70	12.06	12.88	13.05	14.02	14.45
27	13.93	13.96	13.84	13.67	12.73	12.25	13.05	13.18	13.97	14.30
1920.										
Jan. 3	14.39	14.44	14.31	14.13	13.08	12.60	13.22	13.40	14.44	14.90
10	14.78	14.83	14.75	14.48	13.42	12.90	13.11	13.13	14.83	15.35
17	15.01	15.05	14.94	14.73	13.60	13.02	12.94	13.15	15.07	15.55
24	15.34	15.42	15.36	15.11	13.97	13.27	12.98	13.31	15.41	15.80
31	15.55	15.67	15.65	15.41	14.17	13.67	13.96	13.35	15.63	16.45
Feb. 7	14.78	15.10	15.17	14.94	13.58	13.17	13.71	12.83	15.09	15.80
14	15.00	15.40	15.55	15.24	13.21	12.81	13.66	12.42	15.38	16.00
21	14.11	14.70	14.95	14.87	12.42	12.04	13.60	12.96	14.55	15.65
28	13.96	14.59	14.95	14.73	12.53	12.15	13.25	12.88	14.48	15.45
Mar. 6	14.48	15.19	15.36	15.25	12.73	12.38	13.54	13.06	15.19	16.00
13	14.70	15.41	15.68	15.46	12.77	12.48	13.68	13.22	15.52	16.00
20	14.67	15.61	15.98	15.49	12.76	12.44	13.85	13.32	15.82	16.35
27	14.48	15.55	16.13	15.76	12.81	12.44	14.03	13.48	15.91	16.60
Apr. 3	14.83	16.04	16.34	15.99	12.58	12.23	14.30	13.40	16.08	16.75
10	14.83	15.89	16.23	15.72	12.13	11.88	13.67	13.00	15.96	16.90
17	14.33	15.56	16.10	14.75	11.56	11.05	11.53	10.50	15.58	17.50
24	14.99	15.73	16.08	15.31	12.08	11.75	13.48	12.00	15.67	17.00
May 1	14.63	15.35	15.60	15.06	12.15	11.90	13.60	12.23	15.42	16.00
8	14.16	15.00	15.37	14.90	11.94	11.60	13.63	12.29	15.14	15.90
15	14.00	14.75	15.03	14.55	11.93	11.67	13.33	12.04	14.85	15.50
22	14.00	14.52	14.62	14.10	11.88	11.58	13.04	11.73	14.52	15.10
29	14.48	14.66	14.58	13.88	11.98	11.67	12.50	11.67	14.65	14.95
June 5	14.19	14.29	14.19	13.38	12.04	11.78	12.03	11.00	14.35	14.70
12	14.40	14.77	14.63	13.60	12.13	11.88	11.85	11.28	14.81	15.40
19	15.17	15.45	15.34	14.59	12.50	12.19	12.60	12.25	15.47	15.95
26	15.25	15.66	15.65	15.09	12.98	12.50	13.31	13.13	15.68	16.00
July 3	15.70	16.25	15.99	15.61	13.55	13.23	13.53	13.15	16.27	16.65
10	15.82	16.16	16.08	15.59	13.35	13.03	13.43	13.43	16.21	16.55
17	15.73	16.00	16.01	15.48	12.93	12.67	13.73	13.57	16.10	16.55
24	15.90	16.36	16.41	15.66	13.18	12.92	13.74	13.60	16.38	16.70
31	15.63	16.06	16.08	15.56	13.10	12.83	13.83	13.67	16.07	16.60
Aug. 7	15.33	15.98	16.00	15.60	13.08	12.85	13.98	13.81	16.07	16.55
14	14.82	15.70	15.75	15.55	13.00	12.73	13.99	13.77	15.75	16.50
21	14.74	15.45	15.53	15.00	13.17	12.92	13.60	13.46	15.48	16.15
28	14.80	15.48	15.59	15.15	13.19	12.92	13.67	13.29	15.50	16.75
Sept. 4	15.33	16.00	16.13	15.78	13.38	13.02	14.15	13.81	16.06	16.70
11	15.73	16.31	16.60	16.34	13.81	13.31	14.74	14.54	16.59	17.35
18	16.45	16.95	17.44	16.90	14.58	13.63	15.77	15.07	17.42	17.90
25	16.82	17.38	17.49	16.98	15.29	14.27	16.02	15.19	17.35	18.25
Oct. 2	15.92	16.32	16.29	15.72	14.65	13.83	14.96	13.96	16.29	17.90
9	15.43	15.73	15.54	14.90	14.04	13.54	14.44	13.02	15.30	16.40
16	15.34	15.74	15.62	15.10	13.98	13.65	14.85	13.44	15.49	16.15
23	13.90	14.16	13.95	13.59	12.54	12.15	13.42	12.23	14.03	15.65
30	12.96	13.26	13.02	12.86	11.90	11.63	12.63	11.79	13.10	13.70
Nov. 6	13.99	14.24	14.07	14.08	13.00	12.75	14.00	13.22	14.14	14.75
13	13.10	13.28	13.05	13.06	11.75	11.50	13.11	12.69	13.18	14.00
20	12.14	12.28	12.13	11.98	10.88	10.71	12.10	11.75	12.19	13.40
27	10.06	10.11	9.98	9.72	8.93	8.65	9.50	9.13	10.00	11.35
Dec. 4	10.30	10.43	10.30	10.21	9.10	8.83	10.23	9.66	10.43	10.80
11	9.89	9.97	9.85	9.65	8.84	8.58	9.53	9.15	9.90	10.50
18	9.13	9.23	9.18	9.28	8.23	7.98	9.32	8.92	9.22	9.95
25	9.55	9.69	9.69	9.83	8.43	8.18	9.92	9.52	9.74	10.80
1921.										
Jan. 1	9.86	10.03	10.09	10.16	8.45	8.20	10.19	9.78	10.03	11.25

TABLE 50.—*Hogs: Weekly range of prices per 100 pounds for bulk of sales, Chicago, June 8, 1918, to Jan. 1, 1921.*

Week ending.	Range of prices.	Week ending.	Range of prices.	Week ending.	Range of prices.	Week ending.	Range of prices.
1918.		1919.		1919.		1920.	
June 8	$16.40–$17.25	Mar. 29	$19.10–$19.65	Dec. 20	$13.50–$14.30	July 3	$13.90–$16.50
15	16.20–16.85	Apr. 5	19.60–20.25	27	13.25–13.90	10	13.50–16.25
22	16.20–16.95	12	20.10–20.50			17	13.40–16.20
29	16.15–17.10	19	20.15–20.75	1920.		24	14.10–16.50
July 6	16.40–17.10	26	20.55–21.05	Jan. 3	13.90–14.90	31	13.25–16.10
13	16.60–18.00	May 3	20.00–20.85	10	14.30–15.15	Aug. 7	13.50–16.25
20	17.25–18.70	10	20.25–21.35	17	14.40–15.45	14	13.70–16.25
27	17.75–19.10	17	20.40–21.05	24	15.00–15.65	21	14.00–16.00
Aug. 3	17.85–19.75	24	20.30–21.20	31	15.00–15.90	28	13.50–15.65
10	18.10–20.00	31	19.90–20.60	Feb. 7	13.90–15.50	Sept. 4	14.00–16.10
17	17.90–20.10	June 7	19.70–20.60	14	14.15–15.50	11	14.15–16.75
24	17.85–19.90	14	19.75–21.15	21	13.75–15.25	18	15.00–17.80
31	17.85–19.90	21	19.50–21.50	28	13.75–15.25	25	15.40–18.15
Dec. [1]14	17.35–17.70	28	20.00–21.50	Mar. 6	14.25–15.40	Oct. 2	14.25–17.75
21	17.25–17.60	July 5	20.60–22.00	13	14.25–15.80	9	14.00–16.10
28	17.30–17.85	12	21.10–22.90	20	14.10–16.10	16	14.00–16.00
		19	21.35–22.90	27	14.00–16.15	23	12.50–15.65
1919.		26	20.75–23.40	Apr. 3	14.50–16.00	30	12.00–13.25
Jan. 4	17.40–17.95	Aug. 2	21.25–23.00	10	14.00–16.50	Nov. 6	12.75–14.35
11	17.40–17.95	Oct. [1]4	14.00–17.50	17	14.40–16.25	13	12.25–14.00
18	17.35–17.85	11	13.75–17.00	24	13.35–16.50	20	11.35–13.10
25	17.35–17.90	18	13.50–15.50	May 1	13.65–15.60	27	9.60–11.25
Feb. 1	17.35–17.70	25	11.85–14.40	8	13.35–15.50	Dec. 4	9.90–10.50
8	17.35–17.90	Nov. 1	12.75–14.45	15	13.60–15.40	11	9.40–10.25
15	17.50–18.05	8	14.25–15.35	22	13.35–14.75	18	8.80–9.55
22	17.40–17.90	15	14.00–15.40	29	13.75–15.10	25	8.95–10.20
Mar. 1	17.35–17.75	22	13.40–14.80	June 5	13.50–14.75		
8	17.60–18.90	29	12.75–14.25	12	13.60–15.15	1921.	
15	18.70–19.80	Dec. 6	13.20–14.50	19	14.20–15.70	Jan. 1	8.85–10.65
22	19.10–19.80	13	12.00–13.40	26	14.25–16.00		

[1] No bulk of sales quotations between this and preceding date.

TABLE 51.—*Sheep: Monthly average price per 100 pounds, 1918 to 1920.*

CHICAGO.

Month.	Lambs.					Spring lambs, good and choice.	Yearlings.		
	Choice and prime.	Medium and good.	Culls.	Feeders. Good and choice.	Feeders. Common and medium.		Choice and prime.	Medium and good.	Feeders, good and choice.
1918.									
June	$17.51	$16.37	$11.99	$13.44	$10.58	$19.53	....	....	....
July	18.50	17.64	13.79	16.05	14.73	....	$16.22	$14.95	$13.01
August	18.05	16.86	12.37	17.23	16.05	....	15.51	14.54	13.22
September	17.72	16.56	11.66	16.74	15.66	....	14.01	13.44	13.13
October	16.16	14.97	10.47	14.13	12.16	....	12.67	11.84	11.56
November	15.57	14.74	10.95	14.09	12.19	....	12.18	11.25	10.20
December	15.17	14.45	10.96	13.99	12.56	....	12.62	11.44	10.27
1919.									
January	16.59	15.76	12.61	14.71	13.61	....	14.32	12.96	....
February	17.83	16.92	14.13	15.82	14.81	....	15.86	14.25	....

Month.	Wethers.			Ewes.			
	Choice and prime.	Medium and good.	Feeders, good and choice.	Choice and prime.	Medium and good.	Culls.	Breeding, good and choice.
1918.							
June	....	....	....	$13.17	$11.72	$6.86	$13.33
July	$13.85	$13.02	$11.85	13.05	11.57	7.03	15.21
August	13.76	13.06	11.31	13.10	11.98	6.89	15.49
September	12.77	12.19	11.63	11.79	10.85	5.99	15.16
October	11.35	10.73	10.44	10.37	9.52	5.40	13.39
November	10.46	9.91	9.16	9.36	8.66	4.91	....
December	10.69	10.11	9.19	9.43	8.62	5.32	....
1919.							
January	11.65	10.94	....	10.63	9.79	6.31	....
February	12.68	12.04	....	11.75	10.72	6.90	....

TABLE 51.—*Sheep: Monthly average price per 100 pounds, 1918 to 1920*—Continued.

CHICAGO—Continued.

Month.	Lambs.			Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes.		Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.	Feeder ewes, medium and good.
	Medium to prime (84 pounds down).	Medium to prime (85 pounds up).	Culls and common.				Medium to choice.	Culls and common.			
1919.											
March	$19.55	$19.09	$16.23	....	$17.19	$15.06	$13.24	$8.11	....	$17.46	....
April	18.94	18.72	15.64	$19.75	16.97	15.94	13.76	9.01	....	16.39	....
May	15.53	15.24	12.21	18.33	13.56	12.50	11.47	7.70	....	....	....
June	15.45	13.95	11.24	17.68	12.28	9.83	8.24	5.16	$10.22	....	....
July	16.07	....	11.66	....	12.14	9.60	8.17	4.73	10.91	12.84	....
August	15.74	....	11.49	....	11.50	10.02	8.43	4.97	11.62	13.74	....
September	14.12	....	10.20	....	10.62	9.08	7.46	4.28	10.70	12.26	....
October	14.25	....	10.59	....	10.61	9.32	7.21	4.60	9.75	11.89	....
November	13.66	....	10.43	....	10.97	9.72	7.63	4.84	9.12	12.04	....
December	16.19	....	12.93	....	13.31	10.66	8.99	6.00	9.11	13.89	....
1920.											
January	18.90	....	15.75	....	16.16	12.78	10.84	7.38	....	16.87	....
February	19.37	....	16.05	....	17.07	14.51	12.42	8.34	....	17.29	....
March	18.67	....	15.61	....	16.54	14.80	12.80	8.34	....	16.40	....
April	18.72	....	15.33	....	16.23	14.45	12.55	8.22	....	15.38	....
May	17.00	16.29	13.12	17.54	14.14	11.49	10.89	6.77	....	12.97	....
June	15.38	15.16	11.49	15.92	12.38	8.44	7.08	4.43	8.30	11.61	....
July	14.42	....	9.93	....	11.38	8.44	7.24	4.22	8.38	12.49	....
August	12.71	....	9.25	....	9.68	8.15	7.08	4.21	8.53	11.66	....
September	12.93	....	9.81	....	9.70	7.77	6.21	4.02	8.07	12.77	$5.20
October	11.78	....	8.95	....	9.50	7.53	5.52	3.45	6.81	11.77	4.60
November	11.59	....	9.44	....	9.70	7.17	5.45	3.62	6.49	12.04	4.52
December	11.11	....	8.87	....	8.70	5.79	4.52	2.72	5.02	9.91	3.45

KANSAS CITY.

Month.	Lambs.		Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes.		Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.	Feeder ewes, medium and good.
	Medium to prime (84 lbs. down).	Culls and common.				Medium to choice.	Culls and common.			
1919.										
April	$18.20	$14.62	$17.32	$16.20	....	$13.52	$9.12	$13.80	$16.17	....
May	15.97	12.10	16.22	13.78	....	10.44	6.67	12.83	14.09	....
June	14.76	11.59	16.32	11.91	$9.14	7.95	5.14	13.40	....	....
July	14.94	11.06	....	10.90	8.65	6.64	3.76	13.05	13.83	....
August	14.33	9.88	....	10.62	9.20	7.24	4.10	12.25	13.53	....
September	13.45	9.23	....	9.91	8.01	7.27	4.50	11.32	12.37	....
October	14.22	10.14	....	9.78	8.20	6.61	4.29	10.54	11.65	....
November	13.81	10.28	....	10.60	9.21	7.06	4.38	9.88	11.98	....
December	15.86	12.06	....	12.78	11.00	8.43	5.21	9.74	12.73	....
1920.										
January	18.45	14.01	....	15.44	12.61	10.52	6.84	11.14	15.94	....
February	18.65	14.55	....	16.60	12.91	11.76	7.66	11.07	16.48	....
March	18.09	14.51	....	16.22	13.29	12.69	8.23	12.38	15.60	....
April	18.93	15.82	....	16.63	14.12	13.46	8.70	12.75	16.13	....
May	16.00	13.46	16.34	13.91	9.78	8.59	5.91	....	....	....
June	13.58	9.94	15.23	11.70	8.89	7.09	4.49	8.74	10.28	....
July	12.79	8.50	....	10.58	7.45	6.22	3.35	7.89	9.63	....
August	10.95	7.40	....	8.67	7.19	6.05	3.30	7.87	10.42	....
September	11.57	7.96	....	8.32	6.85	5.65	3.31	7.79	11.53	$4.94
October	10.95	7.89	....	8.38	6.55	4.97	3.06	6.64	10.61	4.17
November	10.87	8.10	....	8.96	6.74	5.05	3.13	6.25	10.22	4.15
December	10.03	7.38	....	8.13	5.46	4.05	2.45	4.65	7.81	3.09

TABLE 51.—*Sheep: Monthly average price per 100 pounds, 1918 to 1920*—Continued

OMAHA.

Month.	Lambs.		Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes.		Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.	Feeder ewes, medium and good.
	Medium to prime (84 lbs. down).	Culls and common.				Medium to choice.	Culls and common.			
1919.										
May	$15.77	$11.61	$18.28	$13.63	$12.69	$11.41	$7.93	....	....	....
June	15.59	12.13	18.00	12.66	9.89	8.58	6.29	$8.63	....	....
July	16.10	11.77	....	12.09	9.43	7.76	5.29	10.13	$13.15	....
August	15.72	11.79	....	10.89	9.41	8.03	5.18	10.65	13.70	....
September	13.83	9.86	....	9.04	8.05	6.78	4.07	9.55	11.35	....
October	14.39	10.42	....	10.02	8.70	6.96	4.53	10.24	11.23	....
November	14.02	10.51	....	10.77	9.46	7.76	5.34	10.50	11.60	....
December	15.88	13.04	....	13.16	10.91	9.00	6.57	....	13.33	....
1920.										
January	18.80	15.67	....	15.52	12.22	10.68	7.73	....	16.72	....
February	19.05	16.04	....	16.15	13.30	11.68	8.51	....	17.03	....
March	18.36	15.41	....	16.01	13.46	12.63	8.85	12.11	16.18	....
April	18.23	15.30	....	15.83	13.87	12.69	7.94	12.13	15.73	....
May	16.75	13.61	17.98	13.84	11.52	10.28	6.76	....	13.36	....
June	15.43	11.94	15.97	12.20	8.78	7.29	4.35	....	11.85	....
July	14.13	9.88	....	10.88	7.77	6.32	3.60	8.34	11.86	....
August	12.03	8.99	....	8.77	7.38	6.08	3.38	8.08	11.48	....
September	12.43	9.48	....	8.58	7.32	5.83	3.43	7.96	12.05	$5.38
October	11.49	9.00	....	8.45	6.49	5.04	2.97	7.13	11.44	4.69
November	11.00	8.72	....	8.63	6.88	5.31	3.17	6.43	10.38	4.16
December	10.24	8.12	....	7.64	5.54	4.28	3.24	4.71	8.70	3.27

EAST ST. LOUIS.

Month.	Lambs.		Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes.		Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.
	Medium to prime, 84 pounds down.	Culls and common.				Medium to choice.	Culls and common.		
1919.									
May	$14.45	$11.91	$18.64	....	....	$10.46	$7.58	....	....
June	14.73	10.42	17.02	$12.63	....	8.06	5.58	....	....
July	15.29	8.94	....	10.70	$9.50	8.17	4.54	$11.87	....
August	15.18	7.88	....	10.61	9.43	8.60	4.48	12.19	....
September	13.54	8.89	....	10.00	8.50	6.75	4.14	10.25	....
October	13.70	8.79	....	10.62	8.60	6.12	3.79	8.84	....
November	13.60	9.00	....	11.09	9.03	6.53	4.00	....	....
December	15.44	10.28	....	12.62	10.10	7.96	4.83	....	....
1920.									
January	18.05	13.52	....	15.22	11.45	9.95	6.22	....	$15.06
February	19.18	15.45	....	16.74	13.34	11.53	7.04	....	16.51
March	18.69	15.95	....	16.35	13.59	12.11	7.00	....	....
April	18.27	16.49	19.95	16.43	13.42	12.34	7.00	....	....
May	16.51	14.72	17.50	....	11.56	9.36	5.19	....	....
June	14.63	10.88	13.99	....	....	7.07	4.87	7.50	....
July	13.92	9.87	....	....	....	6.48	4.60	7.50	....
August	11.28	7.97	....	....	....	6.70	4.43	7.45	....
September	11.95	7.56	....	....	....	5.68	3.73	6.76	....
October	11.04	7.52	....	9.07	....	5.02	3.48	6.50	9.40
November	11.16	7.91	....	9.80	....	4.83	3.09	....	....
December	10.10	7.01	....	8.48	5.88	4.00	2.54	....	....

TABLE 52.—*Sheep and lambs: Monthly and yearly top price per 100 pounds, Chicago.*[1]

SHEEP.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	$6.60	$4.75	$5.10	$6.50	$6.30	$6.85	$8.50	$11.75	$13.70	$12.25	$15.75	$8.91
February	7.90	4.85	5.00	7.00	6.50	7.75	9.75	12.50	14.00	14.00	15.75	9.55
March	9.30	5.60	6.50	7.50	7.00	8.15	9.35	13.00	17.00	17.15	15.75	10.57
April	8.50	5.25	8.00	8.00	7.20	8.75	9.40	13.50	17.00	17.35	16.75	10.88
May	7.75	5.60	8.25	7.00	6.50	8.50	10.00	16.00	17.50	16.85	14.50	10.77
June	6.25	4.70	6.00	6.25	6.50	7.00	9.00	13.50	14.75	11.50	11.00	8.77
July	5.00	5.25	5.50	5.40	6.10	7.00	8.50	11.50	14.50	11.40	10.50	8.24
August	4.65	4.00	4.75	5.00	6.10	6.90	8.40	12.50	14.75	12.00	10.00	8.10
September	4.85	4.50	4.80	4.90	6.20	6.75	8.75	12.75	13.25	10.50	8.65	7.81
October	4.50	4.25	5.00	5.10	6.25	7.00	8.65	13.00	12.00	11.25	8.75	7.80
November	4.50	4.25	4.75	5.50	6.65	6.75	9.00	13.00	11.75	10.60	9.00	7.80
December	4.50	4.60	5.65	6.25	6.85	7.00	10.25	13.50	11.50	12.00	7.25	8.12
Yearly top	9.30	5.60	8.25	8.00	7.20	8.75	10.25	16.00	17.50	17.35	16.75	11.36

LAMBS.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	$9.10	$6.65	$7.40	$9.50	$8.40	$9.00	$11.15	$14.45	$18.00	$17.40	$21.65	$12.06
February	9.40	6.50	7.15	9.25	8.10	9.65	11.50	15.00	17.85	19.00	21.65	12.28
March	10.60	6.65	8.25	9.15	8.50	10.10	11.90	15.70	19.50	21.00	20.50	12.90
April	10.20	6.60	10.40	9.35	8.60	11.15	12.00	17.40	22.10	20.50	21.75	13.64
May	9.40	7.85	10.60	8.85	9.50	11.85	12.90	20.60	21.25	20.50	19.40	13.88
June	9.10	7.65	9.25	8.00	9.60	10.85	12.25	18.50	18.25	19.25	18.00	12.79
July	8.60	7.55	8.25	8.70	9.35	10.00	11.10	16.50	19.25	18.25	16.75	12.21
August	7.15	7.40	7.85	8.25	9.00	9.55	11.50	17.75	18.85	18.50	15.40	11.93
September	7.40	6.40	7.75	7.90	9.00	9.25	11.40	18.60	17.25	16.25	14.00	11.38
October	7.20	6.40	7.50	7.65	8.20	9.25	11.25	18.60	17.25	16.25	13.75	11.21
November	6.90	6.50	8.00	8.25	9.50	9.40	12.45	18.00	15.50	15.25	14.00	11.25
December	6.80	6.60	8.90	8.40	9.25	9.90	13.60	17.50	16.25	18.50	13.00	11.70
Yearly top	10.60	7.85	10.60	9.50	9.60	11.85	13.60	20.60	22.10	21.00	21.75	14.46

[1] Prior to June 1, 1918, compiled from Drovers' Journal.

TABLE 53.—*Sheep: Monthly farm price per 100 pounds, United States, 1910 to 1920.*

Date.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
Jan. 15	$5.63	$4.47	$3.89	$4.35	$4.67	$4.95	$5.52	$7.33	$10.55	$9.68	$9.34	$6.40
Feb. 15	5.09	4.34	4.01	4.63	4.67	5.14	5.90	8.17	10.75	9.95	9.97	6.60
Mar. 15	5.64	4.45	4.12	4.97	4.77	5.36	6.35	9.21	11.41	10.45	10.25	7.00
Apr. 15	6.10	4.55	4.57	5.16	4.96	5.60	6.61	9.69	11.98	11.33	10.66	7.38
May 15	5.79	4.51	4.74	4.91	4.87	5.54	6.66	10.15	12.32	10.93	10.34	7.34
June 15	5.44	4.24	4.52	4.84	4.70	5.43	6.54	9.84	11.56	10.34	9.13	6.96
July 15	5.47	4.19	4.21	4.20	4.75	5.35	6.33	9.32	11.04	9.25	8.21	6.57
Aug. 15	4.68	3.98	4.26	4.32	4.87	5.16	6.22	9.33	10.99	9.06	7.54	6.40
Sept. 15	4.81	3.91	4.11	4.23	4.80	5.06	6.25	10.05	10.79	8.69	7.24	6.36
Oct. 15	4.68	3.68	4.19	4.16	4.81	5.18	6.20	10.24	10.35	8.46	6.62	6.23
Nov. 15	4.63	3.65	4.05	4.27	4.68	5.18	6.41	10.20	10.11	8.35	6.20	6.16
Dec. 15	4.54	3.71	4.21	4.46	4.95	5.38	6.77	10.44	9.46	8.53	5.54	6.18
Weighted average	5.08	4.07	4.20	4.46	4.79	5.23	6.27	9.54	10.82	9.35	8.11	6.54

Table 54.—*Sheep: Yearly receipts at principal markets and number on farms, 1900 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

Year.	Receipts at principal markets.										Number on farms Jan. 1.
	Chicago.	Kansas City.	Omaha.	St. Paul.	East St. Louis.	Fort Worth.	Denver.	Sioux City.	St. Joseph.	Total.	
1900	3,549	860	1,277	490	416	(2)	306	61	390	7,349	61,504
1901	4,044	980	1,315	332	520	(2)	226	67	526	8,010	59,757
1902	4,516	1,154	1,743	602	523	10	317	61	561	9,487	62,039
1903	4,583	1,152	1,864	876	528	125	465	42	599	10,234	63,965
1904	4,505	1,004	1,754	773	688	104	519	28	794	10,169	51,630
1905	4,737	1,319	1,971	818	645	125	738	57	981	11,391	45,170
1906	4,805	1,617	2,165	735	579	98	826	64	827	11,716	50,632
1907	4,218	1,582	2,039	568	565	113	828	65	764	10,742	53,240
1908	4,352	1,641	2,106	359	679	120	675	59	592	10,583	54,631
1909	4,441	1,645	2,167	496	776	188	632	78	621	11,044	56,084
1910	5,229	1,841	2,985	865	736	163	600	151	560	13,130	52,448
1911	5,736	2,175	2,978	712	990	187	617	212	718	14,325	53,633
1912	6,056	2,134	2,951	628	1,031	284	775	207	729	14,795	52,362
1913	5,903	2,095	3,222	785	950	328	623	271	812	14,989	51,482
1914	5,378	2,002	3,114	795	749	408	691	404	830	14,371	49,719
1915	3,510	1,815	3,268	704	648	363	765	337	878	12,288	49,956
1916	4,291	1,758	3,171	623	671	431	1,409	321	804	13,479	48,625
1917	3,595	1,499	3,017	430	531	406	2,060	267	679	12,484	47,616
1918	4,630	1,667	3,386	630	536	335	1,652	387	827	14,050	48,603
1919	5,244	1,945	3,789	912	724	453	2,087	686	1,007	16,847	48,866
1920	4,005	1,687	2,891	729	605	394	2,079	358	843	13,591	47,114

[1] Compiled from yearbooks of stockyard companies.
[2] Not in operation.

Table 55.—*Sheep: Combined monthly and yearly receipts at Chicago, Kansas City, Omaha, and East St. Louis, 1910 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. aver.
January	651	822	1,020	892	934	799	742	796	716	780	666	802
February	522	686	849	750	863	670	697	693	525	547	619	675
March	551	740	856	710	909	723	632	682	620	564	580	688
April	477	686	770	770	858	540	586	592	518	623	462	626
May	577	763	665	737	707	469	632	441	538	612	532	607
June	631	796	671	732	716	531	659	470	554	742	632	649
July	794	807	837	831	723	637	634	526	726	1,098	827	767
August	1,199	1,085	1,052	963	979	931	991	650	989	1,461	1,189	1,044
September	1,609	1,566	1,528	1,869	1,558	1,337	1,301	1,111	1,770	1,968	1,288	1,537
October	1,820	2,003	1,906	1,848	1,512	1,000	1,403	1,210	1,569	1,400	946	1,511
November	1,258	1,115	1,113	1,089	705	868	854	715	952	951	817	949
December	702	810	905	979	779	736	761	756	741	957	631	796
Total	10,791	11,879	12,172	12,170	11,243	9,241	9,892	8,642	10,218	11,703	9,189	10,649

[1] Prior to 1915, compiled from yearbooks of stockyard companies.

TABLE 56.—*Sheep: Monthly and yearly receipts at leading markets, 1910 to 1920.*[1]

[In thousands, i. e., 000 omitted.]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. aver.
CHICAGO.												
January	328	418	564	450	485	385	334	306	289	442	290	390
February	222	341	427	353	458	233	306	282	252	275	284	312
March	224	319	390	332	460	259	279	306	258	243	224	299
April	221	298	349	359	400	232	270	308	245	276	178	285
May	259	375	322	355	343	214	282	198	237	271	226	280
June	329	402	361	368	342	226	310	213	252	342	277	311
July	444	446	456	428	375	277	298	230	340	458	373	375
August	570	495	532	465	443	302	410	242	417	482	462	438
September	686	653	658	817	651	347	440	372	668	699	489	589
October	895	886	803	804	681	317	577	469	671	716	427	659
November	649	611	650	622	271	372	438	333	574	559	438	502
December	402	492	544	550	469	346	347	336	427	481	337	430
Total	5,229	5,736	6,056	5,903	5,378	3,510	4,291	3,595	4,630	5,244	4,005	4,871
KANSAS CITY.												
January	156	181	202	158	161	141	167	174	148	108	138	158
February	148	160	166	155	138	170	155	150	88	94	127	141
March	148	194	180	158	153	153	130	140	115	133	148	150
April	111	185	188	181	232	119	128	105	94	165	119	148
May	154	172	181	190	176	136	174	99	142	158	163	159
June	115	164	138	162	145	117	111	107	117	143	130	132
July	81	106	111	106	69	77	71	74	93	122	96	91
August	144	158	136	113	111	146	120	71	101	192	174	133
September	243	242	262	231	289	283	233	160	275	350	221	254
October	221	326	319	318	256	183	239	181	275	232	146	245
November	201	157	143	160	161	164	99	107	126	119	121	142
December	119	130	108	163	111	126	132	131	92	130	105	122
Total	1,841	2,175	2,134	2,095	2,002	1,815	1,759	1,499	1,666	1,946	1,688	1,875
OMAHA.												
January	123	163	170	208	226	221	206	284	244	203	199	204
February	114	135	162	193	220	230	199	237	165	157	179	181
March	149	152	236	174	253	265	182	214	229	164	176	199
April	115	136	179	181	178	150	155	151	165	155	144	155
May	101	117	89	110	114	63	104	105	130	132	103	106
June	81	69	60	63	88	110	134	74	117	174	132	100
July	170	118	150	158	186	217	184	148	199	381	275	199
August	390	334	283	294	365	413	383	264	400	687	483	391
September	614	616	508	740	565	649	576	530	769	850	518	631
October	648	717	678	659	526	463	530	516	571	390	328	548
November	356	294	260	249	234	274	273	242	207	216	212	256
December	124	127	176	193	159	213	245	252	190	280	142	191
Total	2,985	2,978	2,951	3,222	3,114	3,268	3,171	3,017	3,386	3,789	2,891	3,161
EAST ST. LOUIS.												
January	44	60	84	76	62	52	35	32	35	27	39	50
February	38	50	94	49	47	37	37	24	20	21	29	41
March	30	75	50	46	43	46	41	22	18	24	32	39
April	30	67	54	49	48	39	33	28	14	27	21	37
May	63	99	73	82	74	56	72	39	29	51	40	62
June	106	161	112	139	141	78	104	76	68	83	93	106
July	99	137	120	139	93	66	81	74	94	137	83	102
August	95	98	101	91	60	70	78	73	71	100	70	82
September	66	55	100	81	53	58	52	49	58	69	60	64
October	56	74	106	67	49	37	57	44	52	62	45	59
November	52	53	60	58	39	58	44	33	45	57	46	50
December	57	61	77	73	40	51	37	37	32	66	47	53
Total	736	990	1,031	950	749	648	671	531	536	724	605	743

[1] Prior to 1915 compiled from yearbooks of stockyard companies.

TABLE 57.—*Sheep: Yearly receipts, local slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920.*[1]

Market.	Receipts.					
	1915	1916	1917	1918	1919	1920
Albany, N. Y		22,685	44,506	702	672	455
Amarillo, Tex	75,228	55,596	157,991	154,929	235,512	189,211
Atlanta, Ga			1,857	538	2,039	1,325
Augusta, Ga			293	345	480	214
Baltimore, Md	306,171	279,056	349,055	359,261	370,955	366,981
Billings, Mont	11,000	52,563	22,064	24,608	77,133	26,164
Birmingham, Ala		1,539	1,154	1,173	776	812
Boston, Mass	2,626	2,856	3,263	3,745	4,355	4,710
Buffalo, N. Y	835,128	1,023,486	756,454	903,553	1,100,072	1,051,859
Charleston, S. C				10		
Chattanooga, Tenn		3,814	2,406	2,656	2,730	2,123
Cheyenne, Wyo			210,291	370,826	441,546	222,900
Chicago, Ill	3,510,015	4,291,024	3,595,228	4,629,736	5,243,957	4,005,237
Cincinnati, Ohio	356,189	332,241	270,329	274,554	334,692	365,648
Cleveland, Ohio	258,915	254,126	319,784	370,262	466,978	419,744
Columbia, S. C		116	118	281	213	435
Columbus, Ohio	609	817	298	1,169	1,240	1,232
Dallas, Tex		628	452	284	432	585
Dayton, Ohio	11,290	3,951	3,769	4,421	11,261	9,469
Denver, Colo	765,170	1,409,009	2,059,898	1,651,759	2,087,152	2,078,688
Detroit, Mich	269,069	283,573	297,391	278,643	344,068	327,592
Dublin, Ga					24	4
East St. Louis, Ill	648,141	670,838	531,034	536,406	723,895	604,769
El Paso, Tex	99,174	117,228	211,061	87,754	251,449	136,147
Emeryville, Calif			135,754	98,281	155,946	157,461
Erie, Pa				108,956	38,284	37,601
Evansville, Ind		6,991	8,655	11,349	13,979	13,906
Fort Worth, Tex	363,003	430,911	405,810	334,596	453,292	393,929
Fostoria, Ohio	13,277	12,129	11,709	9,643	11,327	17,118
Indianapolis, Ind	112,773	98,142	102,293	113,828	131,329	135,841
Jacksonville, Fla		1,230	35	1,888	1,809	1,403
Jersey City, N. J	1,028,907	1,546,150	1,328,771	1,094,972	1,531,809	1,553,740
Kansas City, Mo	1,814,683	1,758,175	1,498,550	1,667,463	1,945,353	1,687,017
Knoxville, Tenn	1,093	2,471	2,648	1,891	1,969	1,181
La Fayette, Ind	3,045	2,447	3,632	4,544	8,340	7,738
Lancaster, Pa	2,020	1,165	159,610	257,029	73,808	121,759
Logansport, Ind	220	338	156	478	344	1,282
Louisville, Ky	307,570	343,352	272,059	256,706	272,515	277,470
Marion, Ohio				2,126	31,768	49,625
Memphis, Tenn		4,045	242	2,161	1,321	2,011
Milwaukee, Wis	85,837	55,178	48,051	57,108	64,821	60,669
Mobile, Ala	428	1,284	508			
Montgomery, Ala			1,163	6,425	7,360	3,574
Nashville, Tenn		46,680	94,345	114,064	146,823	129,172
Nebraska City, Nebr				465	1,265	896
New Brighton, Minn	146,255	168,580	82,535	203,366	275,841	165,741
New Orleans, La		3,519	6,021	9,144	6,343	5,757
New York, N. Y	178,639	93,872	79,771	271,470	291,091	157,976
Norfolk, Va				1,632		
Ogden, Utah			379,847	423,316	516,412	602,718
Oklahoma, Okla	68,729	114,866	50,424	31,516	19,055	14,812
Omaha, Nebr	3,268,279	3,170,908	3,016,631	3,385,696	3,789,188	2,890,748
Pasco, Wash				58,447	131,154	91,893
Peoria, Ill	894	946	980	1,195	3,578	2,924
Philadelphia, Pa	311,674	282,131	185,010	231,442	297,950	349,536
Pittsburgh, Pa	418,560	337,326	563,056	552,848	766,978	922,167
Portland, Oreg	197,384	171,269	140,887	149,331	214,523	235,941
Pueblo, Colo	794,201	806,163	800,302	761,959	836,452	734,099
Richmond, Va	6,941	10,287	8,094	6,919	9,514	9,805
St. Joseph, Mo	877,930	804,326	678,853	827,489	1,006,960	842,639
St. Louis, Mo	153,428	108,704	61,747	24,812		
St. Paul, Minn	704,119	623,214	429,617	630,203	911,885	728,957
Salt Lake City, Utah		403,625	356,712	423,664	387,962	481,300
San Antonio, Tex	16,916	25,644	51,358	40,688	88,377	69,785
Seattle, Wash		20,289	8,781	51,934	101,654	90,988
Sioux City, Iowa	337,079	320,537	267,441	387,423	686,265	358,112
Sioux Falls, S. Dak			362	1,509	37,132	4,843
Spokane, Wash	1,622	32,210	38,878	102,312	116,833	127,349
Tacoma, Wash		12,120	27,956	28,391	33,277	44,066
Toledo, Ohio	41,124	29,380	33,771	28,517	54,329	69,290
Washington, D. C		15,040	7,200	8,385	19,646	26,822
Wichita, Kans	29,604	20,875	27,366	39,842	58,853	39,569
Total	18,434,959	20,691,665	20,216,287	22,485,038	27,256,345	23,537,534

[1] Complete information for 1915 and 1916, particularly on disposition of stock, is not obtainable from many of the markets.

TABLE 57.—*Sheep: Yearly receipts, local slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920*[1]—Continued.

Market.	Local slaughter.					
	1915	1916	1917	1918	1919	1920
Albany, N. Y	...	...	1,935	435	293	296
Atlanta, Ga	...	...	434	379	1,442	1,277
Augusta, Ga	...	...	293	155	182	204
Baltimore, Md	105,335	92,621	59,852	84,514	103,383	121,077
Billings, Mont	...	...	51	...	43	...
Birmingham, Ala	...	919	509	1,157	446	788
Buffalo, N. Y	...	183,356	118,844	141,785	231,175	262,764
Charleston, S. C	...	...	...	10	...	...
Chattanooga, Tenn	...	...	...	1,978	1,734	1,971
Chicago, Ill	3,252,010	3,461,619	2,758,802	3,424,526	3,934,952	2,803,089
Cincinnati, Ohio	124,365	79,377	50,970	52,080	84,311	81,246
Cleveland, Ohio	168,107	143,953	118,208	131,794	175,634	167,829
Columbia, S. C	...	116	...	249	213	435
Columbus, Ohio	609	519	298	27	423	150
Dallas, Tex	...	628	452	284	429	585
Dayton, Ohio	11,206	2,471	1,640	1,965	3,701	6,357
Denver, Colo	113,037	116,446	95,379	174,483	240,821	238,746
Detroit, Mich	...	208,827	155,926	137,561	211,997	216,482
East St. Louis, Ill	576,176	584,485	462,419	468,260	598,514	464,974
El Paso, Tex	...	...	3,266	6,439	3,339	6,973
Emeryville, Calif	...	...	135,254	101,340	155,596	157,461
Erie, Pa	...	...	...	2,849	3,857	1,350
Evansville, Ind	...	1,102	807	790	1,127	2,681
Fort Worth, Tex	201,220	189,343	143,810	130,677	163,925	206,447
Fostoria, Ohio	...	...	3,580	376	75	154
Indianapolis, Ind	40,070	31,316	20,622	15,903	26,317	31,372
Jacksonville, Fla	...	...	35	1,386	628	254
Jersey City, N. J	1,028,907	1,546,150	1,328,771	1,094,972	1,531,809	1,553,556
Kansas City, Mo	1,193,862	1,177,385	885,552	950,763	1,176,185	1,065,832
Knoxville, Tenn	614	488	417	503	756	650
La Fayette, Ind	...	1,210	913	1,152	1,532	1,267
Lancaster, Pa	...	...	...	661	1,067	1,787
Logansport, Ind	22	61	3	...	...	6
Louisville, Ky	20,485	24,978	20,434	24,250	23,709	29,222
Marion, Ohio	...	...	...	56	371	708
Memphis, Tenn	...	...	...	...	364	...
Milwaukee, Wis	51,335	38,505	37,806	34,474	42,034	45,018
Mobile, Ala	428	84	18	...	...	...
Montgomery, Ala	...	...	...	...	793	622
Nashville, Tenn	...	1,082	8,870	12,836	15,200	17,662
New Orleans, La	...	3,503	5,130	6,506	3,695	2,691
New York, N. Y	178,639	93,872	82,771	271,470	291,091	157,542
Ogden, Utah	...	...	7,556	43,082	23,915	17,012
Oklahoma, Okla	39,300	71,962	27,501	13,768	7,651	5,024
Omaha, Nebr	1,898,916	1,869,557	1,378,240	1,433,183	1,639,040	1,417,203
Pasco, Wash	...	...	...	5	12	...
Peoria, Ill	894	946	876	1,075	1,191	1,825
Philadelphia, Pa	...	...	170,158	219,572	285,601	343,422
Pittsburgh, Pa	56,040	111,004	84,565	94,993	103,261	125,104
Portland, Oreg	145,608	111,886	87,024	76,642	108,984	103,752
Richmond, Va	5,556	1,955	4,404	4,649	6,304	7,441
St. Joseph, Mo	614,608	623,883	471,566	579,750	705,689	615,159
St. Louis, Mo	16,148	17,510	11,322	7,975	...	...
St. Paul, Minn	180,554	151,631	118,369	175,524	251,063	300,074
Salt Lake City, Utah	...	12,706	45,769	26,483	17,220	14,670
San Antonio, Tex	...	...	8,914	852	928	1,861
Seattle, Wash	...	20,289	8,781	51,934	101,384	90,484
Sioux City, Iowa	209,595	216,261	169,630	210,376	281,820	198,692
Sioux Falls, S. Dak	...	...	2	33	125	1,736
Spokane, Wash	1,398	947	4,251	9,303	13,145	16,049
Tacoma, Wash	...	12,120	27,956	24,174	36,587	36,570
Toledo, Ohio	...	2,842	2,667	1,921	3,769	2,105
Washington, D. C	...	15,040	6,283	8,067	19,646	26,562
Wichita, Kans	18,912	3,502	1,967	3,931	5,774	5,172
Total	10,253,956	11,228,486	9,141,872	10,266,337	12,646,272	10,981,442

[1] Complete information for 1915 and 1916, particularly on disposition of stock, is not obtainable from many of the markets.

TABLE 57.—*Sheep: Yearly receipts, local slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920* [1]—Continued.

Market.	Stocker and feeder shipments.					
	1915	1916	1917	1918	1919	1920
Amarillo, Tex		16,795	78,802	49,663	116,267	85,870
Atlanta, Ga					346	
Augusta, Ga					272	10
Baltimore, Md		2,000	1,400	1,100	1,472	660
Billings, Mont			5,708	13,487	16,481	8,833
Birmingham, Ala		620	599		250	
Buffalo, N. Y		13,984	18,340	21,153	13,682	22,846
Chattanooga, Tenn				592	856	152
Chicago, Ill		466,507	633,927	967,995	1,106,034	898,703
Cincinnati, Ohio		5,271	1,315	4,730	8,145	8,170
Cleveland, Ohio			746	3,469	3,641	362
Columbus, Ohio		240				
Denver, Colo		740,765	1,030,080	921,304	1,290,151	1,348,690
Detroit, Mich		5,342	5,115	3,206	8,330	19,920
Dublin, Ga					24	
East St. Louis, Ill	49,230	36,298	47,962	47,697	69,722	59,664
El Paso, Tex			164,493	43,007	188,810	94,797
Evansville, Ind			42	108	125	131
Fort Worth, Tex		71,637	126,740	111,119	163,469	71,339
Fostoria, Ohio				127	85	623
Indianapolis, Ind			4,310	5,447		5,597
Jacksonville, Fla		180		355	892	744
Kansas City, Mo	478,687	459,560	510,338	602,002	671,577	474,409
Knoxville, Tenn			1,712	1,355	1,041	455
La Fayette, Ind		11	241	1,107	762	697
Logansport, Ind				39	17	24
Louisville, Ky				26,644	30,875	19,673
Marion, Ohio				491	1,462	854
Memphis, Tenn		71				
Milwaukee, Wis		942	616	4,471	1,230	1,460
Mobile, Ala			490			
Montgomery, Ala				122	243	822
Nashville, Tenn		4,846	2,722	2,043	19,228	6,404
Nebraska City, Nebr				203	935	250
New Brighton, Minn		4,309	3,606		32,824	3,168
New Orleans, La			438	1,595	1,279	1,554
Ogden, Utah			1,568	40,766	171,287	132,829
Oklahoma, Okla		24,477	13,090	5,490	5,850	3,041
Omaha, Nebr	1,066,542	1,025,946	1,301,720	1,591,704	1,787,236	1,123,637
Pasco, Wash				58,551	131,142	67,636
Peoria, Ill				120	1,291	620
Portland, Oreg		15,222	26,791	17,983	26,565	39,848
Pueblo, Colo				19,803	388	1,157
Richmond, Va		1,083	630	1,112	1,751	1,083
St. Joseph, Mo	107,063	96,589	124,050	126,333	199,818	142,069
St. Paul, Minn	208,600	140,141	91,578	109,009	201,143	113,258
Salt Lake City, Utah		47,378	159,413	214,879	277,152	210,743
San Antonio, Tex		8,680	512	16,683	46,196	32,745
Sioux City, Iowa	79,248	87,556	61,591	128,791	272,233	89,881
Sioux Falls, S. Dak			344	286	28,268	661
Spokane, Wash			15,737	23,680	34,634	74,914
Tacoma, Wash				1,673	634	1,903
Toledo, Ohio					242	3,514
Washington, D. C				59		
Wichita, Kans		839	10,962	15,946	19,392	3,319
Total	(2)	3,277,289	4,447,728	5,207,502	6,955,752	5,179,739

[1] Complete information for 1915 and 1916, particularly on disposition of stock, is not obtainable from many of the markets.
[2] Details incomplete.

TABLE 58.—*Sheep: Combined monthly and yearly receipts at public stockyards, 1915 to 1920.*

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1915	1,517	1,257	1,248	1,019	1,050	1,080	1,264	1,725	2,501	2,359	2,042	1,373	18,435
1916	1,450	1,280	1,156	1,144	1,347	1,394	1,451	1,984	2,650	3,231	2,126	1,479	20,692
1917	1,578	1,384	1,256	1,152	1,059	1,240	1,353	1,763	2,554	3,195	2,099	1,583	20,216
1918	1,354	1,096	1,270	1,159	1,214	1,429	1,639	2,270	3,496	3,327	2,605	1,626	22,485
1919	1,594	1,157	1,268	1,438	1,468	1,775	2,287	3,360	3,854	3,754	2,845	2,456	27,256
1920	1,614	1,416	1,315	1,466	1,488	1,640	2,034	2,606	2,895	3,027	2,471	1,566	23,538

See Note [1] on table 57.

TABLE 59.—*Sheep: Combined monthly and yearly shipments from public stockyards, 1915 to 1920.*

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1915....	374	372	338	235	328	303	383	629	1,269	1,284	845	390	6,750
1916....	488	445	390	425	489	486	522	861	1,479	1,985	1,080	543	9,193
1917....	631	586	454	412	424	549	670	1,000	1,799	2,274	1,371	840	11,010
1918....	590	497	597	553	570	704	750	1,324	2,233	2,147	1,502	737	12,204
1919....	620	431	537	603	643	810	1,092	2,150	2,499	2,291	1,673	1,236	14,585
1920....	717	594	527	740	818	806	1,033	1,486	1,632	2,001	1,499	710	12,563

See Note [1] on table 57.

TABLE 60.—*Sheep: Combined monthly and yearly local slaughter at public stockyards, 1915 to 1920.*

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1915....	980	772	830	683	625	727	822	997	1,088	895	982	853	10,254
1916....	930	821	753	708	850	893	887	1,090	1,104	1,203	1,057	932	11,228
1917....	927	794	803	739	628	684	676	746	731	890	767	757	9,142
1918....	756	610	670	611	634	711	896	933	1,197	1,205	1,135	908	10,266
1919....	969	733	726	842	831	945	1,204	1,166	1,353	1,451	1,210	1,213	12,646
1920....	922	812	792	709	706	845	1,001	1,098	1,217	978	1,010	891	10,981

See Note [1] on table 57.

TABLE 61.—*Sheep: Combined monthly and yearly stocker and feeder shipments from public stockyards, 1916 to 1920.*

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1916....	73	77	62	58	67	83	100	340	661	1,065	546	145	3,277
1917....	126	108	68	102	76	146	195	368	968	1,194	791	306	4,448
1918....	128	122	124	221	161	242	212	525	1,105	1,245	763	360	5,208
1919....	229	131	136	207	160	223	340	1,039	1,505	1,386	860	740	6,956
1920....	311	140	135	269	234	227	325	568	796	1,059	857	259	5,180

See Note [1] on table 57.

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals.)*

CHICAGO, ILL.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	385,095	333,866	306,118	289,335	441,910	289,975
February	233,133	306,465	282,038	251,607	275,126	284,164
March	259,084	278,747	306,316	257,950	242,672	223,493
April	232,281	269,508	307,481	245,154	275,881	177,591
May	213,371	282,047	197,584	237,337	271,404	226,440
June	226,039	309,763	212,815	252,273	341,725	277,346
July	277,366	297,822	230,172	340,342	457,619	373,088
August	301,383	409,803	242,273	416,723	482,510	462,230
September	347,162	440,336	372,062	667,660	699,098	488,787
October	317,205	577,354	469,411	671,208	716,391	427,403
November	372,361	438,315	332,898	573,719	559,065	438,153
December	345,535	346,998	336,060	426,428	480,556	336,567
Total	3,510,015	4,291,024	3,595,228	4,629,736	5,243,957	4,005,237

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals.)*—Continued.

CHICAGO, ILL.—Continued.

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	344,675	269,106	251,892	242,698	341,129	223,349
February	208,477	240,078	237,658	192,347	215,549	225,218
March	236,641	215,499	250,095	201,704	190,499	172,505
April	198,334	219,289	256,436	198,948	237,344	140,840
May	194,321	260,272	189,345	196,647	243,611	173,455
June	223,756	295,562	201,492	224,527	312,224	237,359
July	264,517	279,045	205,302	301,621	377,872	285,691
August	291,206	326,516	193,095	295,453	333,423	308,602
September	314,761	336,358	221,048	421,245	434,022	304,050
October	317,092	361,031	255,774	380,857	468,000	234,387
November	363,910	365,712	240,910	425,597	401,412	270,606
December	294,320	293,151	255,755	342,882	379,867	227,027
Total	3,252,010	3,461,619	2,758,802	3,424,526	3,934,952	2,803,089

Stocker and feeder shipments. [1]

Month.	1915	1916	1917	1918	1919	1920
January			20,296	10,067	61,734	45,669
February		3,388	10,794	19,848	30,586	31,441
March		7,070	15,013	15,950	28,947	19,742
April		4,593	11,463	19,087	17,373	8,331
May		2,534	6,073	13,574	12,199	15,517
June		11,207	9,801	25,276	20,089	27,516
July		14,866	24,202	38,070	64,985	71,654
August		56,156	47,355	120,441	136,989	138,614
September		76,063	149,652	226,833	247,367	175,301
October		190,479	208,977	267,500	241,184	171,323
November		69,111	87,865	138,610	154,057	144,694
December		31,040	42,436	72,739	90,524	48,901
Total		466,507	633,927	967,995	1,106,034	898,703

KANSAS CITY, MO.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	141,450	166,939	174,466	148,400	108,148	138,186
February	169,883	155,097	149,739	88,469	93,653	126,875
March	152,877	129,838	139,695	114,842	133,020	147,926
April	119,494	127,615	105,493	94,041	164,685	118,508
May	136,098	173,996	98,514	142,079	158,021	162,510
June	116,936	110,960	106,989	117,267	143,001	130,006
July	76,572	70,731	74,207	92,558	121,854	95,980
August	145,598	119,995	70,772	101,322	191,946	173,884
September	283,251	232,808	159,878	274,818	350,122	221,388
October	182,684	239,055	181,113	275,472	231,822	145,515
November	164,281	99,372	106,673	125,784	119,058	121,022
December	125,559	131,769	131,011	92,411	130,023	105,217
Total	1,814,683	1,758,175	1,498,550	1,667,463	1,945,353	1,687,017

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	123,866	130,180	126,590	96,836	69,420	93,318
February	136,107	118,525	102,356	61,155	68,741	92,869
March	122,965	104,375	116,863	74,549	100,765	117,432
April	90,526	93,527	85,617	73,528	129,080	72,800
May	71,618	116,001	68,014	80,979	97,749	109,789
June	82,427	82,731	66,647	65,753	95,187	97,823
July	56,808	53,940	45,650	57,717	82,129	67,991
August	98,772	72,765	38,189	53,744	84,254	91,229
September	141,539	109,598	45,626	121,334	171,745	100,766
October	88,767	131,350	73,889	147,016	128,585	79,220
November	89,091	71,103	46,192	60,221	67,319	63,967
December	91,376	93,290	69,919	57,931	81,211	78,628
Total	1,193,862	1,177,385	885,552	950,763	1,176,185	1,065,832

[1] No stocker and feeder shipments in 1915 on account of quarantine.

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals.)*—Continued.

KANSAS CITY, MO.—Continued.

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January	15,133	29,742	36,969	37,352	35,555	37,986
February	15,183	24,155	30,672	25,838	18,431	21,004
March	5,416	17,294	11,348	26,588	26,750	19,187
April	15,036	27,994	11,238	12,343	27,846	13,391
May	37,284	42,390	21,351	51,792	41,607	37,619
June	23,248	31,891	35,220	47,063	34,547	21,845
July	14,602	14,888	23,176	32,427	35,885	26,531
August	33,779	42,425	27,469	42,789	85,574	63,153
September	130,243	81,254	101,418	105,906	169,501	103,713
October	86,868	84,230	102,758	126,274	108,026	63,879
November	66,594	30,390	53,643	61,675	46,622	37,973
December	35,301	32,907	55,086	31,955	41,233	28,128
Total	478,687	459,560	510,338	602,002	671,577	474,409

OMAHA, NEBR.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	221,073	205,627	283,922	244,266	203,568	198,670
February	229,771	199,136	237,330	165,052	156,767	178,810
March	265,447	181,834	214,056	229,292	164,036	175,867
April	150,155	155,387	150,854	164,709	154,665	144,473
May	62,836	103,969	105,145	129,456	132,451	103,002
June	110,069	134,151	74,143	116,791	174,006	131,752
July	217,430	183,885	147,621	198,571	380,767	274,863
August	413,133	382,945	264,213	400,041	687,071	483,272
September	648,780	575,891	529,535	769,395	849,811	517,883
October	463,106	530,093	516,248	571,421	390,630	328,298
November	273,683	273,436	241,555	206,719	215,664	211,664
December	212,796	244,554	252,009	189,983	279,752	142,194
Total	3,268,279	3,170,908	3,016,631	3,385,696	3,789,188	2,890,748

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	181,122	166,512	204,243	139,569	135,273	136,398
February	175,723	142,268	167,285	106,303	112,655	120,440
March	189,987	140,588	158,061	131,195	122,229	134,696
April	116,591	121,704	125,303	101,068	112,908	114,471
May	53,651	88,396	88,291	96,903	111,108	75,885
June	93,819	108,327	60,466	72,425	124,873	82,392
July	155,522	141,094	89,124	117,251	175,596	128,060
August	238,622	193,515	76,011	127,600	161,861	161,293
September	234,635	208,895	91,259	191,967	174,209	191,492
October	158,342	207,179	120,166	126,140	113,810	81,441
November	139,120	168,861	80,887	110,627	131,256	90,307
December	161,782	182,218	117,144	112,135	163,262	100,328
Total	1,898,916	1,869,557	1,378,240	1,433,183	1,639,040	1,417,203

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January	25,426	16,379	18,466	35,695	46,300	40,750
February	17,739	22,824	18,368	36,157	24,560	3,666
March	5,351	13,469	10,672	35,280	26,621	17,216
April	3,647	7,457	7,067	35,102	26,995	17,745
May	990	4,992	3,450	14,780	18,234	....
June	10,306	14,442	10,407	16,946	28,209	28,162
July	42,077	25,898	46,273	57,943	142,792	103,530
August	147,810	169,597	173,531	255,560	432,607	262,141
September	378,376	327,033	409,091	544,854	607,576	286,699
October	273,744	302,420	356,577	419,284	250,006	230,882
November	122,196	91,473	150,424	89,125	80,449	107,826
December	38,880	29,962	97,394	50,978	102,887	25,020
Total	1,066,542	1,025,946	1,301,720	1,591,704	1,787,236	1,123,637

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals)*—Continued.

EAST ST. LOUIS, ILL.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	51,620	34,483	32,072	35,484	26,489	39,223
February	36,848	37,442	24,637	19,699	20,444	29,095
March	46,299	41,138	21,681	18,124	24,126	31,858
April	39,408	33,291	27,975	13,780	27,290	20,388
May	55,680	71,637	38,685	29,151	51,239	39,675
June	78,141	103,479	75,784	68,312	83,361	93,357
July	65,667	81,173	74,028	93,527	136,962	82,757
August	69,805	77,823	72,657	70,603	100,032	70,354
September	58,535	52,344	49,351	58,187	69,349	59,969
October	37,167	57,164	44,122	51,713	62,040	44,548
November	58,293	43,631	32,730	45,499	56,409	46,293
December	50,678	37,233	37,312	32,327	66,154	47,252
Total	648,141	670,838	531,034	536,406	723,895	604,769

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	51,101	31,057	30,979	34,699	25,347	33,563
February	35,364	35,606	23,426	18,407	19,369	21,201
March	39,955	36,433	20,631	16,164	20,948	24,612
April	35,642	31,587	25,595	12,771	25,692	14,233
May	50,254	53,886	32,858	26,518	38,273	31,718
June	76,798	92,758	59,354	57,794	73,138	71,414
July	61,545	67,451	63,445	76,996	104,275	61,346
August	59,256	65,493	62,885	56,413	83,783	51,286
September	36,535	44,868	42,251	52,277	55,392	45,716
October	30,145	49,794	38,351	43,892	50,782	35,613
November	54,072	39,678	27,505	41,769	46,137	37,576
December	45,509	35,874	35,139	30,560	55,378	36,696
Total	576,176	584,485	462,419	468,260	598,514	464,974

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January	....	507	593	559	1,142	5,253
February	224	111	1,211	772	1,075	2,508
March	142	1,382	950	1,960	2,885	2,492
April	837	369	2,380	1,009	1,142	730
May	592	1,332	4,500	1,963	6,794	2,936
June	1,343	3,657	9,436	5,630	4,486	6,841
July	3,555	4,169	3,748	6,322	11,997	10,339
August	8,878	7,861	7,071	10,254	11,266	9,656
September	20,421	5,330	6,570	5,910	10,986	7,859
October	6,361	6,268	5,457	7,821	6,053	3,948
November	4,087	3,953	4,553	3,730	6,200	3,423
December	2,790	1,359	1,493	1,767	5,696	3,679
Total	49,230	36,298	47,962	47,697	69,722	59,664

ST. PAUL, MINN.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	45,319	60,909	73,337	20,236	35,059	50,100
February	64,450	60,052	35,382	16,769	32,535	27,167
March	48,874	33,425	11,377	19,471	35,932	13,200
April	11,025	10,071	3,471	11,142	18,826	9,036
May	8,772	10,842	2,547	5,753	9,135	9,492
June	11,174	5,490	3,975	4,762	17,272	10,558
July	11,043	11,724	11,655	8,046	44,527	36,952
August	21,550	22,676	19,380	25,835	93,900	70,967
September	98,700	70,102	53,619	123,458	164,700	132,257
October	175,094	179,096	126,208	197,150	207,799	148,495
November	144,274	104,897	61,214	151,374	188,512	175,238
December	63,844	53,930	27,452	46,207	63,688	45,495
Total	704,119	623,214	429,617	630,203	911,885	728,957

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals)*—Continued.

ST. PAUL, MINN.—Continued.

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	15,887	7,889	11,259	5,746	12,634	30,676
February	10,083	7,005	5,220	3,111	17,178	16,399
March	9,798	7,430	2,450	5,032	9,921	4,954
April	8,128	8,491	3,076	8,099	2,225	4,651
May	8,037	10,958	2,219	3,075	4,527	7,649
June	7,595	4,876	2,686	2,734	5,012	6,479
July	8,006	6,324	3,991	5,446	10,585	12,071
August	12,257	13,052	9,653	9,106	15,664	29,527
September	19,362	14,975	15,471	20,689	27,840	40,190
October	27,428	32,219	27,270	41,950	56,973	56,593
November	40,481	28,662	24,554	47,140	48,388	65,589
December	13,492	9,750	10,520	23,396	40,116	25,296
Total	180,554	151,631	118,369	175,524	251,063	300,074

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January	7,159	8,125	1,840	3,325	5,325	5,126
February	4,664	4,846	4,168	1,536	5,940	3,147
March	3,150	4,168	787	1,029	2,091	1,846
April	4,918	6,189	2,421	2,204	6,493	1,382
May	306	1,953	197	3,109	1,396	227
June	935	526	984	1,805	2,571	1,719
July	1,526	1,029	1,405	1,324	6,635	2,030
August	4,624	5,872	2,747	2,507	20,877	6,826
September	39,394	10,388	16,598	17,835	49,972	14,139
October	66,828	65,477	35,419	38,278	48,433	36,301
November	60,746	24,206	16,917	25,108	44,302	29,815
December	14,350	7,362	8,095	10,949	7,108	10,700
Total	208,600	140,141	91,578	109,009	201,143	113,258

FORT WORTH, TEX.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	11,289	15,147	15,143	7,539	8,695	10,267
February	13,862	13,455	28,864	7,886	6,382	11,302
March	26,476	24,410	24,245	14,372	13,745	28,488
April	48,464	41,872	33,906	28,013	75,287	120,066
May	115,268	112,335	98,513	61,822	106,697	88,615
June	56,145	51,297	54,404	58,042	47,694	36,240
July	20,467	40,086	31,140	35,199	15,768	16,469
August	15,983	24,252	24,406	34,607	24,177	16,392
September	17,959	30,726	27,831	26,551	32,122	20,691
October	15,079	25,276	36,119	27,443	57,299	15,109
November	12,748	16,317	20,418	14,833	33,316	17,214
December	9,263	35,738	10,821	18,289	32,110	13,076
Total	363,003	430,911	405,810	334,596	453,292	393,929

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	8,808	7,361	6,339	4,055	5,806	2,746
February	12,531	8,604	12,926	3,584	4,244	3,371
March	14,603	14,469	9,564	8,794	3,562	18,043
April	29,617	17,465	14,918	6,596	27,935	68,739
May	55,406	57,021	30,633	18,889	45,146	42,562
June	27,340	25,842	21,776	22,286	21,371	22,263
July	13,342	9,085	8,296	13,250	8,323	10,142
August	7,803	10,485	6,454	14,670	8,157	8,798
September	10,558	7,490	6,930	9,705	8,634	11,000
October	8,864	14,769	9,872	11,543	10,671	9,195
November	7,564	9,371	11,166	7,188	8,997	5,660
December	4,784	7,381	4,936	10,117	11,079	3,928
Total	201,220	189,343	143,810	130,677	163,925	206,447

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards 1915 to 1920. (Number of animals.)*—Continued.

FORT WORTH, TEX.—Continued.

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January			4,680	2,120	1,414	
February		910	10,180	3,871	763	1,080
March		2,210	11,310	4,823	7,566	7,439
April		6,370	3,250	11,174	7,564	6,094
May		7,280	13,910	10,912	13,533	13,660
June		6,117	16,298	17,855	12,167	7,933
July		14,820	11,810	9,548	6,693	3,477
August		11,050	12,889	17,786	10,601	3,703
September		10,140	12,806	11,884	23,407	5,585
October		5,980	19,889	10,005	38,775	5,738
November		3,640	5,692	5,125	21,610	8,163
December		3,120	4,026	6,016	19,376	8,467
Total		71,637	126,740	111,119	163,469	71,339

SIOUX CITY, IOWA.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	47,233	26,575	31,097	28,812	51,099	52,464
February	22,362	17,429	21,048	16,888	30,220	37,898
March	11,472	10,055	11,215	19,403	24,288	17,147
April	7,986	4,852	10,283	7,100	15,654	15,848
May	6,946	6,818	6,350	7,106	16,069	15,992
June	4,294	9,782	7,827	6,607	12,506	10,338
July	7,983	17,375	11,081	9,003	34,139	17,888
August	18,838	37,058	17,279	40,886	124,949	32,335
September	48,676	41,042	30,690	66,013	126,361	41,090
October	72,309	63,449	42,303	79,588	74,251	45,385
November	51,424	44,090	35,391	57,869	72,072	39,779
December	37,556	42,012	42,877	48,148	104,667	31,948
Total	337,079	320,537	267,441	387,423	686,265	358,112

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	36,793	17,686	24,133	23,348	33,532	31,511
February	20,563	11,900	18,261	13,712	21,393	24,029
March	11,328	8,044	12,187	12,353	15,447	12,938
April	7,284	4,479	9,521	5,240	10,755	12,736
May	6,824	6,084	6,333	5,909	15,607	7,380
June	4,290	7,786	4,682	5,506	8,896	5,231
July	7,879	15,451	8,245	7,909	16,390	6,785
August	13,124	20,144	5,706	11,952	23,107	10,826
September	18,886	18,972	11,407	26,727	23,989	22,111
October	29,739	29,636	20,250	30,866	31,551	19,146
November	27,940	33,989	22,220	33,593	33,076	23,449
December	24,945	42,090	26,685	33,261	48,077	22,550
Total	209,595	216,261	169,630	210,376	281,820	198,692

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January	585	2,334	3,955	926	3,330	5,680
February	1,474	3,100	1,677	920	1,828	3,951
March	259	950	20	1,800	2,552	443
April	1	232	517	2,915	4,524	
May	125		1	361	124	6,593
June	4	1,656	956	84	291	5,119
July	106	1,375	3,088	1,501	15,219	8,441
August	1,977	13,540	9,145	22,538	72,260	20,399
September	24,215	17,463	18,395	39,734	99,416	16,521
October	32,914	30,062	12,925	41,204	36,882	13,969
November	9,676	10,965	6,728	11,843	11,274	6,151
December	7,912	5,879	4,184	4,965	24,533	2,614
Total	79,248	87,556	61,591	128,791	272,233	89,881

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards 1915 to 1920. (Number of animals)*—Continued.

JERSEY CITY, N. J.[1]

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	57,749	106,987	89,225	40,407	104,222	111,140
February	26,247	80,152	75,796	28,701	90,437	86,487
March	32,829	74,753	75,954	34,410	59,950	79,246
April	54,323	90,458	86,268	48,453	66,889	68,989
May	63,898	106,000	76,143	53,528	73,404	58,202
June	103,248	142,582	120,798	108,757	126,015	118,895
July	142,787	192,428	123,753	144,462	213,950	212,329
August	139,357	195,239	208,453	164,146	197,975	167,125
September	135,676	161,319	130,125	123,992	138,294	188,691
October	92,838	155,281	142,102	119,014	172,391	154,237
November	101,578	148,421	116,797	156,880	161,578	164,038
December	78,377	92,530	83,357	72,222	126,704	144,361
Total	1,028,907	1,546,150	1,328,771	1,094,972	1,531,809	1,553,740

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	57,749	106,987	89,225	40,407	104,222	111,140
February	26,247	80,152	75,796	28,701	90,437	86,303
March	32,829	74,753	75,954	34,410	59,950	79,246
April	54,323	90,458	86,268	48,453	66,889	68,989
May	63,898	106,000	76,143	53,528	73,404	58,202
June	103,248	142,582	120,798	108,757	126,015	118,895
July	142,787	192,428	123,753	144,462	213,950	212,329
August	139,357	195,239	208,453	164,146	197,975	167,125
September	135,676	161,319	130,125	123,992	138,294	188,691
October	92,838	155,281	142,102	119,014	172,391	154,237
November	101,578	148,421	116,797	156,880	161,578	164,038
December	78,377	92,530	83,357	72,222	126,704	144,361
Total	1,028,907	1,546,150	1,328,771	1,094,972	1,531,809	1,553,556

ST. JOSEPH, MO.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	67,376	93,807	64,922	74,523	67,992	81,644
February	101,939	101,984	84,566	69,105	70,874	85,673
March	113,953	80,857	96,918	106,939	86,729	99,210
April	85,821	51,766	69,943	74,763	97,547	74,576
May	59,405	43,788	28,972	41,914	74,118	44,534
June	33,341	48,796	34,779	43,045	50,768	49,281
July	37,230	43,353	33,907	54,204	60,440	59,364
August	60,928	60,245	37,580	58,816	84,224	79,247
September	139,469	89,724	62,052	108,900	137,966	95,194
October	54,160	76,951	70,278	95,555	115,907	63,169
November	54,242	47,883	42,846	49,401	60,592	42,343
December	70,066	65,172	52,090	50,324	99,803	68,404
Total	877,930	804,326	678,853	827,489	1,006,960	842,639

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	59,582	66,377	58,901	51,321	55,367	56,254
February	77,221	80,164	57,733	55,369	51,735	61,696
March	84,754	66,102	72,953	61,570	63,668	65,960
April	66,529	49,081	58,728	53,245	74,632	61,630
May	38,017	40,114	24,267	38,566	59,771	35,127
June	31,196	4,162	29,757	39,214	44,075	41,353
July	30,347	33,305	29,114	48,743	52,456	49,788
August	40,740	47,859	24,477	38,453	47,697	54,470
September	6,901	54,852	23,928	56,567	70,435	57,292
October	28,091	47,898	34,822	58,527	64,903	42,898
November	40,374	38,481	23,947	40,038	48,045	31,628
December	55,856	58,488	32,939	38,137	72,905	57,063
Total	614,608	623,883	471,566	579,750	705,689	615,159

[1] No stocker and feeder shipments from this public stockyard.

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals)*—Continued.

ST. JOSEPH, MO.—Continued

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January	2,032	6,252	2,830	4,976	5,972	12,892
February	757	3,683	4,061	1,613	11,214	7,239
March	807	1,518	2,450	4,302	3,442	8,534
April	6	352	1,644	3,774	2,758	2,320
May	2,149	900	3,375	1,561	2,672	9,521
June	742	2,998	3,567	1,830	4,027	4,759
July	2,180	5,597	2,647	3,431	7,313	7,842
August	11,004	8,564	9,297	17,594	31,239	21,354
September	54,230	30,362	34,036	37,581	58,732	31,189
October	19,645	25,876	27,316	36,536	45,338	18,443
November	7,104	6,071	17,621	7,172	12,761	8,400
December	6,407	4,416	15,206	5,963	14,350	9,576
Total	107,063	96,589	124,050	126,333	199,818	142,069

INDIANAPOLIS, IND.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	5,578	9,150	5,401	3,343	4,957	8,801
February	3,195	4,252	5,133	4,277	3,795	5,791
March	4,436	2,676	3,141	2,191	3,358	4,452
April	3,446	1,917	1,925	1,322	1,982	2,198
May	4,845	4,058	4,240	2,285	2,225	3,068
June	7,505	7,543	6,864	8,702	7,658	8,403
July	9,202	11,418	11,383	20,556	15,954	14,869
August	12,830	16,028	17,667	24,344	24,712	26,149
September	11,796	12,807	19,522	14,841	27,301	25,489
October	22,014	10,701	13,404	17,332	18,672	14,824
November	14,469	8,458	7,995	8,580	10,440	13,517
December	13,457	9,134	5,618	6,055	10,275	8,280
Total	112,773	98,142	102,293	113,828	131,329	135,841

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	2,973	1,726	1,632	494	2,466	1,425
February	1,499	994	1,649	647	1,064	1,463
March	1,381	1,373	1,090	1,254	499	1,392
April	1,787	1,427	1,119	451	1,212	1,050
May	3,174	2,151	1,721	866	1,286	1,793
June	4,027	3,256	2,214	57	2,206	2,105
July	5,230	3,449	2,413	3,145	4,741	2,740
August	5,589	4,992	1,899	2,491	3,635	6,088
September	4,776	4,009	2,004	2,500	3,612	4,280
October	3,433	3,472	1,948	1,912	2,335	3,869
November	3,380	2,743	1,861	1,121	1,697	3,029
December	2,830	1,724	1,072	965	1,564	2,138
Total	40,070	31,316	20,622	15,903	26,317	31,372

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January	....	....	....	....	....	....
February	....	....	....	....	....	271
March	....	....	....	....	....	239
April	....	....	....	....	....	238
May	....	....	....	....	....	303
June	....	....	....	667	....	665
July	....	....	604	637	....	605
August	....	....	1,285	1,783	....	2,114
September	....	....	1,931	942	....	211
October	....	....	490	1,150	....	392
November	....	....	....	216	....	272
December	....	....	....	52	....	287
Total	....	....	4,310	5,447	....	5,597

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals)*—Continued.

BUFFALO, N. Y.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	143,710	95,873	93,715	70,771	124,342	105,361
February	77,426	89,351	74,478	76,059	112,792	106,662
March	66,860	95,287	74,753	89,129	110,306	90,693
April	77,662	89,351	68,738	75,145	97,003	63,391
May	59,948	118,538	72,844	92,228	86,934	70,251
June	15,085	35,718	34,450	35,840	38,214	41,095
July	20,769	34,417	22,681	28,615	27,986	50,477
August	33,114	62,015	32,301	46,734	62,710	61,389
September	62,744	91,844	55,416	70,982	74,608	83,489
October	93,042	110,305	69,384	91,918	115,388	104,701
November	113,768	111,578	76,358	123,705	139,988	137,777
December	71,000	89,209	81,336	102,427	109,801	136,573
Total	835,128	1,023,486	756,454	903,553	1,100,072	1,051,859

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	....	18,062	9,165	13,586	19,784	30,780
February	....	15,421	11,384	10,587	13,354	27,720
March	....	14,233	7,586	10,055	9,758	26,151
April	....	12,922	6,084	7,200	9,983	13,891
May	....	12,957	9,978	6,622	11,949	12,674
June	....	6,151	6,354	5,855	8,371	12,255
July	....	6,203	7,024	8,259	9,864	12,647
August	....	13,847	7,323	9,737	17,010	18,214
September	....	21,499	10,944	14,030	24,536	26,948
October	....	24,894	13,205	17,013	34,228	27,772
November	....	20,730	16,264	21,161	40,910	31,671
December	....	16,437	13,533	17,680	31,428	22,041
Total	....	183,356	118,844	141,785	231,175	262,764

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
anuary	....	183	....	....	1,139	1,105
February	....	398	494	1,400	267	1,975
March	....	609	....	8	4	1,377
April	....	441	100	2,285	446	677
May	....	707	465	4,103	729	1,652
June	....	140	6,019	2,967	1,520	2,656
July	....	372	569	284	238	406
August	....	1,044	260	749	2,918	1,407
September	....	3,639	2,739	1,927	1,691	2,086
October	....	2,545	4,748	3,099	1,774	2,289
November	....	3,228	1,411	2,785	1,268	5,044
December	....	678	1,535	1,546	1,688	2,172
Total	....	13,984	18,340	21,153	13,682	22,846

PITTSBURGH, PA. [1]

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	34,080	28,902	54,204	37,758	46,708	64,950
February	29,160	14,073	42,568	37,522	29,524	44,404
March	24,960	11,307	36,858	32,168	26,099	46,854
April	34,920	26,505	53,039	40,613	43,024	62,186
May	36,720	44,730	35,386	36,938	42,614	70,208
June	18,120	19,518	31,539	34,457	64,370	90,128
July	42,480	28,996	51,764	46,474	90,666	111,466
August	47,880	39,116	81,371	79,555	111,566	117,394
September	43,080	29,744	44,931	53,026	89,439	89,059
October	32,280	34,211	38,398	48,510	67,275	71,661
November	38,760	33,149	44,218	62,086	64,411	73,932
December	36,120	27,075	48,750	43,741	91,282	79,925
Total	418,560	337,326	563,056	552,848	766,978	922,167

[1] No stocker and feeder shipments from this public stockyard.

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals)*—Continued.

PITTSBURGH, PA.[1]—Continued.

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	960	10,800	8,535	4,043	9,808	6,791
February	6,480	7,273	5,863	4,649	7,131	5,933
March	120	6,507	5,273	5,325	6,751	5,258
April	3,600	9,545	5,382	5,337	6,558	9,923
May	6,840	16,230	5,421	6,141	8,357	7,832
June	1,560	5,618	6,005	7,618	8,513	10,605
July	6,120	11,736	3,858	8,788	9,698	11,646
August	2,520	10,136	9,775	11,142	11,246	13,271
September	7,920	9,424	9,985	9,353	11,729	13,875
October	8,160	8,511	8,829	9,971	11,343	13,541
November	6,480	6,869	7,856	11,779	4,983	12,220
December	5,280	8,355	7,783	10,847	7,144	14,209
Total	56,040	111,004	84,565	94,993	103,261	125,104

DENVER, COLO.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	28,536	20,027	66,765	62,672	87,725	118,686
February	24,643	18,498	113,511	80,965	62,699	127,720
March	33,242	22,682	101,463	88,963	93,715	136,428
April	12,612	20,096	42,026	67,805	102,644	196,830
May	6,891	8,200	17,535	53,268	58,072	53,873
June	9,770	18,340	31,254	68,429	71,051	41,411
July	17,084	42,950	76,429	81,444	47,472	70,803
August	23,876	91,330	94,516	80,460	182,684	95,690
September	122,723	301,118	353,809	224,405	337,679	205,817
October	280,275	472,506	594,152	319,594	447,275	565,840
November	182,440	329,626	432,863	373,996	357,045	370,556
December	23,078	63,636	135,575	149,758	239,091	95,034
Total	765,170	1,409,009	2,059,898	1,651,759	2,087,152	2,078,688

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	10,359	7,820	8,202	13,351	13,226	20,966
February	7,410	7,555	8,019	18,088	12,006	24,558
March	10,100	7,396	8,518	18,675	18,837	37,230
April	8,773	7,002	7,711	16,855	23,853	27,573
May	5,030	6,039	4,530	9,994	22,901	17,392
June	5,983	5,244	1,876	4,803	10,028	8,314
July	7,532	9,642	5,106	9,640	10,249	7,643
August	9,532	16,096	6,880	12,635	20,514	14,434
September	12,485	17,461	10,239	14,656	33,358	27,753
October	12,851	16,688	17,845	28,554	40,548	27,922
November	15,913	10,014	12,858	13,608	19,211	14,839
December	7,069	5,489	3,595	13,624	16,090	10,122
Total	113,037	116,446	95,379	174,483	240,821	238,746

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January	....	6,395	21,536	13,840	50,158	95,029
February	....	3,557	3,807	19,082	25,155	23,131
March	....	7,734	4,210	13,128	18,702	17,004
April	....	2,745	9,292	10,797	19,490	88,895
May	....	540	3,451	13,242	14,655	38,990
June	....	5,931	22,058	37,008	27,838	31,175
July	....	10,716	39,272	37,020	11,673	51,873
August	....	6,764	24,093	8,088	40,548	12,175
September	....	76,679	128,955	51,790	165,294	101,992
October	....	299,412	345,290	211,377	368,201	404,765
November	....	298,071	368,167	359,172	336,015	397,609
December	....	22,221	59,949	146,760	212,412	86,052
Total	....	740,765	1,030,080	921,304	1,290,151	1,348,690

[1] No stocker and feeder shipments from this public stockyard.

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals)*—Continued.

CINCINNATI, OHIO.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	5,893	5,179	3,557	1,195	4,236	4,016
February	1,197	5,452	2,184	1,126	1,950	2,469
March	4,735	3,386	2,092	1,642	2,693	1,856
April	7,444	4,566	1,281	2,044	2,354	2,843
May	28,836	18,782	6,953	5,327	4,667	10,709
June	58,676	71,678	52,168	42,261	45,380	79,146
July	87,034	87,909	56,011	72,002	90,040	101,137
August	97,139	88,959	93,640	90,540	108,546	86,239
September	27,329	20,030	28,005	31,536	36,000	36,088
October	15,560	12,599	14,450	11,714	18,039	19,160
November	13,052	8,521	7,293	9,518	10,244	14,600
December	9,294	5,180	2,695	5,649	10,543	7,385
Total	356,189	332,241	270,329	274,554	334,692	365,648

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	5,082	5,083	2,729	829	3,794	2,791
February	1,132	5,155	1,625	940	1,439	2,358
March	4,296	3,162	2,065	1,394	2,041	1,702
April	4,885	3,821	1,181	1,226	1,780	2,472
May	7,459	10,472	3,953	3,088	2,406	4,961
June	16,053	11,460	9,547	3,909	7,824	12,520
July	17,649	3,273	6,483	9,491	9,326	4,550
August	22,923	10,209	10,820	10,353	18,679	16,474
September	12,134	7,805	3,418	6,139	12,571	10,590
October	12,864	8,411	4,599	4,943	11,273	9,010
November	11,434	5,954	2,722	5,645	7,311	7,925
December	8,454	4,572	1,828	4,123	5,867	5,893
Total	124,365	79,377	50,970	52,080	84,311	81,246

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January					64	
February						111
March						
April						
May		109		77	136	
June		908	286	375	424	1,512
July		1,107	295	1,239	901	2,222
August		2,469	226	1,894	2,480	2,495
September		256	178	773	2,340	894
October		222	330	372	1,230	671
November		111			288	265
December		89			282	
Total		5,271	1,315	4,730	8,145	8,170

OKLAHOMA, OKLA.

Receipts.

Month.	1915	1916	1917	1918	1919	1920
January	2,311	9,169	8,018	2,744	1,128	521
February	3,527	5,019	1,703	2,671	497	1,143
March	2,075	4,559	1,424	2,524	440	1,349
April	4,816	1,311	3,934	271	1,719	132
May	11,984	12,550	10,144	6,572	2,590	510
June	5,629	4,093	3,632	894	1,291	769
July	4,645	1,749	3,110	2,519	3,234	919
August	9,864	10,460	3,975	3,682	1,343	3,994
September	2,814	22,261	8,054	2,343	3,192	1,997
October	5,149	18,295	3,447	3,133	1,263	1,614
November	6,130	13,344	2,234	1,856	684	984
December	9,785	12,056	749	2,307	1,674	880
Total	68,729	114,866	50,424	31,516	19,055	14,812

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals)*—Continued.

OKLAHOMA, OKLA.—Continued.

Local slaughter.

Month.	1915	1916	1917	1918	1919	1920
January	1,939	7,647	7,499	2,412	278	290
February	1,710	3,774	1,806	2,414	29	557
March	1,968	4,215	557	2,358	154	666
April	4,816	1,286	2,905	271	852	74
May	10,765	10,313	7,340	1,031	1,645	152
June	2,687	1,694	1,845	543	299	225
July	1,156	1,236	725	883	1,160	354
August	....	4,437	928	541	352	531
September	1,477	1,648	1,138	967	669	454
October	1,955	12,853	1,840	515	821	346
November	3,999	11,587	732	411	281	455
December	6,828	11,272	186	1,422	1,111	920
Total	39,300	71,962	27,501	13,768	7,651	5,024

Stocker and feeder shipments.

January	....	....	....	231	....	....
February	....	....	....	....	309	267
March	....	....	....	153	240	131
April	....	....	373	4	730	....
May	....	....	614	....	....	194
June	....	282	962	320	37	77
July	....	270	2,021	13	1,615	148
August	....	5,985	1,362	141	419	947
September	....	13,425	4,506	1,596	1,344	722
October	....	3,710	1,987	954	916	323
November	....	805	670	380	....	....
December	....	....	595	1,698	240	232
Total	....	24,477	13,090	5,490	5,850	3,041

CLEVELAND, OHIO.

Receipts.

January	29,515	21,347	43,596	22,121	34,146	40,311
February	17,415	11,807	19,750	20,874	25,332	28,479
March	14,717	8,298	17,298	14,167	18,877	15,119
April	14,410	11,387	15,561	29,411	28,519	32,683
May	12,870	12,196	17,970	19,489	26,071	19,230
June	10,636	11,171	16,558	25,741	31,941	40.392
July	10,967	8,250	17,230	28,056	41,273	52,577
August	15,541	20,970	34,825	51,190	59,983	40,970
September	26,781	29,610	28,161	33,721	34,711	26,487
October	29,607	37,987	37,417	30,919	46,368	37,993
November	46,737	46,364	39,957	48,340	54,145	45,848
December	29,719	34,739	31,461	46,233	65,612	39,655
Total	258,915	254,126	319,784	370,262	466,978	419,744

Local slaughter.

January	27,965	13,529	10,005	9,375	15,603	14,712
February	10,068	10,419	6,795	5,486	12,934	10,582
March	12,842	5,822	5,118	2,960	7,642	8,910
April	12,210	7,617	5,946	7,224	11,114	16,347
May	9,875	7,119	7,278	6,430	12,073	11,577
June	9,009	9,605	6,701	9,885	9,008	12,326
July	10,005	7,721	7,723	9,931	12,173	12,495
August	13,235	17,121	10,524	13,196	15,362	16,623
September	16,181	17,006	13,229	14,026	18,968	7,280
October	17,247	17,018	16,675	15,412	20,435	19,434
November	16,427	15,801	15,371	17,625	24,164	21,076
December	13,043	15,175	13,343	20,244	16,158	16,467
Total	168,107	143,953	118,208	131,794	175,634	167,829

TABLE 62.—*Sheep: Monthly receipts, slaughter, and stocker and feeder shipments at public stockyards, 1915 to 1920. (Number of animals)*—Continued.

CLEVELAND, OHIO—Continued.

Stocker and feeder shipments.

Month.	1915	1916	1917	1918	1919	1920
January	....	....	....	....	82	....
February	....	....	....	....	....	....
March	....	....	....	....	29	....
April	....	....	....	....	....	....
May	....	....	....	690	326	....
June	....	....	....	955	....	....
July	....	....	202	565	146	....
August	....	....	87	167	1,500	362
September	....	....	....	318	1,344	....
October	....	....	192	198	214	....
November	....	....	265	494	....	....
December	....	....	....	82	....	....
Total	....	....	746	3,469	3,641	362

TABLE 63.—*Mutton (except canned): Yearly exports, United States, by countries of destination.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	Year ending June 30.									Calendar year.		
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1918	1919	1920
United Kingdom	723	705	1,087	531	207	898	2,109	177	78	88	24	176
Bermuda	101	122	107	139	107	162	174	192	26	63	80	165
Canada	781	991	2,078	4,199	3,911	2,545	2,925	2,450	1,783	1,368	2,595	1,819
Panama	325	270	280	373	391	214	233	295	106	5	177	309
Newfoundland and Labrador	......	13	4	......	......	2	......	......	......	10	......	1
British West Indies	4	2	5	5	2	6	66	10	6	4	3	2
Cuba	42	39	14	17	65	48	22	46	62	58	35	127
Other countries	13	18	21	2	2	2	24	26	37	35	95	976
Total	1,989	2,160	3,596	5,266	4,685	3,877	5,553	3,196	2,098	1,631	3,009	3,575

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 64.—*Mutton: Yearly exports, by principal countries.*

[In thousands of pounds; i. e., 000 omitted.]

Exported from—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Argentina	165,569	189,411	154,708	101,253	129,384	77,250	113,136	87,787	111,145	125,131
Australia	190,229	129,569	115,372	204,932	193,264	38,344	66,813	19,175	59,687	....
British South Africa	....	67	130	28	112	323	1	2	....	46
Canada	70	50	35	58	1,056	83	188	844	731	4,939
Denmark	....	348	422	263	209	810	365	....	....	....
France	....	284	319	399	247	232	229	132	114	134
Netherlands	....	15,505	21,053	15,080	19,894	25,150	4,857	4,125	2	5,286
New Zealand	227,865	211,595	248,569	246,363	280,324	302,218	251,245	169,644	139,575	....
Russia	618	361	310	423	105	[1] 125	....	....	....	....
Sweden	....	109	78	113	152	54	2	5	1	....
United States	1,997	2,574	5,076	4,789	3,847	4,231	5,258	2,862	1,631	3,009
Uruguay	8,092	6,476	3,309	....	5,356	7,806	8,088	4,589	....	....

[1] Tallow.

TABLE 65.—*Mutton and lamb: Yearly imports, United States.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Imported from—	Year ending June 30.					Calendar year.		
	1914	1915	1916	1917	1918	1918	1919	1920
Argentina	5,082	12,049	19,077	3,799	1,498	....	1,307	9,010
Australia	3,291	524	....	....	....	....	67	1,429
Canada	113	480	41	118	497	608	6,792	9,208
Chile	....	....	....	732	....	....	....	....
England [2]	1,305	137	....	....	....	....	....	11,699
Mexico	48	....	....	....	....	....	....	....
New Zealand	639	1,548	....	....	....	....	43	65,183
Uruguay	2,231	791	1,140	35	....	....	....	4,639
Other countries	2	....	....	....	13	....	....	....
Total	12,711	15,529	20,258	4,684	2,008	608	8,209	101,168

[1] Compiled from Monthly Summary of Foreign Commerce. [2] Probably re-exports.

TABLE 66.—*Mutton: Yearly imports, by principal countries.*

[In thousands of pounds; i. e., 000 omitted.]

Imported by—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
British South Africa	....	2,746	1,402	1,593	162	24	10	20	1	175
Canada	....	3,409	5,333	5,410	4,194	2,906	2,786	2,008	5,311	4,746
Cuba	40	23	18	83	52	56	13	22	81	....
Denmark	4,605	4,055	3,072	4,357	2,913	858	....	....	....	....
France	155	622	1,194	975	6,346	20,409	29,309	35,172	29,944	63,448
Germany	651	488	716	1,933	....	....	....	....	....	....
Netherlands	19	116	69	42	49	10	40	2,985	13	1,224
Sweden	1,268	1,331	1,384	938	522	116	26	3	37	....
United Kingdom	622,296	611,868	574,698	604,132	577,339	527,517	406,814	292,922	237,862	478,987
United States	....	....	....	554	19,876	11,879	17,235	5,624	608	8,209

TABLE 67.—*Sheep: Weekly average price per 100 pounds, 1918 to 1920.*

CHICAGO.

Week ending—	Lambs.					Spring lambs, good and choice.	Yearlings.		
	Choice and prime.	Medium and good.	Culls.	Feeders. Good and choice.	Feeders. Common and medium.		Choice and prime.	Medium and good.	Feeders, good and choice.
1918.									
June 1	....	....	....	....	....	....	....	....	....
8	$17.87	$17.50	....	....	....	$20.31	....	....	....
15	17.82	16.64	$12.88	$10.53	$13.38	19.93	....	....	....
22	17.42	15.99	11.95	10.63	13.50	19.55	....	....	....
29	16.93	15.36	11.15	....	....	18.34	....	....	....
July 6	18.82	18.22	14.47	15.86	14.56	....	$16.28	$14.63	$13.44
13	18.85	18.31	14.50	15.78	14.52	....	16.43	14.95	13.28
20	18.49	17.52	13.60	15.83	14.58	....	16.13	15.13	12.63
27	18.69	17.76	13.40	16.15	14.93	....	16.23	15.13	12.78
Aug. 3	17.63	16.41	13.00	16.61	15.08	....	16.05	14.93	12.93
10	17.84	16.55	13.00	16.96	15.48	....	16.00	14.83	13.18
17	18.35	17.14	12.58	17.35	16.25	....	15.90	14.83	13.43
24	18.08	16.96	12.00	17.37	16.25	....	15.33	14.43	13.13
31	17.91	16.78	11.90	17.24	16.21	....	14.80	14.07	13.13
Sept. 7	17.71	16.68	11.75	17.27	16.19	....	14.16	13.54	13.13
14	17.66	16.59	11.75	17.03	16.07	....	14.00	13.50	13.13
21	17.93	16.70	11.75	16.60	15.63	....	14.00	13.50	13.23
28	17.59	16.25	11.40	16.06	14.73	....	13.87	13.20	13.04
Oct. 5	16.33	14.90	10.00	14.75	13.05	....	12.90	12.13	12.10
12	16.10	14.83	10.20	14.03	12.28	....	12.43	11.68	11.74
19	15.68	14.48	10.00	13.45	10.98	....	12.02	11.28	10.91
26	16.04	14.97	10.60	14.04	11.96	....	12.62	11.80	11.25
Nov. 2	16.63	15.67	11.53	14.38	12.55	....	13.38	12.32	11.78
9	15.95	14.95	11.15	14.22	12.13	....	12.80	11.78	11.23
16	15.23	14.39	10.59	13.91	11.88	....	11.75	10.78	9.91
23	15.83	15.01	11.13	14.22	12.38	....	12.14	11.29	9.88
30	15.27	14.61	10.94	14.00	12.38	....	12.03	11.13	9.78

TABLE 67.—*Sheep: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

CHICAGO—Continued.

Week ending—	Lambs.					Spring lambs, good and choice.	Yearlings.		
	Choice and prime.	Medium and good.	Culls.	Feeders. Good and choice.	Feeders. Common and medium.		Choice and prime.	Medium and good.	Feeders, good and choice.
1918.									
Dec. 7	$15.26	$14.63	$10.98	$14.15	$12.58	....	$12.43	$11.35	$10 15
14	15.47	14.75	11.03	14.10	12 68	....	12.90	11.59	10.38
21	14.78	14.02	10.68	13.65	12.23	....	12.36	11.25	....
28	15.18	14.41	11.13	14.06	12.75	....	12.79	11.56	....
1919.									
Jan. 4	16.34	15.54	12.20	14.28	13.25	....	13.86	12.51	10.75
11	17.11	16.14	12.80	14.75	13.60	....	14.46	13.11	....
18	16.61	15.74	12.55	14.79	13.70	....	14.42	13.05	....
25	16.31	15.56	12.53	14.87	13.75	....	14.28	12.92	....
Feb. 1	16.57	15.84	12.98	14.88	13.75	....	14.60	13.22	....
8	17.06	16.22	13.33	14.88	13.75	....	14.92	13.35	....
15	17.41	16.43	13.78	15.28	14.18	....	15.39	13.79	....
22	18.20	17.24	14.53	16.32	15.43	....	16.23	14.60	....
Mar. 1	18.63	17.78	14.88	16.79	15.89	....	16.91	15.27	....
8	19.45	18.71	15.85	17.59	16.78	....	17.95	16.23	....

Week ending—	Wethers.			Ewes.			
	Choice and prime.	Medium and good.	Feeders, good and choice.	Choice and prime.	Medium and good.	Culls.	Breeding, good and choice.
1918.							
June 1	....	....	....	....	....	....	....
8	....	....	....	....	....	....	....
15	....	....	....	$14.35	$12.98	$7.25	$13.33
22	....	....	....	13.15	11.60	6.83	....
29	....	....	....	12.00	10.58	6.50	....
July 6	$13.47	$12.63	$11.84	12.53	10.89	6.66	15.00
13	13.70	12.88	12.00	13.02	11.55	7.15	15.05
20	14.00	13.13	11.75	13.13	11.63	7.25	15.25
27	14.00	13.23	11.80	13.23	11.83	7.10	15.35
Aug. 3	14.08	13.25	11.88	13.34	11.95	7.00	15.38
10	14.21	13.38	11.88	13.55	12.18	7.00	15.68
17	14.26	13.50	11.70	13.50	12.35	7.00	15.53
24	13.64	13.02	10.75	13.00	11.97	6.80	15.35
31	12.94	12.33	10.90	12.35	11.40	6.75	15.38
Sept. 7	12.70	12.09	11.28	11.78	10.91	6.06	15.34
14	12.69	12.16	11.58	11.85	10.95	6.00	15.05
21	12.93	12.43	11.84	11.88	10.88	6.00	15.13
28	12.75	12.08	11.80	11.65	10.65	5.90	15.10
Oct. 5	11.69	11.04	11.05	10.70	9.78	5.40	14.68
12	11.18	10.57	10.56	10.35	9.58	5.25	13.98
19	10.88	10.20	9.95	10.18	9.30	5.25	12.80
26	11.30	10.68	10.15	10.23	9.33	5.35	12.75
Nov. 2	11.68	11.16	10.50	10.38	9.63	5.75	12.75
9	10.84	10.30	9.95	9.77	9.10	5.23	....
16	10.18	9.55	8.84	9.13	8.38	4.63	....
23	10.51	9.99	9.10	9.33	8.58	4.88	....
30	10.31	9.79	8.75	9.19	8.59	4.88	....
Dec. 7	10.65	10.06	9.00	9.35	8.63	5.13	....
14	11.04	10.33	9.38	9.54	8.68	5.33	....
21	10.44	9.87	....	9.21	8.35	5.30	....
28	10.63	10.16	....	9.63	8.81	5.53	....
1919.							
Jan. 4	11.41	10.74	....	10.43	9.48	6.20	....
11	11.82	11.06	....	10.80	9.90	6.33	....
18	11.62	10.89	....	10.63	9.78	6.30	....
25	11.58	10.86	....	10.52	9.77	6.28	....
Feb. 1	11.81	11.15	....	10.78	10.02	6.45	....
8	11.93	11.28	....	10.89	10.14	6.60	....
15	12.30	11.63	....	11.38	10.50	6.93	....
22	12.98	12.35	....	12.09	10.89	7.00	....
Mar. 1	13.52	12.88	....	12.62	11.34	7.05	....
8	14.45	13.83	....	13.51	12.15	7.35	....

TABLE 67.—*Sheep: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

CHICAGO—Continued.

Week ending—	Lambs.			Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes.		Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.	Feeder ewes, medium to good.[1]
	Medium to prime (84 lbs. down).	Medium to prime (85 lbs. up).	Culls and common.				Medium to choice.	Culls and common.			
1919.											
Mar. 15	$19.73	$19.07	$16.19	....	$17.21	$14.57	$13.20	$7.71	....	$17.32	....
22	19.78	19.50	16.78	....	17.28	15.61	13.41	8.68	....	17.67	....
29	19.25	19.08	16.10	....	17.19	15.93	13.50	8.70	....	17.66	....
Apr. 5	19.37	19.12	15.95	....	17.45	16.20	13.80	9.05	....	16.93	....
12	18.88	18.70	15.85	....	17.10	16.10	13.93	9.13	....	16.38	....
19	18.99	18.81	15.96	....	16.93	15.85	13.78	9.03	....	16.13	....
26	18.74	18.50	15.40	$19.75	16.69	15.69	13.65	8.90	....	16.13	....
May 3	18.74	18.46	15.05	19.75	16.68	15.88	13.65	8.93	....	....	....
10	18.95	18.73	15.13	19.29	17.00	15.91	13.89	9.10	....	....	....
17	14.47	14.24	11.58	17.88	12.80	11.83	11.13	7.55	....	....	....
24	14.10	13.77	10.85	17.80	12.10	11.05	10.55	7.10	....	....	....
31	14.61	14.21	11.28	18.34	12.33	11.19	10.31	7.06	....	....	....
June 7	14.08	13.85	10.65	17.78	11.80	10.55	9.23	6.05	....	....	....
14	14.17	14.05	10.55	17.58	11.60	9.78	8.25	5.20	....	....	....
21	17.38	....	12.45	....	13.83	9.95	8.20	5.20	$10.18	....	....
28	16.18	....	11.30	....	11.90	9.05	7.28	4.18	10.25	....	....
July 5	16.41	....	11.69	....	12.19	9.16	7.81	4.53	10.41	....	....
12	16.17	....	11.75	....	12.35	9.48	8.13	4.75	10.50	11.75	....
19	16.62	....	12.45	....	12.40	9.91	8.43	4.88	10.80	12.80	....
26	16.07	....	11.93	....	12.23	9.96	8.40	4.88	11.45	13.57	....
Aug. 2	15.08	....	10.50	....	11.55	9.48	8.10	4.63	11.40	13.23	....
9	15.22	....	10.83	....	11.20	9.63	8.05	4.68	11.38	13.13	....
16	16.00	....	11.98	....	11.63	9.93	8.50	5.00	11.70	13.63	....
23	16.63	....	12.30	....	11.93	10.50	8.83	5.20	11.80	14.20	....
30	15.10	....	10.83	....	11.23	10.03	8.33	5.00	11.58	14.00	....
Sept. 6	13.76	....	9.83	....	10.75	9.30	7.88	4.48	11.30	13.03	....
13	14.85	....	10.90	....	11.55	9.48	7.93	4.50	11.40	13.05	....
20	14.03	....	10.13	....	10.35	8.90	7.30	4.25	10.23	11.83	....
27	13.85	....	9.93	....	9.83	8.65	6.73	3.88	9.88	11.13	....
Oct. 4	14.70	....	11.00	....	10.40	9.08	7.20	4.45	10.13	11.98	....
11	14.54	....	10.83	....	10.37	9.13	7.13	4.55	10.00	12.10	....
18	13.98	....	10.35	....	9.86	9.38	6.89	4.53	9.53	11.53	....
25	14.25	....	10.53	....	11.70	9.44	7.40	4.70	9.45	11.98	....
Nov. 1	13.76	....	10.24	....	10.70	9.56	7.45	4.75	9.63	11.88	....
8	13.51	....	10.18	....	10.83	9.73	7.40	4.75	9.48	11.88	....
15	13.55	....	10.32	....	10.69	9.53	7.60	4.80	9.13	11.88	....
22	13.64	....	10.45	....	11.08	9.74	7.71	4.88	8.98	12.03	....
29	13.92	....	10.75	....	11.28	9.88	7.80	4.91	8.88	12.37	....
Dec. 6	15.23	....	11.95	....	12.68	10.63	8.49	5.68	9.08	13.08	....
13	15.59	....	12.43	....	13.06	10.68	8.79	5.88	9.13	13.52	....
20	16.13	....	13.05	....	13.41	10.53	8.90	6.00	....	14.03	....
27	16.84	....	13.53	....	13.45	10.50	9.19	6.16	....	14.00	....
1920.											
Jan. 3	17.18	....	13.68	....	13.96	10.95	9.60	6.30	....	14.80	....
10	17.93	....	14.63	....	14.75	11.49	9.95	6.65	....	15.74	....
17	18.39	....	15.20	....	15.58	12.26	10.50	6.85	....	16.48	....
24	18.96	....	15.85	....	16.43	13.03	10.88	7.40	....	17.05	....
31	20.33	....	17.33	....	17.87	14.32	12.03	8.60	....	18.20	....
Feb. 7	18.89	....	15.85	....	16.81	14.00	11.80	8.23	....	17.35	....
14	19.88	....	16.58	....	17.19	14.73	12.48	8.43	....	17.38	......
21	19.65	....	16.13	....	17.23	14.53	12.50	8.30	....	17.25	....
28	19.05	....	15.63	....	17.03	14.78	12.88	8.38	....	17.18	....
Mar. 6	18.74	....	15.55	....	16.65	14.75	12.78	8.38	....	16.60	....
13	18.56	....	15.48	....	16.48	14.75	12.73	8.38	....	16.38	....
20	18.09	....	15.33	....	16.30	14.75	12.53	8.20	....	16.25	....
27	18.85	....	15.68	....	16.53	14.85	12.98	8.35	....	16.25	....
Apr. 3	19.13	....	16.00	....	16.75	14.88	13.00	8.38	....	16.50	....
10	19.33	....	16.21	....	16.96	14.98	13.00	8.38	....	16.50	....
17	19.88	....	16.79	....	17.44	15.33	13.19	8.50	....	17.00	....
24	18.21	....	14.70	....	15.45	13.75	12.00	8.00	....	14.00	....
May 1	17.45	....	13.63	....	15.05	13.75	12.00	8.00	....	14.00	....
8	17.49	....	13.50	....	14.68	12.10	11.40	7.30	....	13.30	....
15	17.84	17.31	13.90	19.00	14.88	12.00	11.48	6.93	....	13.25	....
22	16.50	16.00	12.85	17.33	13.70	11.23	10.90	6.73	....	12.85	....
29	16.15	15.55	12.23	16.30	13.28	10.63	9.78	6.10	....	12.48	....

[1] Classification adopted January, 1920.

TABLE 67.—*Sheep: Weekly average price per 100 pounds, 1918 to 1920.*—Continued.

CHICAGO—Continued.

Week ending—	Lambs.			Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes.		Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.	Feeder ewes, medium to good.[1]
	Medium to prime (84 lbs. down).	Medium to prime (85 lbs. up).	Culls and common.				Medium to choice.	Culls and common.			
1920.											
June 5....	$15.53	$15.00	$11.45	$15.73	$12.18	$9.00	$8.15	$4.75	....	$11.45	....
12....	15.55	15.05	11.43	15.53	11.40	8.55	6.96	4.50	....	11.22	....
19....	15.60	15.44	11.95	16.50	13.13	8.53	6.95	4.60	....	11.35	....
26....	15.50	....	12.19	....	12.80	8.20	6.83	4.40	$8.50	12.24	....
July 3....	14.73	....	10.45	....	12.40	7.90	6.50	3.90	8.10	11.80	....
10....	14.06	....	9.25	....	10.81	7.34	6.31	3.63	7.63	12.03	....
17....	15.00	....	10.45	....	11.80	8.80	7.63	4.45	8.65	12.58	....
24....	14.53	....	10.15	....	11.80	8.85	7.53	4.40	8.70	12.93	....
31....	14.07	....	9.85	....	11.10	8.75	7.50	4.40	8.55	12.43	....
Aug. 7....	13.48	....	9.63	....	10.83	8.83	7.68	4.50	8.70	11.35	....
14....	12.66	....	9.25	....	9.80	8.45	7.29	4.35	8.60	11.39	....
21....	11.84	....	8.63	....	8.70	7.52	6.51	3.85	8.35	11.57	....
28....	12.87	....	9.48	....	9.38	7.78	6.82	4.15	8.45	12.32	....
Sept. 4....	13.01	....	9.75	....	9.65	7.81	6.75	4.15	8.28	12.55	....
11....	13.24	....	10.03	....	9.84	7.94	6.59	4.16	8.38	12.91	$5.28
18....	13.44	....	10.30	....	9.98	8.03	6.49	4.30	8.40	13.09	5.38
25....	12.53	....	9.53	....	9.54	7.53	5.73	3.88	7.78	12.84	5.13
Oct. 2....	12.43	....	9.43	....	9.48	7.56	5.49	3.63	7.53	12.45	5.00
9....	11.92	....	8.75	....	8.95	7.35	5.20	3.28	6.75	11.41	4.50
16....	11.76	....	8.75	....	9.35	7.38	5.38	3.38	6.75	11.60	4.60
23....	11.35	....	8.73	....	9.33	7.43	5.40	3.38	6.78	11.62	4.60
30....	12.10	....	9.58	....	10.35	7.94	6.10	3.75	6.95	12.43	4.70
Nov. 6....	12.55	....	10.13	....	10.76	8.30	6.50	4.30	7.15	12.78	5.08
13....	11.70	....	9.78	....	10.10	7.30	5.83	3.93	6.98	12.40	5.00
20....	11.46	....	9.30	....	9.53	6.83	5.10	3.50	6.33	12.15	4.35
27....	10.66	....	8.56	....	8.41	6.25	4.38	2.75	5.50	10.81	3.63
Dec. 4....	11.93	....	9.55	....	9.45	6.53	4.71	2.95	5.30	10.38	3.63
11....	10.98	....	8.88	....	8.83	5.80	4.66	2.80	5.25	10.38	3.63
18....	11.01	....	8.78	....	8.55	5.87	4.83	2.98	5.15	10.05	3.58
25....	10.35	....	8.00	....	7.64	5.06	3.93	2.30	4.75	9.35	3.25
1921.											
an. 1....	11.30	....	9.15	....	9.03	5.70	4.45	2.55	4.65	9.38	3.1[illegible]
KANSAS CITY.											
1919.											
Mar. 22....	$19.25	$19.25	$16.85	....	$17.18	....	$13.51	$9.73	$14.33	$16.88	....
29....	18.69	18.69	15.90	....	16.83	....	13.14	9.08	14.03	16.55	....
Apr. 5....	18.68	18.59	15.73	....	16.86	....	14.00	10.40	14 20	16.30	....
12....	18.35	18.08	14.86	....	16.45	....	13 78	9.19	14.09	16.25	....
19....	18.26	17.85	14.93	$18.00	16.30	....	13.78	9.03	14.00	16.29	....
26....	17.90	17.54	13.93	17.20	15.89	....	13.18	8.85	13.45	16.03	....
May 3....	17.79	17.30	13.63	16.75	15.50	....	12.88	8.13	13.25	16.00	....
10....	18.49	17.97	13.97	17.00	15.75	....	12.88	8.13	13.25	16.00	....
17....	17.43	17.00	13.30	16.25	14.70	....	11.28	7.53	13.25	14.90	....
24....	14.08	13.73	10.70	15.77	12.48	....	8.75	5.47	12.00	12.75	....
31....	13.87	13.56	10.44	15.86	12.19	....	8.84	5.56	....	12.69	....
June 7....	13.55	13.28	10.45	15.98	11.78	$9.03	8 38	5.38	....	....	....
14....	13.85	13.48	10.65	16.66	11.98	9.30	8.28	5.38	....	....	....
21....	16.38	....	13.30	....	12.43	9.65	8.25	5.53	13.50	....	....
28....	15.27	....	11.95	....	11.43	8.58	6.90	4 28	13.30	....	....
July 5....	14.78	....	11.19	....	10.88	8.00	5.94	3.47	13.00	....	....
12....	15.09	....	11.55	....	10.95	8.00	5.88	3.38	13.00	....	....
19....	15.53	....	11.58	....	11.23	8.73	6.88	3.93	13.00	....	....
26....	14.86	....	10.73	....	11.25	9.25	7.00	4.00	13.80	14.03	....
Aug. 2....	14.43	....	10.23	....	10.18	9.25	7.50	4 00	12.45	13.63	....
9....	14.05	....	9.90	....	10.18	9.25	7.35	4.00	12.25	13.63	....
16....	14.72	....	10.08	....	10.85	9.38	7.25	4.00	12 30	13.50	....
23....	14.90	....	10.13	....	11.13	9.35	7.08	3.95	12.43	13.50	....
30....	13.63	....	9.40	....	10.30	8.83	7.28	4.43	12.00	13.50	....
Sept. 6....	12.75	....	8.50	....	9.90	8.18	7.15	4.45	11.40	12 93	....
13....	13.74	....	8.95	....	10.25	8.23	7.68	4.58	11.28	12.83	....
20....	13 78	....	9.78	....	10.00	7.93	7.45	4.60	11.35	12.35	....
27....	13 53	....	9.68	....	9.50	7.70	6.78	4.35	11.25	11.38	....
Oct. 4....	14.21	....	10.03	....	9.50	7.63	6.40	4.20	10.50	11.80	....
11....	14.50	....	10.25	....	9.70	7.88	6.50	4.25	10.50	12.00	....
18....	13.98	....	10.13	....	9.85	8.20	6.51	4.25	10.50	11.70	....
25....	14.20	....	10.13	....	9.75	8.38	6.82	4.38	10.50	11.35	....

[1] Classification adopted January, 1920.

TABLE 67.—*Sheep: Weekly average price per 100 pounds, 1918 to 1920.*—Continued.

KANSAS CITY—Continued.

Week ending—	Lambs. Medium to prime (84 lbs. down).	Lambs. Medium to prime (85 lbs. up).	Lambs. Culls and common.	Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes. Medium to choice.	Ewes. Culls and common.	Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.	Feeder ewes, medium to good.[1]
1919											
Nov. 1	$14.22	....	$10.18	....	$10.10	$8.90	$6.80	$4.38	$10.70	$11.38	....
8	13.83	....	9.73	....	10.15	8.93	6.88	4.38	10.55	11.88	....
15	13.53	....	10.15	....	10.38	9.10	7.00	4.38	9.73	12.00	....
22	13.83	....	10.50	....	10.98	9.38	7.13	4.38	9.75	12.08	....
29	14.06	....	10.75	....	10.88	9.44	7.22	4.38	9.50	11.94	....
Dec. 6	15.08	....	11.50	....	11.68	10.43	7.60	4.60	9.50	12.23	....
13	15.13	....	11.52	....	12.13	10.63	7.96	4.90	9.80	12.45	....
20	15.86	....	11.98	....	12.73	11.18	8.68	5.33	9.75	12.65	....
27	16.31	....	12.41	....	13.38	11.19	8.84	5.50	9.63	13.00	....
1920.											
Jan. 3	16.90	....	12.91	....	13.98	11.57	9.09	5.73	10.00	13.33	....
10	17.73	....	13.57	....	14.71	11.92	9.46	5.98	10.85	14.98	....
17	18.65	....	14.23	....	15.28	12.30	10.29	6.70	11.20	15.95	....
24	18.16	....	13.32	....	15.33	12.73	10.69	7.00	11.25	16.18	....
31	19.25	....	14.93	....	16.45	13.49	11.65	7.68	11.25	16.63	....
Feb. 7	18.47	....	14.58	....	16.20	12.83	11.25	7.36	11.13	16.18	....
14	18.73	....	14.55	....	16.68	12.80	11.78	7.64	11.13	16.24	....
21	18.75	....	14.55	....	16.75	12.88	11.88	7.75	11.00	16.93	....
28	18.66	....	14.53	....	16.75	13.13	12.13	7.88	11.00	16.58	....
Mar. 6	18.10	....	14.25	....	16.55	13.38	12.38	8.00	11.75	16.05	....
13	17.75	....	14.16	....	16.18	13.25	12.58	8.10	12.20	15.75	....
20	17.47	....	14.08	....	15.83	12.88	12.44	8.13	12.55	15.35	....
27	18.19	....	14.43	....	16.13	13.25	12.88	8.38	12.65	15.25	....
Apr. 3	18.94	....	15.63	....	16.40	13.70	13.18	8.53	12.75	15.60	....
10	18.98	....	15.63	....	16.63	13.88	13.38	8.63	12.75	16.13	....
17	18.83	....	15.71	....	16.75	14.38	13.63	8.75	....	16.13	....
24	19.47	....	16.25	....	16.80	14.38	13.63	8.75	....	....	....
May 1	18.43	....	15.70	....	16.35	13.83	13.18	8.65	....	....	....
8	17.20	....	14.70	....	15.18	9.32	8.48	6.05	....	....	....
15	17.63	....	14.88	$18.79	15.30	10.53	9.35	6.35	....	....	....
22	15.30	....	12.88	15.53	13.28	9.80	8.48	5.85	....	....	....
29	13.88	....	11.38	14.69	11.88	9.45	8.03	5.38	....	....	....
June 5	13.75	....	11.25	14.99	11.63	9.11	7.89	5.23	....	....	....
12	13.79	....	10.90	15.35	11.48	8.92	7.58	4.83	....	....	....
19	13.53	....	9.68	15.34	12.00	9.75	7.40	4.50	....	....	....
26	13.53	....	9.05	....	12.03	8.90	6.50	4.10	9.00	10.50	....
July 3	13.30	....	8.80	....	11.38	7.75	6.08	3.78	8.48	10.05	....
10	12.75	....	8.31	....	10.25	7.00	5.75	3.25	7.25	8.88	....
17	13.13	....	8.60	....	10.85	7.63	6.38	3.38	8.05	9.68	....
24	12.68	....	8.63	....	10.88	7.63	6.38	3.38	8.13	9.85	....
31	12.58	....	8.45	....	10.35	7.55	6.38	3.38	8.13	10.10	....
Aug. 7	11.60	....	7.80	....	9.80	7.50	6.38	3.38	8.23	10.25	....
14	10.85	....	7.30	....	9.00	7.43	6.25	3.38	8.60	10.23	....
21	10.33	....	7.00	....	7.80	6.93	5.78	3.23	7.63	10.50	....
28	11.01	....	7.50	....	8.08	6.90	5.78	3.20	7.63	10.70	....
Sept. 4	11.44	....	7.90	....	8.18	7.03	5.90	3.38	7.63	11.18	....
11	11.82	....	8.06	....	8.50	7.16	5.97	3.38	8.25	11.69	$5.25
18	12.19	....	8.35	....	8.75	6.98	5.80	3.38	8.20	11.80	5.25
25	11.35	....	7.88	....	8.18	6.58	5.35	3.18	7.55	11.68	4.63
Oct. 2	11.04	....	7.60	....	7.98	6.50	5.23	3.25	7.33	11.30	4.63
9	10.59	....	7.40	....	7.80	6.25	4.83	3.03	6.80	10.45	4.18
16	10.95	....	7.88	....	8.30	6.33	4.78	2.95	6.50	10.63	4.03
23	10.90	....	7.88	....	8.50	6.50	4.89	3.00	6.50	10.83	4.13
30	11.34	....	8.38	....	8.90	7.10	5.36	3.25	6.75	10.52	4.33
Nov. 6	11.99	....	8.98	....	10.00	7.97	6.38	3.95	6.98	10.95	4.70
13	11.00	....	8.28	....	9.53	7.28	5.69	3.60	6.85	10.83	4.60
20	10.41	....	7.70	....	8.42	6.01	4.33	2.68	5.85	9.99	3.90
27	10.07	....	7.44	....	7.88	5.69	3.78	2.28	5.31	9.09	3.38
Dec. 4	10.64	....	7.83	....	8.50	5.88	4.30	2.73	5.13	8.20	3.38
11	9.79	....	7.28	....	8.01	5.66	4.06	2.53	4.97	8.08	3.25
18	10.29	....	7.56	....	8.34	5.73	4.50	2.84	4.66	8.10	3.06
25	9.38	....	6.75	....	7.59	4.97	3.64	2.13	4.25	7.43	2.88
1921.											
Jan. 1	10.04	....	7.48	....	8.21	5.05	3.75	2.00	4.25	7.22	2.88

[1] Classification adopted January, 1920.

TABLE 67.—*Sheep: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

OMAHA.

Week ending—	Lambs.			Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes.		Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.	Feeder ewes, medium to good.[1]
	Medium to prime (84 lbs. down).	Medium to prime (85 lbs. up).	Culls and common.				Medium to choice.	Culls and common.			
1919.											
May 3	$18.79	$18.04	$12.85	$19.38	$16.23	$15.40	$13.38	$7.70	....	....	....
10	19.74	19.18	14.20	19.21	16.60	15.63	13.63	8.00	....	....	....
17	15.29	14.50	10.65	17.98	13.28	12.58	11.58	8.00	....	....	....
24	13.98	13.13	10.60	17.90	12.50	11.35	10.55	8.03	....	....	....
31	14.08	13.23	11.00	18.04	12.13	11.19	9.89	7.69	....	....	....
June 7	14.20	13.48	11.18	17.85	11.90	10.75	9.65	7.43	....	....	....
14	15.25	14.43	11.93	18.15	12.48	10.60	9.65	7.20	....	....	....
21	17.52	....	13.70	....	13.75	9.75	8.43	5.93	$9.05	....	....
28	15.40	....	11.70	....	12.50	8.45	6.60	4.60	8.20	$12.00	....
July 5	15.50	....	11.63	....	12.25	8.75	6.59	4.56	9.00	12.25	....
12	16.08	....	12.00	....	12.25	9.15	7.28	4.88	9.05	12.55	....
19	16.88	....	12.25	....	12.50	9.83	8.25	5.68	10.68	13.43	....
26	16.54	....	12.10	....	12.18	9.97	8.65	6.00	10.85	13.73	....
Aug. 2	15.52	....	10.88	....	11.28	9.45	8.03	5.35	11.05	13.80	....
9	15.21	....	11.28	....	10.88	9.25	7.65	4.93	10.80	13.18	....
16	16.14	....	12.00	....	10.88	9.30	8.25	5.50	10.85	13.63	....
23	16.39	....	12.13	....	11.28	9.65	8.30	5.25	10.78	14.27	....
30	15.12	....	11.73	....	10.50	9.43	7.93	5.03	10.15	13.71	....
Sept. 6	13.58	....	9.90	....	8.98	8.25	7.07	4.38	9.33	12.63	....
13	14.48	....	10.38	....	9.20	8.20	7.15	4.25	9.85	12.10	....
20	13.64	....	9.60	....	8.90	7.78	6.60	3.78	9.50	10.38	....
27	13.63	....	9.55	....	9.08	7.98	6.28	3.88	9.50	10.30	....
Oct. 4	14.29	....	10.35	....	9.40	8.40	6.40	3.98	9.70	11.00	....
11	14.95	....	10.75	....	9.75	8.63	6.80	4.35	10.15	11.35	....
18	14.13	....	10.15	....	10.05	8.53	6.80	4.40	10.35	11.35	....
25	14.35	....	10.45	....	10.38	8.88	7.25	4.75	10.50	11.27	....
Nov. 1	14.23	....	10.40	....	10.53	9.08	7.55	5.15	10.50	11.18	....
8	14.09	....	10.18	....	10.50	9.33	7.77	5.37	10.50	11.25	....
15	14.09	....	10.38	....	10.89	9.50	8.04	5.63	10.50	11.63	....
22	13.78	....	10.55	....	10.76	9.30	7.55	5.10	10.50	11.75	....
29	14.11	....	10.94	....	10.94	9.69	7.69	5.24	10.50	11.75	....
Dec. 6	14.74	....	11.75	....	11.53	10.18	8.37	5.73	10.48	12.30	....
13	15.35	....	12.65	....	12.55	10.75	8.79	6.38	10.06	12.73	....
20	15.63	....	12.90	....	13.10	11.00	8.90	6.63	....	13.33	....
27	16.64	....	13.84	....	13.88	11.22	9.29	6.97	....	14.01	....
1920.											
Jan. 3	17.03	....	14.05	....	14.73	11.38	9.63	7.13	....	14.30	....
10	17.79	....	14.88	....	14.78	11.40	9.96	7.45	....	15.30	....
17	18.58	....	15.35	....	15.13	11.60	10.59	7.75	....	16.61	....
24	18.95	....	15.68	....	15.48	12.23	10.78	7.35	....	16.89	....
31	19.86	....	16.78	....	16.70	13.63	11.40	8.35	....	18.06	....
Feb. 7	18.95	....	16.30	....	16.08	13.25	10.98	8.03	....	17.39	....
14	19.22	....	16.18	....	16.13	13.25	11.50	8.33	....	17.23	....
21	19.24	....	16.10	....	16.25	13.45	12.07	8.80	....	16.98	....
28	18.78	....	15.58	....	16.13	13.25	12.15	8.88	....	16.53	....
Mar. 6	18.18	....	15.00	....	15.75	12.88	11.88	8.50	....	16.03	....
13	18.20	....	15.15	....	15.75	13.18	12.40	8.80	12.42	16.15	....
20	17.67	....	14.90	....	15.75	13.25	12.50	9.00	12.25	16.08	....
27	18.52	....	15.68	....	16.13	13.48	12.82	9.35	11.75	16.13	....
Apr. 3	19.25	....	16.30	23.50	16.65	14.50	13.53	8.60	12.00	16.50	....
10	18.93	....	15.94	....	16.63	14.88	13.34	8.00	12.00	16.44	....
17	18.98	....	16.00	....	17.19	15.25	13.75	8.50	12.25	16.69	....
24	17.56	17.21	14.70	....	14.75	12.60	11.93	7.75	....	14.90	....
May 1	17.44	17.01	14.55	....	14.75	12.75	11.75	7.50	....	14.90	....
8	17.69	17.25	14.50	19.63	14.75	12.55	11.55	7.45	....	14.75	....
15	17.58	17.07	14.40	19.23	14.65	12.10	11.00	7.20	....	14.08	....
22	16.15	15.67	13.05	16.98	13.33	11.03	9.55	6.58	....	12.35	....
29	15.58	14.93	12.50	16.08	12.63	10.38	9.00	5.80	....	12.25	....
June 5	16.98	14.83	12.30	16.05	12.40	9.90	8.70	5.50	....	12.20	....
12	15.20	14.75	11.85	15.78	11.38	9.30	7.75	4.75	....	11.75	....
19	15.23	14.81	12.23	16.09	12.55	8.88	7.35	4.25	....	11.73	....
26	15.34	....	12.05	....	12.60	7.93	6.50	3.65	....	11.75	....
July 3	14.42	....	11.25	....	12.08	7.88	6.15	3.60	....	11.83	....
10	13.86	....	9.94	....	10.50	7.13	5.44	2.94	8.00	11.66	....
17	14.88	....	10.30	....	10.98	7.75	6.45	3.65	8.40	12.15	....
24	13.88	....	9.60	....	11.05	7.95	6.55	3.80	8.44	11.49	....
31	13.88	....	9.69	....	10.98	8.25	6.85	4.00	8.50	12.15	....

[1] Classification adopted January, 1920.

TABLE 67.—*Sheep: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

OMAHA—Continued.

Week ending—	Lambs. Medium to prime (84 lbs. down).	Lambs. Medium to prime (85 lbs. up).	Lambs. Culls and common.	Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes. Medium to choice.	Ewes. Culls and common.	Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.	Feeder ewes, medium to good.
1920.											
Aug. 7	$12.60	....	$9.03	....	$9.83	$7.83	$6.40	$3.70	$8.20	$11.25	....
14	12.14	....	8.98	....	9.00	7.48	6.08	3.40	8.00	11.50	....
21	11.37	....	8.78	....	8.03	7.00	5.75	3.15	8.10	11.38	....
28	12.02	....	9.18	....	8.20	7.20	6.08	3.28	8.00	11.80	....
Sept. 4	12.46	....	9.38	....	8.35	7.50	6.13	3.88	8.00	11.93	....
11	12.61	....	9.48	....	8.55	7.62	6.12	3.43	8.10	12.29	$$5.63
18	12.82	....	9.78	....	8.75	7.75	6.05	3.45	8.13	12.41	5.63
25	12.28	....	9.48	....	8.70	7.18	5.60	3.33	8.00	12.06	5.38
Oct. 2	11.98	....	9.28	....	8.53	6.53	5.23	3.05	7.55	11.55	4.88
9	11.50	....	8.88	....	8.13	6.18	4.63	2.75	6.90	11.29	4.33
16	11.69	....	9.28	....	8.33	6.43	4.83	2.85	7.00	11.56	4.53
23	11.35	....	8.98	....	8.38	6.13	5.03	2.93	7.25	11.51	4.88
30	11.40	....	8.85	....	8.95	7.20	5.68	3.35	7.38	11.40	5.00
Nov. 6	11.80	....	9.18	....	9.75	7.88	6.28	3.83	7.08	10.95	4.75
13	11.33	....	9.00	....	9.05	7.40	5.83	3.55	6.85	10.88	4.63
20	10.73	....	8.58	....	8.15	6.35	4.89	2.85	6.33	10.56	4.08
27	10.13	....	8.13	....	7.56	5.88	4.25	2.44	5.44	9.11	3.19
Dec. 4	10.74	....	8.60	....	8.02	6.08	4.66	2.73	5.13	8.72	3.10
11	10.03	....	7.85	....	7.45	5.53	4.13	2.35	4.88	8.40	3.18
18	10.08	....	7.85	....	7.73	5.45	4.29	2.63	4.75	8.60	3.28
25	10.14	....	7.98	....	7.40	5.25	4.28	2.70	4.43	8.85	3.40
1921.											
Jan. 1	10.23	....	8.30	....	7.58	5.40	4.02	2.56	4.38	8.95	3.38

EAST ST. LOUIS.

Week ending—	Lambs. Medium to prime, 84 lbs. down.	Lambs. Medium to prime, 85 lbs. up.	Lambs. Culls and common.	Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes. Medium to choice.	Ewes. Culls and common.	Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.
1919.										
May 3	....	$15.38	$14.13	....	....	....	$12.25	$8.50	....	....
10	$15.88	16.03	13.75	$20.50	....	....	11.50	9.00	....	....
17	14.03	13.95	11.73	18.25	....	....	10.55	7.30	....	....
24	13.95	13.75	11.25	18.00	$11.00	....	10.05	7.00	....	....
31	13.93	13.33	10.90	17.79	....	....	9.74	7.00	....	....
June 7	13.56	12.38	10.00	17.03	....	....	8.95	6.45	....	....
14	13.25	13.25	10.50	17.01	....	....	8.05	5.90	....	....
21	16.79	....	11.44	....	13.25	....	8.00	5.42	....	....
28	15.32	....	9.75	....	12.00	$9.50	7.25	4.55	....	....
July 5	15.38	....	9.75	....	11.38	9.50	7.25	4.38	$11.50	....
12	15.38	....	9.71	....	10.63	9.50	7.77	4.58	11.83	....
19	15.69	....	9.29	....	10.50	9.50	8.33	4.67	12.00	....
26	15.38	....	8.40	....	10.50	9.50	8.75	4.55	12.00	....
Aug. 2	14.63	....	7.55	....	10.50	9.50	8.75	4.50	12.00	....
9	15.15	....	7.50	....	10.50	9.50	8.75	4.50	12.00	....
16	15.61	....	7.50	....	10.50	9.50	8.75	4.50	12.40	....
23	15.41	....	8.00	....	10.63	9.50	8.75	4.50	12.50	....
30	14.55	....	8.53	....	10.80	9.20	8.15	4.40	11.85	....
Sept. 6	13.33	....	9.05	....	10.00	8.50	7.00	4.20	10.65	....
13	14.13	....	9.00	....	10.00	8.50	7.00	4.25	11.00	....
20	13.50	....	8.75	....	10.00	8.50	6.90	4.15	10.30	....
27	13.20	....	8.75	....	10.00	8.50	6.10	3.95	9.05	....
Oct. 4	13.60	....	8.75	....	10.50	8.50	6.00	3.75	9.40	....
11	13.89	....	8.75	....	10.50	8.50	6.00	3.75	9.00	....
18	13.78	....	8.75	....	10.50	8.50	6.00	3.75	9.00	....
25	13.50	....	8.75	....	10.50	8.50	6.10	3.75	8.80	....
Nov. 1	13.73	....	8.95	....	11.10	9.00	6.50	3.95	8.00	....
8	13.60	....	9.00	....	11.00	9.05	6.50	4.00	8.00	....
15	13.58	....	9.00	....	11.10	9.00	6.50	4.00	....	....
22	13.58	....	9.00	....	11.13	9.00	6.53	4.00	....	....
29	13.63	....	9.00	....	11.13	9.08	6.58	4.00	....	....
Dec. 6	14.60	....	9.70	....	11.63	9.65	7.53	4.55	....	....
13	14.90	....	10.03	....	12.00	10.00	7.85	4.75	....	....
20	15.11	....	10.05	....	12.65	10.20	7.78	4.65	....	....
27	16.00	....	10.53	....	13.25	10.25	8.13	4.94	....	....

TABLE 67.—*Sheep: Weekly average price per 100 pounds, 1918 to 1920*—Continued.

EAST ST. LOUIS—Continued.

Week ending—	Lambs.			Spring lambs, medium to choice.	Yearling wethers, medium to prime.	Wethers, medium to prime.	Ewes.		Breeding ewes, full mouths to yearlings.	Feeder lambs, medium to choice.
	Medium to prime, 84 lbs. down.	Medium to prime, 85 lbs. up.	Culls and common.				Medium to choice.	Culls and common.		
1920.										
Jan. 3	$16.59		$11.09		$13.59	$10.38	$8.50	$5.25		
10	17.15		11.60		13.98	10.50	8.75	5.45		$14.00
17	17.83		13.60		14.88	11.05	9.83	6.25		14.70
24	18.09		14.00		15.46	11.35	10.15	6.38		15.30
31	19.11		14.88		16.54	12.90	11.05	6.78		16.23
Feb. 7	18.78		14.95		16.35	13.40	11.15	7.00		16.20
14	19.46		15.65		16.98	13.30	11.58	7.15		16.33
21	19.33		15.65		16.88	13.40	11.68	7.00		16.75
28	19.13		15.53		16.75	13.25	11.69	7.00		16.75
Mar. 6	18.85		15.45		16.63	13.55	12.05	7.00		16.75
13	18.64		15.25		16.38	13.50	12.13	7.00		
20	18.47		15.85		16.13	13.63	12.13	7.00		
27	18.53		16.43		16.20	13.63	12.13	7.00		
Apr. 3	18.95		16.75		16.40	13.63	12.13	7.00		
10	18.98		16.75		16.75	13.63	12.13	7.00		
17	18.93		16.75		16.75	13.63	12.13	7.00		
24	17.61		16.25	$20.00	16.00		13.00			
May 1	17.54		16.20	19.90	16.20	13.00	12.10			
8	17.30		15.95	19.80		11.70	10.33			
15	17.43		15.88	18.50		11.42	9.45			
22	16.20		15.00	16.88			9.35	5.25		
29	15.10		12.03	14.80			8.30	5.13		
June 5	15.19		11.09	13.63			8.00	5.22		
12	14.20		10.68	14.10			7.50	5.35		
19	15.00		11.83				7.30	5.23		
26	14.88		10.83				6.43	4.38	$7.50	
July 3	13.90		9.95				6.10	4.18	7.50	
10	13.75		9.44				5.53	3.91	7.50	
17	14.74		10.43				6.30	4.33	7.50	
24	13.90		10.08				7.00	5.13	7.50	
31	13.30		9.53				7.10	5.03	7.50	
Aug. 7	11.75		8.28				7.00	4.63	7.50	
14	11.45		8.03				6.90	4.60	7.50	
21	10.43		7.43				6.40	4.35	7.50	
28	11.48		8.13				6.48	4.13	7.30	
Sept. 4	11.83		8.45				6.25	4.03	6.83	
11	12.41		6.66				5.91	3.84	6.91	
18	12.23		7.45				5.83	3.55	6.75	
25	11.73		7.55				5.30	3.63	6.50	
Oct. 2	11.55		7.68				5.10	3.60	6.80	
9	10.98		7.50		9.13		5.00	3.50	6.80	
16	10.95		7.45		9.00		5.03	3.50	6.50	9.50
23	10.88		7.48		9.00		5.05	3.48	6.45	9.45
30	11.34		7.65		9.15		5.00	3.43	6.25	9.25
Nov. 6	12.03		8.25		11.00		5.50	3.43		
13	11.33		8.15		9.88		5.08	3 28		
20	11.13		7.98		9.73		4.48	2.98		
27	10.13		7.25		8.58		4.25	2.66		
Dec. 4	10.88		7.70		9.38		4.35	2.88		
11	9.93		7.10		8.30		4.28	2.70		
18	10.05		7.05		8.33	6.25	4.26	2.78		
25	9.25		6.25		7.75		3.44	2.13		
1921.										
Jan. 1	10.41		6.94		8.66	5.50	3.69	2.22		

TABLE 68.—*Lambs: Weekly range of prices per 100 pounds, Chicago, Mar. 22, 1919, to Dec. 31, 1920.*[1]

Week ending.	Price.	Week ending.	Price.	Week ending.	Price.	Week ending.	Price.
1919.		1919.		1920.		1920.	
Mar. 22	$18.65–$21.00	Sept. 6	$12.00–$15.25	Feb. 7	$17.00–$21.00	July 24	$12.50–$16.50
29	18.00– 20.50	13	13.50– 16.25	14	18.00– 21.65	31	12.00– 16.25
Apr. 5	18.00– 20.50	20	12.00– 15.75	21	18.00– 21.50	Aug. 7	12.00– 15.40
12	17.75– 20.35	27	12.25– 15.50	28	17.50– 20.75	14	10.75– 14.50
19	18.00– 20.10	Oct. 4	12.75– 16.15	Mar. 6	17.25– 20.30	21	10.50– 13.35
26	17.75– 19.85	11	12.75– 16.25	13	17.00– 20.00	28	10.75– 14.85
May 3	17.75– 20.00	18	12.25– 15.75	20	16.75– 19.50	Sept. 4	11.50– 14.75
10	17.25– 20.50	25	12.50– 16.00	27	17.25– 20.50	11	12.00– 14.50
17	13.50– 15.25	Nov. 1	12.00– 15.50	Apr. 3	17.75– 20.50	18	12.00– 14.75
24	13.25– 15.25	8	12.00– 15.00	10	17.75– 20.75	25	11.00– 14.00
31	13.50– 15.75	15	12.00– 15.10	17	18.00– 21.75	Oct. 2	10.50– 14.00
June 7	12.25– 15.60	22	12.25– 15.00	24	17.00– 19.25	9	10.25– 13.50
14	12.50– 15.85	29	12.50– 15.25	May 1	16.25– 19.00	16	10.00– 13.40
21	15.00– 19.25	Dec. 6	13.75– 16.50	8	16.25– 19.10	23	9.75– 13.00
28	14.50– 17.50	13	14.25– 17.00	15	16.50– 19.40	30	9.75– 13.75
July 5	15.00– 17.75	20	14.75– 17.35	22	15.25– 17.75	Nov. 6	11.00– 14.00
12	14.75– 17.50	27	15.25– 18.50	29	15.00– 17.50	13	10.75– 12.75
19	14.75– 18.25			June 5	13.50– 17.50	20	10.50– 12.65
26	14.00– 18.00	1920.		12	13.50– 17.25	27	10.00– 11.50
Aug. 2	13.00– 17.25	Jan. 3	15.50– 18.85	19	13.00– 18.00	Dec. 4	10.50– 13.25
9	13.25– 17.25	10	16.00– 19.65	26	13.00– 17.50	11	10.00– 12.00
16	14.00– 18.25	17	16.75– 19.75	July 3	11.50– 17.50	18	8.75– 12.50
23	14.50– 18.50	24	17.25– 20.50	10	11.50– 16.25	25	8.75– 11.75
30	12.25– 17.50	31	19.00– 21.65	17	13.00– 16.75	Jan. 1, '21	9.00– 13.00

[1] Prices given are for lambs 84 pounds down.

TABLE 69.—*Horses and mules: Yearly receipts at principal markets and number on farms, 1900 to 1920.*

[In thousands; i. e., 000 omitted.]

Year.	Receipts at principal markets.[1]										Number on farms January 1.		
	Chicago.	Kansas City.	Omaha.	St. Paul.	East St. Louis.	Fort Worth.	Denver.	Sioux City.	St. Joseph.	Total.	Horses.	Mules.	Total.
1900....	99	103	60	27	145	(2)	23	31	13	501	18,267	3,265	21,532
1901....	109	97	36	15	129	(2)	17	18	23	444	16,745	2,864	19,609
1902....	102	77	42	8	109	5	24	19	20	406	16,531	2,757	19,288
1903....	101	67	53	8	129	10	19	12	20	419	16,557	2,728	19,285
1904....	106	68	47	6	181	18	13	4	29	472	16,736	2,758	19,494
1905....	127	66	45	6	178	18	16	15	32	503	17,058	2,889	19,947
1906....	127	70	42	9	166	21	17	19	28	499	18,719	3,404	22,123
1907....	102	62	44	15	117	19	11	16	27	413	19,747	3,817	23,564
1908....	92	56	40	7	109	12	11	13	23	363	19,992	3,869	23,861
1909....	91	68	32	6	112	21	15	15	23	383	20,640	4,053	24,693
1910....	83	70	30	5	130	34	16	16	28	412	19,833	4,210	24,043
1911....	105	85	32	8	171	37	18	17	42	515	20,277	4,323	24,600
1912....	93	73	33	5	164	49	15	10	39	481	20,509	4,362	24,871
1913....	91	82	32	5	157	57	16	10	32	482	20,567	4,386	24,953
1914....	106	87	31	6	148	48	17	10	25	478	20,962	4,449	25,411
1915....	165	102	42	10	271	55	72	22	41	780	21,195	4,479	25,674
1916....	205	123	27	12	267	79	53	17	27	810	21,159	4,593	25,752
1917....	107	128	33	10	280	115	20	29	34	756	21,210	4,723	25,933
1918....	88	85	22	7	242	79	15	23	39	600	21,555	4,873	26,428
1919....	46	83	25	11	250	60	23	16	43	557	21,482	4,954	26,436
1920....	43	72	19	10	143	45	18	23	30	403	21,109	4,995	25,826

[1] Compiled from yearbooks of the stockyard companies.
[2] Not in operation.

TABLE 70.—*Horses and mules: Monthly receipts, 1910 to 1920.*[1]

[In thousands; i. e., 000 omitted.]

CHICAGO.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	9	10	9	9	7	11	13	11	6	4	4	8
February	10	12	12	11	10	12	16	6	6	4	6	10
March	11	14	13	13	14	15	17	11	8	5	7	12
April	8	12	12	14	12	11	15	8	6	4	3	10
May	8	13	8	9	8	14	18	8	6	4	5	9
June	5	7	7	6	7	15	18	7	11	4	3	8
July	5	7	5	4	4	12	19	8	10	3	2	7
August	5	7	6	5	4	15	24	5	9	3	4	8
September	6	7	6	6	8	18	21	7	6	4	3	8
October	6	7	6	5	5	18	19	11	8	3	2	8
November	5	5	5	5	15	14	14	16	9	5	2	9
December	5	4	4	4	12	10	11	9	3	3	2	6
Total	83	105	93	91	106	165	205	107	88	46	43	103

KANSAS CITY.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	10	14	8	12	12	17	8	15	14	8	14	12
February	7	11	12	9	8	12	5	15	12	7	15	10
March	6	10	9	9	8	13	5	14	12	6	8	9
April	6	6	7	6	7	14	7	13	2	5	3	7
May	4	5	5	5	6	11	8	5	2	3	4	5
June	3	3	3	3	3	5	7	3	2	3	3	3
July	3	3	2	3	2	4	11	4	2	4	3	4
August	4	7	5	5	2	3	14	4	5	8	10	6
September	5	7	5	8	9	4	13	10	10	11	6	8
October	8	8	6	8	6	7	17	14	12	9	4	9
November	8	6	5	7	14	7	13	18	8	12	1	9
December	6	5	6	7	10	5	15	13	4	7	1	7
Total	70	85	73	82	87	102	123	128	85	83	72	90

EAST ST. LOUIS.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	19	31	20	24	27	26	26	25	34	25	33	26
February	11	20	24	15	17	30	20	15	33	20	24	21
March	11	17	16	13	14	26	18	17	28	15	17	17
April	7	10	15	9	11	24	15	13	7	11	11	12
May	5	10	7	8	9	26	21	8	5	7	5	10
June	5	7	7	7	6	26	16	7	6	11	6	9
July	5	8	8	6	4	21	26	16	9	16	9	12
August	8	14	11	9	4	17	23	14	18	22	15	14
September	12	18	16	15	10	14	27	31	32	38	10	20
October	16	18	15	17	14	27	31	51	30	33	7	24
November	16	9	10	15	18	17	22	48	25	31	3	19
December	15	9	15	19	14	17	22	35	16	19	3	17
Total	130	171	164	157	148	271	267	280	243	248	143	202

[1] Prior to 1915, compiled from yearbooks of the stockyard companies.

TABLE 71.—*Horses and mules: Yearly receipts at public stockyards, 1915 to 1920.*

Market.	1915	1916	1917	1918	1919	1920
Albany	....	6,014	3,303	....	....	....
Amarillo	5,006	14,390	13,367	14,655	15,014	12,804
Atlanta	....	....	....	78,160	60,327	25,931
Augusta	....	....	23,125	33,219	22,089	7,055
Baltimore	3,956	13,901	7,442	8,670	4,961	4,313
Billings	....	3	777	1,363	1,841	760
Boston	3,237	8,106	627	253	276	....
Buffalo	12,280	56,482	16,515	10,034	18,594	22,526
Cheyenne	....	....	5,539	3,824	2,076	1,782
Chicago	165,253	205,449	107,311	87,820	45,762	43,020
Cincinnati	30,425	19,671	27,279	18,521	18,880	14,181
Cleveland	....	....	9,060	4,320	5,260	5,580

TABLE 71.—*Horses and mules: Yearly receipts at public stockyards, 1915 to 1920*—Contd.

Market.	1915	1916	1917	1918	1919	1920
Columbia	...	1,356	1,351	1,271	1,174	817
Columbus	...	32	100	2,035	1,224	224
Dallas, Tex	...	...	...	58	...	...
Dayton, Ohio	...	221	58	71	47	...
Denver	71,870	52,800	19,758	14,599	22,936	17,591
Detroit	...	...	13,755	3,544	1,835	2,584
Dublin	...	...	...	245	13	26
East St. Louis	270,612	266,818	279,837	241,751	250,311	143,425
El Paso	7,892	23,385	15,052	9,126	16,295	13,931
Emeryville	...	...	...	20	...	...
Erie, Pa	...	...	...	1,608	761	1,706
Evansville	...	658	993	1,080	1,135	962
Fort Worth	53,640	79,209	115,233	78,881	60,363	45,362
Indianapolis	28,203	29,144	61,692	19,608	9,080	8,814
Jacksonville	...	526	131	...	18	16
Jersey City	62,122	154,721	70,268	42,185	10,574	2,624
Kansas City	102,153	123,141	127,823	84,628	82,852	71,797
Knoxville	7,040	7,378	8,254	6,430	7,214	4,160
Lafayette	35	...	...	...	...	...
Lancaster	1,017	1,417	8,342	11,228	2,068	3,132
Logansport	...	1,068	...	...	...	52
Louisville	2,800	5,200	14,127	16,967	11,274	9,031
Marion	...	...	...	141	977	2,444
Memphis	...	39,816	60,848	33,116	32,598	8,006
Milwaukee	1,126	1,714	1,849	2,185	1,879	2,246
Mobile	27	...	...	...	...	...
Montgomery	...	...	7,169	24,102	22,291	11,969
Nashville	...	15,855	74,280	103,818	97,425	29,572
Nebraska City	...	...	...	83	342	244
New Brighton	3,870	616	809	1,097	9,489	3,653
New Orleans	...	852	2,614	556	368	1,254
New York	17,447	8,529	7,574	307	1,952	1,723
Ogden, Utah	...	...	25,425	18,809	6,467	5,630
Oklahoma, Okla	36,954	47,381	62,306	12,687	9,951	5,847
Omaha	11,679	27,486	32,781	32,212	25,201	18,751
Paseo	...	...	...	159	380	303
Peoria	389	764	637	125	171	535
Philadelphia	7,214	11,002	9,892	7,800	7,222	5,792
Pittsburgh	48,340	53,505	39,073	35,265	17,992	20,472
Portland	4,668	2,904	6,933	2,483	2,308	1,887
Pueblo	8,359	8,250	6,665	3,798	3,812	3,563
Richmond	...	17,514	25,004	23,970	25,100	16,167
St. Joseph	41,254	27,206	33,584	39,260	43,380	29,768
St. Louis	3,577	2,108	1,968	930	...	...
St. Paul	10,091	11,777	9,959	6,541	11,228	10,488
Salt Lake City	...	1,785	1,981	1,573	1,484	1,641
San Antonio	14,094	41,105	31,898	29,955	29,881	24,573
Seattle	...	20	...	420	923	671
Sioux City	21,742	16,717	29,391	23,306	16,272	23,238
Sioux Falls	...	...	49	243	253	176
Spokane	3,657	6,493	7,125	4,733	2,926	2,535
Tacoma	...	20	...	12	63	...
Toledo	...	1,336	1,969	1,789	2,788	4,558
Washington, D. C	...	178	1,556	396	30	60
Watertown	...	44,514	22,084	6,578	1,440	...
Wichita	14,472	17,146	19,312	11,150	16,750	24,714
Total	1,106,501	1,477,983	1,475,849	1,215,776	1,067,597	727,006

TABLE 72.—*Horses and mules: Combined monthly and yearly receipts at public stockyards, 1915 to 1920.*

[In thousands; i. e., 000 omitted.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1915	97	95	95	88	98	103	94	74	85	110	97	70	1,107
1916	118	105	111	84	120	104	162	138	139	153	129	115	1,478
1917	148	95	117	93	68	63	83	58	129	236	223	163	1,476
1918	161	149	133	44	36	45	54	84	129	162	145	76	1,216
1919	115	87	71	53	37	43	53	92	148	130	146	93	1,068
1920	146	112	87	50	43	34	38	75	62	40	23	17	727

TABLE 73.—*Western dressed fresh meats: Beef, lamb, and mutton—Monthly average wholesale price per 100 pounds, 1917 to 1920.*

CHICAGO.

Month.	Beef.										Lamb and mutton.										
	Steer.				Cow.			Bull.			Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	Choice	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1919.																					
July	$22.38	$20.94	$18.65	$15.18	$17.39	$15.58	$13.39	......	......	$12.42	$28.40	$26.94	$23.72	$19.96	$25.26	$22.68	$18.90	$17.50	$15.69	$13.46	......
August	24.43	22.64	18.68	13.60	......	14.24	11.94	......	......	11.30	28.89	27.01	23.16	18.11	22.36	18.63	......	18.03	15.99	13.64	......
September	23.83	21.35	17.11	12.74	......	13.15	10.81	......	......	9.60	24.88	23.09	19.72	15.67	19.33	16.57	......	15.81	13.59	11.26	......
October	25.58	23.47	18.81	13.43	14.98	13.32	11.07	......	......	9.72	24.09	22.17	19.87	16.75	18.70	16.70	......	13.97	11.74	9.96	......
November	26.54	23.26	17.76	12.51	14.47	12.56	10.35	......	......	9.05	23.51	21.12	19.01	16.22	18.63	16.42	......	14.69	12.39	10.11	......
December	26.14	22.38	17.33	13.27	15.01	13.35	11.60	......	......	9.35	24.66	23.14	20.94	18.33	20.80	18.75	......	15.01	12.58	10.61	......
1920.																					
January	......	21.61	17.79	15.16	16.88	15.21	13.49	......	......	11.03	31.36	30.38	28.38	26.08	28.10	26.44	......	19.49	17.15	14.76	......
February	......	19.64	16.59	14.74	15.80	14.09	12.88	......	......	11.04	33.53	32.23	30.47	27.59	29.96	26.88	......	22.95	20.25	17.55	......
March	......	20.05	17.87	16.26	16.72	15.38	14.31	......	......	10.50	31.35	29.38	27.57	25.04	27.82	25.35	......	23.66	21.51	18.91	......
April	......	20.63	18.90	17.13	17.46	16.39	15.31	......	......	11.75	33.65	31.95	30.45	27.45	......	......	......	26.58	24.78	22.10	......
May	21.00	19.70	18.50	16.89	17.64	16.43	15.35	......	......	12.49	33.40	31.10	29.55	26.85	......	......	......	22.95	21.53	19.78	......
June	24.38	22.90	21.37	19.34	19.42	18.20	16.58	......	......	12.44	32.47	29.81	27.40	25.16	......	......	......	19.06	16.98	15.46	$31.26
July	26.10	23.69	20.38	16.81	19.39	17.81	15.51	......	......	12.15	33.71	31.10	27.40	22.75	27.95	25.20	22.13	14.83	13.00	11.13	......
August	26.76	24.18	19.03	15.25	17.98	16.25	13.70	......	......	11.08	30.03	27.68	24.60	20.55	24.83	22.25	19.65	14.60	12.60	10.60	......
September	28.05	25.02	20.63	16.56	17.95	15.74	12.86	......	......	10.71	28.62	26.38	24.12	21.16	23.14	20.90	18.40	13.54	11.54	9.82	......
October	27.64	23.50	18.48	14.48	16.48	14.48	12.00	......	......	10.15	25.00	23.20	21.18	18.10	19.80	17.80	15.73	11.35	9.65	8.65	......
November	27.65	23.73	18.66	14.35	15.89	14.11	11.88	......	......	9.98	26.81	24.59	21.96	18.56	20.08	18.15	15.95	12.65	9.83	8.50	......
December	23.88	20.02	16.38	12.26	13.38	11.54	10.26	......	......	9.72	24.36	22.26	19.98	16.96	17.98	16.82	14.82	11.86	9.24	7.74	......

NEW YORK.

Month.	Steer Choice.	Steer Good.	Steer Medium.	Steer Common.	Cow Good.	Cow Medium.	Cow Common.	Bull Good.	Bull Medium.	Bull Common.	Lamb Choice	Lamb Good.	Lamb Medium.	Lamb Common.	Yearling Good.	Yearling Medium.	Yearling Common.	Mutton Good.	Mutton Medium.	Mutton Common.	Spring lamb.
1917.																					
March	$15.72	$14.84	$14.18	$13.52	$14.39	$13.37	$12.53	$12.75	$12.44	$12.13	......	......	......	......	......	......	......	......	......	......	......
April	16.68	15.94	15.22	14.31	15.18	14.46	13.54	13.85	13.50	13.14	......	......	......	......	......	......	......	......	......	......	......
May	16.78	16.24	15.67	14.22	......	14.91	14.17	14.84	14.51	14.24	......	......	......	......	......	......	......	......	......	......	......
June	17.05	16.59	15.99	14.59	......	14.93	14.12	14.42	13.69	13.12	......	......	......	......	......	......	......	......	......	......	......
July	18.07	17.43	16.22	13.77	15.08	14.11	12.86	14.11	12.88	11.85	$22.03	$20.78	$19.42	$17.15	$19.20	$17.68	$14.84	$18.25	$16.46	$14.15	......
August	20.12	18.90	16.52	13.87	14.95	13.65	12.61	14.50	12.50	10.97	23.88	23.00	22.01	20.09	......	......	......	20.00	18.23	15.65	......
September	22.25	20.35	17.44	14.60	15.59	14.75	13.62	14.69	13.07	11.92	26.35	25.44	24.35	22.64	......	......	......	21.37	20.00	18.44	......

October	22.50	19.33	15.98	13.38	14.84	13.75	12.63	14.03	12.52	11.71	24.60	23.74	22.76	20.60	21.11	19.53	......	20.38	19.18	17.88	......
November	......	18.89	16.20	13.79	14.69	13.63	12.50	......	12.38	11.75	22.88	22.10	20.77	18.78	20.00	18.78	......	19.14	17.95	16.43	......
December	20.60	18.58	17.05	15.42	15.69	14.95	14.12	14.94	13.41	12.54	24.60	23.84	22.91	21.13	21.50	......	......	20.65	19.28	17.84	......
1918.																					
January	18.95	17.90	17.00	15.68	15.78	15.08	14.30	......	15.12	14.43	24.92	23.90	22.78	21.13	......	......	......	20.49	18.92	17.40	......
February	18.23	17.55	16.82	15.97	15.85	15.16	14.21	......	15.38	14.56	22.89	22.05	20.74	......	......	......	......	19.94	18.61	17.15	......
March	18.38	17.89	17.26	16.43	16.33	15.55	14.77	15.54	14.75	13.93	25.85	24.90	23.83	21.83	22.60	......	......	21.39	20.01	17.55	......
April	21.94	21.41	20.74	19.75	19.79	19.00	18.09	18.44	17.76	17.03	28.84	27.85	26.61	......	26.00	......	......	25.29	24.08	......	......
May	24.16	23.58	22.80	21.56	21.77	20.71	19.25	19.23	18.15	17.17	29.02	28.31	27.54	26.84	27.97	26.88	......	26.12	25.07	23.21	......
June	25.98	25.39	24.60	22.58	22.84	21.89	20.31	20.49	18.95	17.79	28.58	27.63	26.46	25.30	25.34	24.49	......	23.93	22.78	21.46	$30.63
July	25.95	24.20	21.63	18.18	20.73	18.26	15.38	16.93	15.74	14.41	26.54	25.18	26.60	21.13	......	......	......	24.35	22.51	19.26	27.03
August	27.24	25.21	22.15	18.33	21.24	18.30	15.91	17.14	15.32	14.08	27.75	26.56	25.08	22.49	......	......	......	23.61	21.43	18.15	......
September	28.31	26.53	22.99	19.11	22.16	19.55	17.18	18.20	16.36	14.95	27.93	26.73	24.89	22.14	......	......	......	21.65	20.23	17.61	......
October	27.84	25.04	19.38	15.45	17.83	15.43	13.89	......	14.51	13.08	23.13	21.68	20.10	18.05	......	......	......	16.84	15.26	12.46	......
November	27.83	25.91	22.54	19.43	20.60	18.85	17.15	18.00	15.98	14.65	26.01	25.07	23.33	21.27	......	......	......	19.00	16.42	13.72	......
December	26.24	23.88	20.95	17.72	18.48	16.34	14.76	......	14.47	13.24	22.71	21.60	20.41	17.98	......	......	......	15.72	13.78	11.11	......
1919.																					
January	26.58	25.13	22.98	19.73	19.90	18.08	16.32	15.88	14.62	13.49	27.83	26.17	24.55	22.37	22.07	20.85	......	18.59	17.19	15.62	......
February	26.13	25.16	23.79	21.36	21.39	19.55	18.00	15.96	14.94	13.74	29.75	28.68	27.63	26.27	22.40	20.75	19.33	20.40	18.98	17.43	......
March	25.63	24.81	23.25	20.63	21.80	20.32	18.58	17.44	16.20	15.26	32.82	31.80	30.80	29.68	26.78	25.36	24.09	23.36	21.92	20.12	......
April	......	24.43	23.09	20.91	20.91	19.44	18.02	17.87	16.48	15.20	32.38	30.49	29.36	28.16	27.08	25.84	24.35	25.15	23.84	22.12	......
May	25.00	23.26	21.80	20.18	21.00	19.06	18.03	18.41	16.84	15.76	29.75	27.70	26.02	24.77	24.85	......	......	20.64	19.29	18.78	31.17
June	......	18.83	16.80	15.03	......	15.39	14.28	......	14.58	13.25	28.43	27.15	25.93	23.18	......	......	......	18.43	16.43	14.63	30.15
July	22.64	20.96	18.03	15.99	17.93	15.59	13.68	17.17	14.72	12.78	26.85	25.24	22.44	19.10	23.05	21.08	......	18.79	16.94	14.26	......
August	24.35	22.05	18.13	13.80	......	13.98	11.75	......	13.13	10.65	27.66	25.23	20.98	17.03	......	18.53	......	17.50	15.28	12.68	......
September	23.25	21.28	18.10	14.76	......	14.28	12.73	......	......	10.23	23.99	21.75	19.34	17.03	......	16.91	......	15.09	13.54	11.34	......
October	25.71	23.58	19.44	15.03	16.25	14.80	13.02	......	......	10.06	24.42	22.80	20.74	18.24	......	16.50	......	16.08	14.16	11.98	......
November	......	23.60	19.14	14.89	15.51	14.28	13.02	......	......	9.40	23.16	21.80	20.33	18.20	......	......	......	15.47	14.08	11.38	......
December	23.70	20.61	18.10	15.22	15.77	14.26	13.18	......	11.50	9.77	26.14	24.10	22.00	19.68	......	......	......	15.49	14.06	11.02	......
1920.																					
January	......	21.28	18.63	16.33	17.05	15.45	14.33	14.39	12.61	11.36	30.33	27.68	24.60	22.25	......	......	......	18.10	15.78	12.70	......
February	......	18.58	17.02	15.13	15.02	14.10	12.88	14.22	12.98	12.14	33.94	32.18	29.51	26.41	......	......	......	21.77	19.05	16.59	......
March	......	19.64	18.03	16.82	16.74	15.46	14.29	13.53	12.09	11.22	29.88	27.72	25.42	23.76	......	......	......	21.42	19.08	15.62	......
April	......	21.94	20.00	17.23	18.90	16.98	15.35	......	15.99	13.33	37.43	35.25	30.45	28.03	......	......	......	27.75	25.50	22.44	......
May	......	19.00	17.75	15.75	16.96	15.48	13.93	......	15.34	13.43	32.15	30.25	27.70	24.83	......	......	......	20.31	18.78	15.58	......
June	......	24.82	22.22	19.23	19.81	17.82	15.33	......	16.54	14.24	31.33	28.00	25.03	21.91	......	......	......	18.61	16.77	13.52	34.16
July	26.17	24.94	20.81	16.27	......	17.55	14.69	......	......	11.85	33.30	29.83	25.88	20.13	29.30	......	......	22.97	20.00	15.72	......
August	26.74	23.78	20.13	16.48	......	16.88	14.33	......	......	12.60	28.25	25.98	22.53	18.28	......	19.60	......	16.28	15.10	11.39	......
September	27.68	23.66	19.88	17.22	......	16.06	14.08	......	13.19	11.87	28.82	26.66	24.02	20.18	......	......	......	15.07	13.68	10.28	......
October	27.61	22.00	17.33	14.57	14.72	13.39	12.03	......	......	11.00	25.78	23.15	20.73	15.66	19.17	18.23	......	13.82	12.19	9.48	......
November	27.00	21.08	17.36	14.81	15.50	13.85	13.00	......	12.60	11.41	27.22	25.30	22.85	18.59	21.63	19.10	......	14.53	13.20	10.05	......
December	......	18.20	15.50	12.92	12.98	11.82	10.68	......	......	9.45	26.24	24.34	22.38	18.34	22.13	19.74	......	12.24	10.84	8.90	......

TABLE 73.—*Western dressed fresh meats: Beef, lamb, and mutton—Monthly average wholesale price per 100 pounds, 1917 to 1920*—Continued.

PHILADELPHIA.

Month.	Beef.										Lamb and mutton.										
	Steer.				Cow.			Bull.			Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1917.																					
March	$15.79	$14.81	$14.00	$13.52	......	$13.51	$12.74	$12.70	$12.33	$11.96	......	......	......	......	......	......	......	......	......	......	......
April	16.71	15.86	15.09	14.51	$15.43	14.31	13.47	13.73	13.32	12.90	......	......	......	......	......	......	......	......	......	......	......
May	16.98	16.11	15.44	14.86	......	14.85	13.96	14.44	14.04	13.63	......	......	......	......	......	......	......	......	......	......	......
June	17.09	16.51	15.77	14.74	14.75	14.56	13.66	14.43	13.43	12.81	......	......	......	......	......	......	......	......	......	......	......
July	18.05	17.39	16.11	13.66	14.95	13.95	12.77	14.54	12.51	11.72	$23.49	$22.41	$20.86	$18.48	$19.63	$18.18	$15.68	$19.13	$17.16	$14.61	......
August	19.46	18.35	16.26	13.44	14.85	13.17	11.84	......	11.69	10.49	23.64	22.57	20.82	17.43	20.17	......	......	19.84	18.14	......	......
September	23.38	20.60	17.59	14.31	15.38	13.84	12.51	......	12.50	11.41	25.49	24.60	22.66	19.55	22.25	20.75	......	21.18	19.80	17.25	......
October	24.22	19.36	15.63	12.85	13.91	13.15	11.93	......	12.39	11.59	24.44	23.44	21.54	19.18	20.78	19.59	......	18.91	17.83	15.76	......
November	22.25	18.42	16.04	13.35	13.85	13.24	12.11	......	12.29	11.43	23.33	22.35	20.63	17.10	19.45	18.36	......	17.78	16.75	14.23	......
December	22.64	18.67	16.75	14.90	15.12	14.42	13.17	......	13.14	12.21	22.97	21.71	20.35	18.96	19.64	18.76	......	18.28	17.43	15.49	......
1918.																					
January	20.00	18.69	17.23	15.58	15.77	14.94	14.12	......	14.51	13.86	23.71	22.71	21.85	20.18	19.83	18.79	......	18.40	17.36	15.02	......
February	18.94	17.97	16.86	15.70	15.58	14.94	14.10	......	14.94	14.34	22.57	21.49	20.48	......	20.35	19.17	......	18.72	17.23	15.18	......
March	18.82	17.96	17.19	16.25	16.09	15.03	14.06	15.00	13.86	13.20	24.95	23.95	22.73	21.78	21.65	......	......	19.61	18.60	15.90	......
April	22.14	21.41	20.86	19.95	19.84	19.14	18.18	17.89	17.08	16.31	28.74	27.93	27.23	......	25.79	......	......	24.42	......	......	......
May	25.08	24.20	23.19	21.67	21.32	20.15	18.56	19.35	18.28	17.08	28.81	27.76	26.85	24.38	26.81	......	......	24.64	22.75	......	......
June	26.74	25.89	24.88	22.88	23.15	21.99	19.93	19.62	18.42	17.51	29.77	28.73	27.55	25.67	27.13	25.92	......	24.01	22.62	20.78	$31.75
July	26.47	24.86	21.49	17.92	19.51	17.35	14.99	......	16.44	14.39	28.94	26.60	23.67	20.83	25.54	24.00	......	23.38	21.13	18.27	29.97
August	27.52	25.61	22.28	17.93	21.85	18.13	15.85	16.50	14.83	13.75	29.90	27.85	25.40	22.63	25.88	......	......	24.43	21.93	19.40	......
September	28.79	26.38	22.61	19.18	20.43	18.51	16.98	17.50	15.81	14.69	27.50	25.15	22.98	20.30	......	......	......	21.07	19.18	17.24	......
October	28.91	26.50	20.48	16.38	17.84	15.78	14.06	16.25	14.57	12.98	24.76	22.92	21.18	19.42	......	......	......	17.47	15.12	13.02	......
November	28.95	26.50	22.05	17.70	19.16	17.03	15.35	16.33	15.50	13.62	25.15	23.76	22.29	20.91	21.25	19.50	......	19.35	16.91	14.15	......
December	28.43	25.25	21.29	17.31	18.65	15.88	14.48	......	15.12	13.32	23.85	22.38	21.20	19.58	19.69	17.28	......	16.45	14.00	11.28	......
1919.																					
January	27.98	25.74	22.70	19.76	20.46	18.33	16.16	16.35	15.28	14.14	28.09	26.78	25.55	23.50	23.92	21.92	......	20.35	17.95	15.48	......
February	27.21	24.95	23.40	21.15	22.05	19.98	18.03	17.57	15.41	14.30	30.77	29.28	27.68	25.89	23.94	22.57	......	22.35	19.78	17.53	......
March	26.88	25.24	24.25	22.28	23.50	21.63	19.00	18.14	16.25	14.70	33.28	31.85	29.43	27.64	......	......	......	24.73	22.73	29.68	......
April	27.00	24.90	23.86	21.94	22.00	21.06	19.18	18.54	17.38	15.50	32.75	31.78	30.78	29.62	31.00	30.00	......	25.68	24.42	22.12	......
May	......	24.29	22.91	20.08	21.50	20.46	18.69	19.17	17.25	15.55	31.33	29.86	28.55	26.38	28.30	26.67	25.50	22.57	21.16	19.20	......
June	......	20.86	18.73	15.78	16.30	14.88	13.35	15.17	13.90	12.40	30.63	29.30	27.54	23.72	27.47	......	......	21.28	19.35	16.73	31.38
July	......	22.33	19.58	17.06	17.47	15.99	14.68	15.83	14.53	13.36	26.69	25.07	23.01	19.30	22.72	20.03	19.19	19.01	17.41	14.92	......

August	24.73	22.90	19.10	16.05	16.17	14.60	12.75		12.38	10.79	29.24	27.68	25.05	21.30		21.34		18.71	16.43	13.43	
September	24.67	22.82	17.02	14.46	15.00	13.62	11.74		11.00	9.94	24.22	22.49	20.73	18.40		19.18		15.98	14.50	12.37	
October	26.44	23.78	19.78	15.88	16.26	14.91	13.14			10.11	25.11	23.78	22.02	20.26	20.58			16.80	15.22	13.26	
November		23.67	19.08	14.68	15.23	13.78	12.35			9.93	24.20	22.98	21.10	18.53				15.44	13.80	11.81	
December		22.76	18.77	14.78	15.77	14.10	13.06			9.82	26.49	24.93	23.39	20.69	20.58	18.92		15.85	14.43	12.63	
1920.																					
January		20.93	18.88	16.83	17.07	15.95	14.78		13.83	11.63	31.57	30.13	28.35	24.95				18.94	17.10	14.43	
February		18.18	16.76	15.68	16.00	14.70	13.70		13.88	11.35	34.35	33.16	31.15	29.04				22.48	20.03	17.88	
March		19.73	18.71	17.70	17.10	15.98	15.10		13.73	11.30	31.63	30.02	28.26	26.36	30.50	29.50		22.68	20.12	17.10	
April		21.48	20.23	18.71		18.00	16.75		14.75	14.50	36.21	34.60	31.74	28.90	31.98			28.23	25.50	22.57	
May		19.33	18.05	16.90			15.10		14.50	13.08	34.46	32.75	30.80	27.68	31.91			21.05	19.38	17.64	
June		24.68	22.06	19.58		18.60	17.38			13.28	34.65	32.65	30.18	26.87				22.35	19.63	16.97	35.61
July		25.38	21.40	16.56		16.53	14.11			11.22	33.18	30.23	28.10	24.56				22.25	18.63	15.46	
August	26.28	24.35	20.75	16.93	18.00	16.38	14.83			11.93	29.81	27.53	24.90	21.73				18.94	16.63	13.85	
September	27.53	25.04	21.50	17.57		16.76	15.05			12.18	30.39	28.51	26.67	23.50		24.00	20.88	18.60	16.06	12.90	
October	27.00	22.48	18.56	15.25	15.75	14.33	12.59			10.84	27.53	26.06	24.53	21.01				16.43	14.50	12.22	
November		21.37	18.24	15.44	15.53	14.53	13.23			11.25	29.89	28.22	25.99	21.24	24.48			17.93	15.98	13.50	
December		18.46	15.96	13.00	13.81	12.50	11.24			9.00	27.79	25.86	23.74	20.85	22.17			14.58	12.92	10.76	

BOSTON.

1917.																					
March	$15.50	$14.75			$13.79	$13.29	$12.63	$12.17	$11.94	$11.70											
April	16.44	15.86	$15.03	$14.25	15.30	14.81	13.82	13.65	13.35	13.05											
May	16.47	16.07	15.99		15.51	15.09	14.39	14.44	14.12	13.79											
June	16.59	16.33	16.11	13.30	15.47	15.08	14.27	14.37	14.26	13.55											
July	17.78	17.22	16.38	13.51	14.89	14.20	12.61	13.75	12.97	11.72	$23.68	$22.51	$20.28	$16.85	$16.83	$15.69		$16.10	$14.75	$11.26	$23.57
August	19.86	18.89	17.01	14.09	14.78	13.52	12.32	13.96	12.05	11.09	25.83	24.24	22.14	18.28	18.97	17.88		20.40	18.97		
September	22.27	20.60	17.27	15.40	15.01	14.12	13.02		12.41	11.54	25.74	24.68	23.15		20.27	18.69		20.90	19.75	17.88	
October	21.33	17.99	15.58		13.72	12.82			11.52		24.94	24.13	23.13		19.37	16.96	$14.01	18.63	17.51		
November	20.21	16.61	14.76		13.60	12.68	11.86	12.25	11.50		24.58	23.06	21.59		19.61	15.75	13.21	17.53	16.34		
December	20.02	18.15	16.74	16.05	15.04	14.33	13.53	12.63	11.98		23.67	22.36	20.52		19.05	15.62	12.38	18.29	17.43		
1918.																					
January	17.89	17.38	16.81		15.29	14.74	14.01	14.02	13.49		24.14	22.81	21.21		20.01	16.79	14.78	18.95	18.30		
February	18.06	17.68	17.19		15.82	15.18		14.59	14.10		23.54	22.13	19.92			16.95	15.17	18.64	17.77		
March	17.89	17.61	17.39		16.10	15.51	14.93	13.91	13.57		24.50	23.31	21.48		20.11	17.43	15.21	20.23	19.26		
April	21.23	20.98	20.78		19.50	18.94	18.01	17.62	17.22		27.84	26.89	25.56		24.08	21.81		24.42			
May	23.43	23.21	23.08		21.11	19.73	18.63	17.49	16.91		28.39	27.07	25.97			22.48		25.47			
June	25.12	24.96	24.31	20.69	23.00	21.88	19.39	20.56	19.24	17.77	28.94	27.75	26.42		24.61	22.30	20.42	25.20	22.58	19.23	30.67
July	25.54	25.09	22.38	17.82	20.98	17.56	15.39	15.86	14.89	14.26	29.14	27.80	25.85	22.01	23.60	20.73	14.38	24.60	23.51		29.79
August	27.23	26.23	23.30	20.50	22.38	17.90	16.20	15.19	14.26	13.66	29.14	27.93	26.26	21.64	24.06	22.45	16.35	21.81	19.88		
September	27.54	25.81	22.55	20.63	19.71	17.80	16.59		15.43	14.50	27.38	26.02	24.37	21.04	22.25	19.68	15.10	20.16	18.01	15.92	
October	27.78	25.12	22.06	19.88	18.02	16.06	14.73		13.79	13.16	24.26	23.32	22.32	20.65	21.05			17.48	16.14	14.50	
November	27.93	25.85	23.17	20.49	18.62	16.73	15.92	15.23	14.56	14.05	24.78	23.93	22.38	20.75	21.22	15.17	13.00	17.13	15.50	14.50	
December	27.35	24.60	22.26	19.79	16.90	14.93	14.22	14.63	14.03	13.56	23.03	22.08	21.04	19.25	18.86	13.96	11.95	15.18	14.01	12.63	

TABLE 73.—*Western dressed fresh meats: Beef, lamb, and mutton—Monthly average wholesale price per 100 pounds, 1917 to 1920*—Continued.

BOSTON—Continued.

Month.	Beef.										Lamb and mutton.										
	Steer.				Cow.			Bull.			Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1919.																					
January	$26.62	$25.13	$22.48	$20.12	$18.90	$16.37	$15.48	$14.82	$14.07	$13.30	$26.61	$25.74	$24.54	......	$22.17	......	......	$17.33	$15.53	$13.69	......
February	25.91	24.81	22.66	19.25	20.37	18.78	17.79	15.62	14.59	13.74	29.19	28.49	27.48	$26.06	23.46	$18.06	$16.79	19.01	17.46	15.54	......
March	25.94	24.86	23.84	......	21.53	19.83	18.41	17.03	16.19	15.41	30.96	30.14	29.25	27.39	......	23.17	20.63	22.25	20.43	18.63	......
April	24.68	23.86	23.22	22.17	21.55	20.38	19.30	17.70	15.72	15.03	30.19	29.48	28.66	27.81	27.76	25.00	23.09	25.41	24.06	22.53	......
May	23.03	22.37	21.77	20.30	20.29	19.34	18.16	17.76	16.84	15.86	28.42	27.48	26.23	24.82	25.58	20.39	18.25	21.33	19.91	18.67	......
June	19.03	18.33	17.29	16.44	16.10	14.64	13.25	14.01	13.08	12.35	29.23	28.41	26.93	24.53	22.19	......	......	17.55	16.25	13.60	$30.83
July	21.50	20.78	19.20	17.65	18.07	16.48	15.25	16.81	15.08	14.16	28.43	27.51	25.39	20.82	21.32	18.51	14.98	17.58	14.90	12.63	......
August	22.99	21.41	18.13	15.58	......	13.79	12.63	......	11.80	9.68	28.15	27.00	24.43	20.68	20.14	17.90	15.46	16.57	15.28	13.03	......
September	22.85	21.21	18.54	16.07	......	13.75	12.79	......	......	9.90	24.12	22.80	21.60	20.00	16.90	14.98	12.94	......	12.53	11.09	......
October	24.26	22.46	19.08	15.12	15.40	13.75	12.78	......	11.71	11.02	24.24	23.52	22.50	20.96	18.08	15.66	......	16.59	14.00	11.57	......
November	24.50	21.68	17.73	14.06	14.80	12.92	12.12	......	11.00	9.39	22.48	21.63	20.79	18.98	18.10	15.04	......	12.41	11.26	9.60	......
December	24.39	21.79	18.75	15.57	15.09	13.66	12.80	......	11.97	10.87	24.03	23.20	22.06	20.29	18.42	16.48	......	13.07	11.42	10.20	......
1920.																					
January	......	20.60	19.03	17.38	16.54	15.46	14.75	14.15	13.26	12.56	29.51	28.68	27.66	25.98	......	......	......	16.23	14.80	13.40	......
February	......	19.36	18.15	17.41	15.69	14.67	13.74	13.18	12.53	11.80	32.65	32.07	31.13	29.48	......	......	......	20.34	18.42	16.99	......
March	......	19.52	18.57	17.91	16.85	16.01	15.33	13.44	12.62	11.59	30.05	29.13	28.16	27.06	......	......	......	20.87	18.55	16.88	......
April	......	21.78	20.88	19.73	19.79	19.15	18.01	15.41	14.62	13.55	35.15	34.32	33.28	31.18	......	......	......	......	......	......	......
May	......	18.42	17.61	16.73	16.76	16.25	15.51	......	14.38	13.47	31.71	30.38	28.78	26.40	......	......	......	22.34	21.05	......	......
June	......	24.24	22.83	20.92	21.26	20.06	18.83	......	18.04	16.19	31.05	29.31	26.75	23.90	24.10	22.93	20.63	17.94	15.77	13.19	32.53
July	......	23.76	21.70	19.30	20.22	18.41	17.25	......	14.63	12.97	33.64	32.50	30.73	27.11	27.17	24.11	......	19.58	15.81	13.00	......
August	27.25	25.78	22.95	19.49	......	16.41	15.08	......	14.25	12.01	29.33	27.48	24.68	21.43	25.70	21.78	18.63	16.85	15.10	12.78	......
September	27.60	26.01	21.52	18.30	17.00	15.54	14.51	......	13.55	11.84	28.09	26.92	24.21	20.55	21.67	19.38	......	15.06	12.78	10.92	......
October	27.11	24.62	18.90	16.05	15.75	14.38	13.71	......	......	......	25.96	24.39	21.57	18.92	20.04	18.40	......	14.52	12.50	10.35	......
November	......	22.42	17.98	16.18	15.25	14.26	13.50	......	......	......	27.34	26.15	23.56	......	21.25	19.25	......	15.97	13.99	11.24	......
December	21.51	18.45	15.65	13.97	12.82	11.66	10.94	......	10.75	9.94	26.01	24.98	22.62	......	20.12	18.03	......	12.32	10.58	8.76	......

TABLE 74.—*Western dressed fresh meats: Pork cuts and veal—Monthly average wholesale price per 100 pounds, 1919 and 1920.*

CHICAGO.

Month.	Pork cuts.										Veal.			
	Loins.				Shoulders, skinned.	Picnics.			Butts.					
	8 to 10 pounds.	10 to 12 pounds.	12 to 14 pounds.	14 pounds and over.		4 to 6 pounds.	6 to 8 pounds.	8 pounds and over.	Boneless.	Boston style.	Choice.	Good.	Medium.	Common.
1919.														
July	$34.58	$32.75	$30.77	$28.74	$26.42	$26.00	$25.50	$24.50	$32.13	$28.70	$28.97	$27.44	$23.98	$19.95
August	37.13	35.34	32.70	30.18	27.81	26.35	25.74	24.74	33.78	31.43	30.16	28.06	24.58	19.03
September	38.05	35.95	32.70	27.67	26.65	23.74	22.95	21.93	33.97	32.35	30.63	28.63	23.90	16.88
October	34.35	32.24	29.10	25.11	23.19	17.94	17.28	16.64	32.87	27.47	28.82	26.47	22.25	15.88
November	29.37	28.30	26.86	25.07	21.43	20.15	19.15	18.01	......	23.98	27.32	24.81	20.80	17.04
December	24.83	24.20	23.32	22.13	19.80	19.79	18.92	17.25	......	21.34	25.81	23.26	20.04	16.51
1920.														
January	25.14	24.31	22.78	21.35	19.51	19.53	18.53	17.10	......	21.56	28.48	26.85	24.51	21.46
February	26.88	25.88	24.03	22.26	20.05	19.47	18.48	17.29	......	22.96	28.11	26.67	24.57	21.69
March	30.13	28.81	26.47	24.24	21.46	19.08	17.96	16.94	......	24.98	28.17	26.05	23.41	20.30
April	34.60	32.80	30.58	28.50	22.70	20.29	19.26	18.23	......	28.18	26.23	24.23	21.59	18.85
May	28.33	26.98	25.63	23.88	20.30	19.32	18.17	17.02	......	23.83	22.03	20.00	18.00	15.93
June	27.79	26.19	24.19	22.02	20.26	20.17	18.97	17.77	......	22.09	23.74	22.25	20.67	17.86
July	34.45	32.63	29.75	26.16	21.61	20.70	19.70	18.70	......	24.93	24.93	23.18	20.63	18.80
August	36.93	34.58	31.28	27.28	21.80	20.76	19.75	18.58	......	26.95	24.65	22.18	19.20	16.45
September	40.69	38.96	35.68	32.27	24.56	21.90	20.90	19.20	......	31.25	27.42	24.20	19.84	16.20
October	37.30	35.45	33.20	30.75	25.53	22.03	20.75	18.90	......	30.25	25.15	22.55	19.08	13.88
November	29.54	27.56	24.86	23.00	22.29	20.08	18.71	17.71	......	25.23	23.38	21.33	19.45	15.73
December	21.04	19.62	17.74	16.00	16.00	15.35	14.34	13.26	......	17.70	18.48	16.00	14.46	11.88
NEW YORK.														
1919.														
July	$35.35	$33.58	$31.74	$29.40	$26.71	......	$24.86	......	$31.98	$29.16	$28.13	$26.28	$23.52	$18.89
August	36.70	33.95	31.13	27.55	26.93	......	24.53	......	33.08	29.73	29.14	26.90	23.78	20.40
September	37.66	35.39	32.99	29.78	27.33	......	25.48	......	33.71	31.29	31.61	29.13	25.33	20.26
October	36.76	34.56	31.80	28.38	23.55	......	21.07	......	32.50	29.56	30.59	27.58	24.19	19.58
November	35.63	33.50	31.41	28.55	22.53	......	21.40	......	30.36	26.78	28.43	25.33	22.37	18.46
December	26.65	25.00	23.46	21.52	21.73	$22.33	21.19	......	25.94	23.34	27.86	24.76	21.34	16.52
1920.														
January	25.93	24.23	22.78	20.93	20.95	20.85	19.18	......	24.93	23.00	30.53	26.95	23.55	19.50
February	25.74	23.95	22.26	20.81	20.30	......	19.11	......	25.34	22.83	31.02	27.88	25.35	21.08
March	29.81	28.18	26.34	24.10	21.14	......	19.50	......	28.65	25.16	......	28.20	25.44	21.00
April	34.57	31.46	29.60	27.85	23.75	......	22.63	......	32.44	28.38	......	29.50	26.83	22.90
May	31.50	29.25	27.40	24.90	21.58	......	20.73	......	30.01	25.98	22.73	20.78	18.40	15.95
June	28.90	27.02	25.25	23.31	20.91	......	19.35	......	28.28	24.00	24.55	22.34	20.06	17.76
July	30.71	28.26	25.89	23.61	21.86	......	19.39	......	29.57	23.33	28.65	25.54	22.39	18.60
August	34.23	31.93	29.03	25.95	21.98	......	19.88	......	31.93	25.73	26.56	23.35	20.30	16.65
September	40.48	38.58	36.06	32.02	24.37	......	21.91	......	35.67	30.10	30.16	27.38	23.11	18.22
October	37.51	35.92	34.18	31.53	26.02	......	21.88	......	......	30.92	27.78	24.07	19.43	14.63
November	34.25	32.26	31.00	27.88	25.48	......	20.66	......	34.50	28.93	27.88	25.26	21.22	16.97
December	22.32	20.70	19.02	17.52	16.36	......	15.30	......	21.01	18.60	21.67	18.88	15.96	12.52

TABLE 74.—*Western dressed fresh meats: Pork cuts and veal—Monthly average wholesale price per 100 pounds, 1919 and 1920*—Continued.

PHILADELPHIA.

Month.	Pork cuts. Loins. 8 to 10 pounds.	Loins. 10 to 12 pounds.	Loins. 12 to 14 pounds.	Loins. 14 pounds and over.	Shoulders, skinned.	Picnics. 4 to 6 pounds.	Picnics. 6 to 8 pounds.	Picnics. 8 pounds and over.	Butts, Boston style.	Veal. Choice.	Veal. Good.	Veal. Medium.	Veal. Common.
1919.													
July	$35.65	$33.72	$32.22	$30.46	$27.92	$24.50	$23.50	$22.50	$30.20	$23.50	$21.17	$19.04	$16.60
August	36.93	35.08	33.25	28.90	28.05	......	......	......	31.03	......	21.19	17.20	14.80
September	36.28	33.99	32.00	28.23	27.45	23.30	21.60	......	30.84	......	19.80	15.60	13.08
October	35.60	33.44	31.46	27.36	24.82	22.75	20.86	......	29.06	24.19	20.92	17.86	14.34
November	31.84	30.59	28.81	27.03	22.93	21.54	19.75	......	26.27	......	19.84	16.01	11.90
December	26.24	25.36	24.18	22.60	21.84	20.74	19.54	......	23.90	......	20.52	16.34	13.65
1920.													
January	25.83	24.50	23.35	21.28	21.33	20.68	18.88	......	23.91	......	24.35	20.90	17.28
February	25.80	24.30	23.13	20.83	20.85	20.35	19.16	......	23.61	......	23.49	20.49	16.65
March	29.12	27.34	25.80	23.64	21.72	19.42	18.50	......	24.90	26.77	23.64	20.56	16.92
April	34.74	33.20	31.65	29.75	23.03	22.21	......	......	27.70	......	23.17	20.10	16.83
May	30.68	28.70	27.03	24.78	21.93	20.03	......	......	25.98	......	20.99	18.68	15.80
June	27.75	25.99	24.04	21.36	20.20	19.92	......	......	22.63	......	22.05	19.24	16.30
July	31.14	29.61	27.63	24.74	20.68	19.69	......	......	23.90	......	24.59	21.43	16.85
August	33.93	31.88	29.65	26.10	21.85	20.13	......	......	25.75	......	22.29	19.13	15.53
September	39.65	38.04	36.12	32.50	24.92	24.03	22.03	......	29.90	26.75	24.06	20.80	17.61
October	37.34	35.81	33.87	30.48	26.00	24.18	22.43	......	30.83	25.75	22.39	19.61	15.78
November	32.73	31.40	30.30	27.51	24.51	22.75	21.04	......	28.35	26.92	24.22	21.28	17.28
December	21.26	20.04	18.66	16.74	16.82	15.19	13.64	......	18.70	......	20.64	16.42	12.54

BOSTON.

Month.	Loins. 8 to 10 pounds.	Loins. 10 to 12 pounds.	Loins. 12 to 14 pounds.	Loins. 14 pounds and over.	Shoulders, skinned.	Picnics. 4 to 6 pounds.	Picnics. 6 to 8 pounds.	Picnics. 8 pounds and over.	Butts, Boston style.	Veal. Choice.	Veal. Good.	Veal. Medium.	Veal. Common.
1919.													
July	$34.19	$32.84	$29.98	$27.73	......	$27.05	$26.10	$24.65	$27.00	......	$16.08	$14.80	$13.56
August	36.08	34.30	32.21	28.25	......	26.60	25.41	24.61	......	......	15.48	13.48	10.98
September	37.90	36.03	33.75	28.48	......	26.50	24.85	24.20	......	......	......	14.38	12.28
October	37.51	36.48	34.15	28.82	......	22.44	21.48	20.52	......	......	......	12.09	10.66
November	34.75	33.63	31.30	27.66	......	21.97	21.06	19.54	......	......	......	10.71	9.31
December	25.81	24.99	23.45	20.94	......	20.21	19.19	18.25	......	......	......	13.90	10.96
1920.													
January	25.61	24.61	23.04	20.60	......	19.21	18.28	17.34	......	......	......	15.63	13.65
February	25.80	24.43	23.24	20.89	......	19.41	18.53	17.35	......	......	......	15.68	13.85
March	29.21	27.79	26.17	23.41	......	19.30	18.25	16.85	......	......	......	16.28	14.80
April	33.64	31.91	29.33	26.98	......	21.52	20.41	19.12	......	......	......	15.85	13.90
May	30.19	28.73	26.88	23.69	......	20.50	19.46	18.36	......	......	......	14.05	12.70
June	28.41	27.07	24.58	21.63	......	20.64	19.42	18.09	......	......	......	18.36	16.42
July	31.69	29.83	27.08	22.45	......	21.53	20.10	18.86	......	......	......	16.35	14.52
August	34.08	32.40	29.03	24.48	......	21.50	20.50	19.50	......	......	18.80	16.26	14.20
September	40.32	37.98	35.48	30.43	......	23.01	21.94	20.54	......	......	......	18.11	15.79
October	40.62	38.73	36.98	32.65	......	24.08	23.08	22.00	......	......	......	15.08	12.85
November	35.40	33.90	31.66	28.76	......	23.40	22.37	20.88	......	......	......	16.83	14.90
December	22.33	21.35	20.13	18.08	......	15.81	14.71	13.67	......	......	......	14.32	11.96

TABLE 75.—*Live stock: Slaughtered under Federal inspection, 1910 to 1920.*

[In thousands of animals; i. e., 000 omitted.]

Year ending June 30.	Cattle.	Calves.	Swine.	Sheep.	Goats.	All animals.	Pounds of food products.	Pounds condemned.
1910	7,962	2,295	27,656	11,150	116	49,179	6,223,965	19,032
1911	7,781	2,220	29,916	13,006	54	52,977	6,934,233	21,074
1912	7,532	2,243	34,966	14,209	64	59,014	7,279,559	18,097
1913	7,156	2,098	32,288	14,724	57	56,323	7,094,810	18,852
1914	6,724	1,815	33,290	14,959	122	56,910	7,033,296	19,135
1915	6,964	1,736	36,248	12,909	166	58,023	7,533,070	18,780
1916	7,404	2,048	40,483	11,986	180	62,101	7,474,242	17,897
1917	9,299	2,680	40,211	11,343	175	63,708	7,663,634	19,857
1918	10,938	3,323	35,449	8,770	150	58,630	7,905,185	17,543
1919	11,242	3,674	44,399	11,268	126	70,709	9,169,042	30,323
1920	9,710	4,228	38,982	12,335	77	[1] 65,332	7,755,158	18,202
Total	92,712	28,360	393,888	136,659	1,287	652,906	82,066,194	218,792

[1] Includes 1,089 horses.

TABLE 76.—*Meats and lard: Cold-storage holdings first of each month, 1915 to 1920.*

[In thousands of pounds; i. e., 000 omitted.]

Month.	Frozen beef.					Cured beef.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
January	126,374	202,442	315,572	298,818	261,812	21,443	37,301	39,243	36,267	37,052
February	132,266	190,909	292,114	298,514	252,037	20,852	35,891	38,793	35,810	36,715
March	124,954	169,793	276,114	265,293	223,145	26,959	37,660	37,575	31,246	37,002
April	118,279	154,193	268,015	221,725	196,890	25,811	30,601	34,106	30,689	35,047
May	90,176	118,391	212,725	184,586	170,455	21,869	29,409	29,217	27,822	30,333
June	73,025	103,007	190,084	163,913	130,619	17,324	30,831	24,804	27,089	26,653
July	55,109	109,354	154,638	162,639	95,297	18,915	35,679	21,968	29,244	26,355
August	58,867	108,729	180,962	159,279	77,469	18,589	32,401	28,065	30,943	23,617
September	58,303	100,453	185,144	162,069	67,010	18,450	30,290	29,981	35,526	22,711
October	66,319	119,221	194,469	166,244	58,461	21,653	31,246	28,713	37,328	19,594
November	92,815	179,032	224,312	184,196	68,663	30,013	32,223	29,339	37,595	20,352
December	158,148	235,664	229,668	223,311	89,718	37,958	38,325	32,381	35,547	22,448
	Frozen pork.					Pickled pork.				
January	44,194	50,564	41,663	61,539	55,551	230,881	307,478	269,003	302,763	279,467
February	63,376	66,062	61,659	104,708	106,677	298,939	348,269	322,004	392,260	337,238
March	88,604	63,352	104,630	128,897	132,095	350,750	378,847	369,014	435,197	369,026
April	88,344	64,996	116,548	142,189	148,922	351,051	362,931	402,377	431,714	361,973
May	77,812	74,728	117,786	139,205	144,453	337,464	281,236	406,191	434,671	353,864
June	83,195	77,534	118,601	144,212	156,963	326,183	403,185	397,486	440,989	371,593
July	82,571	91,562	117,976	155,263	169,616	359,300	412,810	372,347	422,387	403,719
August	85,845	96,648	108,220	131,137	161,804	350,570	403,704	365,941	384,764	389,896
September	63,420	72,286	71,385	90,510	129,197	303,399	328,943	315,517	341,724	361,381
October	38,851	39,767	46,593	61,417	87,592	251,004	252,152	249,827	297,712	295,460
November	23,988	25,347	36,958	47,271	67,148	209,061	192,884	231,136	239,719	254,838
December	32,015	23,504	34,750	44,864	60,007	251,519	204,907	242,976	226,893	252,270
	Lard.					Dry salt pork.				
January	63,304	80,977	54,539	104,274	62,614	145,661	200,998	252,934	359,254	262,620
February	92,342	86,208	59,310	138,353	97,649	194,053	228,424	341,422	471,747	332,848
March	111,897	88,460	65,355	125,410	111,975	226,910	259,059	402,734	435,661	402,229
April	97,237	65,179	89,854	112,469	132,993	206,703	234,396	448,114	430,205	457,745
May	108,731	61,640	103,373	112,409	141,819	202,392	219,819	471,809	425,411	462,389
June	85,113	72,365	106,194	83,096	152,307	206,008	213,802	493,795	402,652	430,782
July	87,127	95,197	107,871	92,132	193,316	202,088	224,813	402,549	381,736	408,681
August	95,991	112,249	102,411	100,478	191,531	205,251	231,905	370,203	366,547	381,328
September	82,028	102,172	104,668	87,947	170,774	183,194	195,678	333,472	338,270	316,433
October	71,570	69,929	90,398	76,456	109,258	140,908	143,319	283,572	332,786	233,389
November	56,929	37,095	76,124	66,036	47,329	118,958	110,652	247,194	281,930	150,812
December	58,950	44,367	81,676	49,147	36,683	142,858	150,882	283,002	242,224	114,400
	Frozen lamb and mutton.					Miscellaneous meats.				
January	4,976	4,886	7,403	12,760	10,290	....	....	55,560	128,892	108,766
February	5,286	5,895	6,315	11,360	7,787	....	....	55,658	141,914	113,228
March	5,812	4,949	7,855	8,013	5,781	....	....	67,632	132,070	109,452
April	5,084	4,872	5,599	6,505	3,517	....	....	80,200	125,735	100,048
May	3,858	4,369	3,348	7,623	2,579	....	....	78,252	113,125	87,435
June	2,525	3,508	3,860	7,718	5,735	....	....	71,148	97,195	86,384
July	1,939	4,380	2,429	7,279	4,311	....	....	77,470	95,908	86,047
August	2,098	3,912	3,150	7,263	2,299	....	16,173	79,959	91,448	78,670
September	2,135	2,716	4,046	7,817	11,021	....	47,754	96,316	85,358	69,471
October	2,579	2,768	5,275	8,318	25,325	....	44,328	96,879	80,454	63,957
November	3,465	4,194	8,645	7,894	48,997	....	42,914	102,623	82,113	59,486
December	5,000	5,406	9,035	9,409	56,702	....	50,355	106,254	82,853	60,092

TABLE 77.—*Western dressed fresh meats: Beef, lamb, and mutton—Weekly average wholesale price per 100 pounds, 1917 to 1920.*

CHICAGO.

Week ending—	Beef.								Lamb and mutton.										
	Steer.				Cow.			Bull, common.	Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.		Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1919.																			
July 5	$20.00	$18.42	$17.00	$14.75	$16.17	$14.67	$13.42	$11.67	$25.50	$24.50	$22.00	$20.00	....	....	....	$16.00	$14.00	$12.00	$28.50
12	21.00	19.70	18.25	15.45	17.10	15.80	13.95	12.70	29.00	27.35	25.20	22.60	$26.20	$24.10	$20.20	18.00	15.50	13.50	....
19	22.88	21.30	19.25	15.80	17.90	16.55	14.05	13.75	29.10	28.10	24.40	19.70	25.20	22.20	19.00	18.00	15.90	13.60	....
26	23.50	22.45	20.10	15.95	18.40	16.10	13.55	12.65	29.40	27.85	24.00	19.40	24.38	21.75	17.50	18.00	16.30	14.05	....
Aug. 2	24.50	22.85	18.65	13.95	....	14.80	12.00	11.35	29.00	26.90	23.00	18.10	....	....	....	....	16.75	14.15	....
9	24.50	22.90	18.85	14.00	....	14.55	12.60	11.15	29.05	27.10	23.50	18.40		18.50	....	17.50	16.50	14.00	....
16	24.88	23.40	19.95	13.95	....	14.90	12.20	11.90	29.80	28.00	24.10	19.30	23.67	19.00	....	18.50	16.20	14.00	....
23	24.50	22.70	18.70	13.70	....	14.35	11.95	11.60	29.10	27.30	23.20	18.10	22.70	19.00	....	18.75	16.15	13.85	....
30	23.85	21.55	17.20	12.75	....	13.15	11.00	10.55	27.60	25.65	21.85	16.65	20.70	18.00	....	17.35	15.10	12.70	....
Sept. 6	23.50	20.50	16.25	12.50	....	12.50	10.50	9.75	26.13	24.25	20.13	15.06	20.17	....	....	17.38	14.94	12.69	....
13	23.80	21.05	17.20	13.00	15.50	13.35	11.00	9.95	25.60	23.50	20.20	15.80	20.13	....	....	16.30	14.05	11.65	....
20	24.00	21.60	17.50	12.85	16.00	13.55	11.05	9.60	24.35	22.65	19.80	16.25	18.75	16.75	....	15.25	13.25	10.75	....
27	24.00	22.25	17.50	12.60	....	13.20	10.70	9.10	23.45	21.95	18.75	15.55	18.25	16.38	....	14.30	12.10	9.95	....
Oct. 4	24.20	22.25	17.75	12.75	....	13.25	11.00	9.80	23.45	21.80	19.05	17.62	18.50	16.00	....	13.80	11.60	9.35	....
11	25.00	23.25	19.00	13.95	....	14.10	11.65	10.00	25.35	23.35	21.00	17.90	19.50	18.00	....	14.55	11.85	10.45	....
18	25.90	23.65	19.20	13.75	15.25	13.70	11.25	10.00	24.40	22.35	20.35	16.55	18.50	16.50	....	14.20	11.75	10.10	....
25	26.30	24.05	19.25	13.65	15.05	13.15	10.90	9.50	23.85	21.75	19.75	16.00	18.50	16.50	....	13.70	11.75	10.00	....
Nov. 1	26.50	24.15	18.85	13.05	14.65	12.40	10.55	9.30	23.40	21.60	19.20	15.70	18.50	16.50	....	13.60	11.75	9.90	....
8	26.63	23.25	17.65	12.40	14.25	12.40	10.40	8.95	23.80	21.20	19.15	15.70	18.50	15.67	....	14.40	11.95	10.00	....
15	26.75	23.25	17.65	12.25	14.25	12.40	10.00	9.05	23.65	21.15	19.00	16.50	18.50	16.50	....	14.90	12.65	10.55	....
22	....	23.65	18.25	12.75	14.75	12.75	10.50	9.15	23.45	21.00	19.00	16.50	18.50	16.50	....	14.95	12.70	10.00	....
29	26.25	22.88	17.50	12.63	14.63	12.69	10.44	9.06	23.13	21.13	18.88	16.19	19.00	17.00	....	14.50	12.25	9.88	....
Dec. 6	26.25	22.65	17.30	12.65	14.50	12.75	10.75	9.25	23.85	21.90	19.50	17.10	19.75	17.75	....	14.40	11.95	9.80	....
13	26.50	22.50	17.00	12.75	14.55	13.00	11.25	9.25	24.20	22.20	20.00	17.55	20.00	18.00	....	14.50	11.85	10.00	....
20	26.06	22.60	17.35	13.45	15.25	13.50	11.95	9.15	24.50	23.25	21.00	18.50	21.00	18.50	....	15.00	12.35	10.75	....
27	25.75	22.13	17.25	13.50	15.25	13.50	11.81	9.44	24.94	23.38	21.38	18.81	21.00	19.00	....	15.25	13.00	10.75	....
1920.																			
Jan. 3	....	22.00	17.75	14.00	15.50	14.00	12.25	9.67	25.83	24.83	22.83	19.67	22.25	20.50	....	15.92	13.75	11.75	....
10	....	21.80	17.95	14.75	16.35	14.85	12.85	9.90	29.00	28.00	25.40	22.90	25.25	23.88	....	17.45	15.30	13.05	....
17	....	21.90	17.90	14.95	17.05	15.35	13.40	10.65	31.30	30.30	27.80	25.80	27.50	26.00	....	18.90	16.30	14.10	....
24	....	21.60	17.90	15.55	17.15	15.45	14.00	11.45	31.70	30.70	29.30	27.10	28.88	27.25	....	19.95	17.60	15.40	....
31	....	21.15	17.40	15.40	16.95	15.20	13.70	12.10	33.44	32.50	31.00	28.50	30.75	28.63	....	21.65	19.40	16.50	....

Feb. 7	....	20.25	16.80	14.90	16.45	14.80	13.45	12.20	34.20	32.75	30.75	28.00	30.88	28.25	....	22.50	20.20	17.30	....
14	....	19.65	16.30	14.55	15.50	13.90	12.75	11.35	33.60	32.45	30.65	27.80	29.50	26.75	....	22.90	20.10	17.20	....
21	....	19.40	16.50	14.50	15.50	13.65	12.50	10.65	33.70	32.35	30.60	27.80	29.94	26.38	....	22.90	20.20	17.45	....
28	....	19.25	16.75	15.00	15.75	14.00	12.81	9.94	32.63	31.38	29.88	26.75	29.50	26.13	....	23.50	20.50	18.25	....
Mar. 6	....	19.00	16.80	15.10	15.85	14.10	13.05	9.60	31.90	30.40	28.40	25.60	28.13	25.69	....	23.80	20.90	18.45	....
13	....	20.15	17.90	16.15	16.75	15.30	14.00	10.05	31.00	29.00	27.00	24.50	27.50	25.00	....	23.10	21.00	18.50	....
20	....	20.30	18.10	16.40	16.75	15.50	14.50	10.40	30.70	28.70	26.85	24.50	....	....	....	23.15	21.15	18.60	....
27	....	19.80	17.80	16.40	16.75	15.50	14.50	10.95	30.55	28.20	26.50	24.50	....	....	....	23.75	21.75	19.00	....
Apr. 3	....	21.00	18.75	17.25	17.50	16.50	15.50	11.50	32.60	30.60	29.10	26.10	....	....	....	24.50	22.75	20.00	....
10	....	20.75	18.95	17.20	17.50	16.50	15.50	11.73	33.80	31.80	30.30	27.30	....	....	....	24.50	22.75	20.00	....
17	....	21.00	19.00	17.10	17.50	16.50	15.50	11.88	33.80	32.00	30.50	27.50	....	....	....	28.30	26.35	23.40	....
24	....	21.25	19.35	17.65	17.80	16.75	15.45	11.65	33.50	32.00	30.50	27.50	....	....	....	29.00	27.00	24.00	....
May 1	....	19.50	18.30	16.55	17.05	15.80	14.80	11.73	33.50	32.00	30.50	27.50	....	....	....	24.50	23.00	21.00	....
8	....	19.55	18.50	16.80	17.40	16.20	15.20	12.55	34.10	32.00	30.50	27.50	....	....	....	24.50	23.00	21.00	....
15	....	19.75	18.50	17.05	17.75	16.50	15.50	13.00	34.50	32.00	30.50	27.40	....	....	....	24.30	22.90	21.00	....
22	21.00	19.75	18.50	16.95	17.70	16.55	15.50	12.40	33.50	31.00	29.50	26.50	....	....	....	22.50	21.40	20.10	....
29	21.00	19.75	18.50	16.75	17.70	16.45	15.20	12.00	31.50	29.40	27.70	26.00	....	....	....	20.50	18.80	17.00	33.00
June 5	21.50	20.31	18.94	17.19	18.00	16.75	15.50	11.50	31.63	29.00	27.00	25.38	....	....	....	19.50	17.50	16.00	33.25
12	23.40	21.90	20.80	19.30	18.60	17.55	16.40	11.90	32.50	30.00	27.80	25.50	....	....	....	19.50	17.50	16.00	34.00
19	25.00	23.50	22.00	20.00	19.50	18.50	17.00	12.80	32.50	30.00	27.50	25.50	....	....	....	19.50	17.50	16.00	34.80
26	26.00	24.50	22.75	20.75	20.10	18.80	17.00	13.00	32.50	30.00	27.50	25.50	....	....	....	19.50	17.50	16.00	35.00
July 3	26.00	24.30	22.35	19.45	20.90	19.40	17.00	13.00	33.20	30.20	27.20	23.90	28.20	25.40	22.40	17.30	14.90	13.30	....
10	25.63	23.25	21.00	17.75	20.25	18.75	16.25	12.38	33.75	31.00	27.50	23.50	28.00	25.00	22.00	16.00	13.50	12.00	....
17	26.50	24.00	21.30	18.10	19.80	18.30	15.80	12.00	34.50	32.00	28.00	23.50	29.00	26.00	23.00	14.10	12.50	10.50	....
24	26.15	23.90	19.90	15.90	18.70	17.20	15.00	12.15	34.30	31.80	28.00	23.20	28.10	25.60	22.40	14.50	13.00	11.00	....
31	26.10	23.60	19.30	15.50	18.80	17.00	15.00	12.05	32.30	29.60	26.10	20.80	26.70	24.20	21.10	14.70	13.00	11.00	....
Aug. 7	26.50	24.00	19.50	15.50	19.00	17.00	15.00	11.38	31.40	29.00	25.50	20.50	26.30	23.80	20.90	15.00	13.00	11.00	....
14	26.20	23.90	19.30	15.40	17.90	16.00	13.80	11.08	30.80	28.60	25.60	21.60	25.10	22.60	20.10	15.00	13.00	11.00	....
21	26.90	24.30	18.60	15.00	17.50	16.00	13.00	10.95	29.40	27.30	24.30	20.60	24.10	21.60	19.10	14.40	12.40	10.40	....
28	27.45	24.50	18.70	15.10	17.50	16.00	13.00	10.90	28.50	25.80	23.00	19.50	23.80	21.00	18.50	14.00	12.00	10.00	....
Sept. 4	27.75	25.50	20.70	16.20	17.50	16.00	13.00	10.85	29.10	26.80	24.00	20.50	23.80	21.00	18.50	14.00	12.00	10.00	....
11	28.50	26.00	22.25	17.88	18.25	16.00	13.00	10.53	28.88	26.50	24.50	21.50	23.50	21.00	18.50	14.00	12.00	10.00	....
18	28.70	25.80	21.30	17.10	18.50	16.00	13.00	10.65	29.10	26.80	24.50	21.50	23.50	21.00	18.50	14.00	12.00	10.00	....
25	27.80	24.30	20.00	16.30	18.20	15.80	12.90	10.75	28.50	26.30	24.10	21.30	23.50	21.00	18.50	13.20	11.20	9.60	....
Oct. 2	27.50	23.50	18.90	15.30	17.30	14.90	12.40	10.75	27.50	25.50	23.50	21.00	22.90	20.50	18.00	12.50	10.50	9.50	....
9	27.50	23.50	18.50	14.50	16.50	14.50	12.00	10.60	25.90	23.90	21.90	19.60	20.70	18.70	16.40	12.10	10.10	9.10	....
16	27.95	23.50	19.00	15.00	16.50	14.50	12.00	10.15	24.70	22.90	20.80	17.80	19.50	17.50	15.50	11.50	9.50	8.50	....
23	27.60	23.50	18.40	14.40	16.50	14.50	12.00	10.00	24.50	23.00	21.00	17.50	19.50	17.50	15.50	10.90	9.50	8.50	....
30	27.50	23.50	18.00	14.00	16.40	14.40	12.00	9.85	24.90	23.00	21.00	17.50	19.50	17.50	15.50	10.90	9.50	8.50	....
Nov. 6	27.50	23.50	18.80	14.80	16.25	14.25	12.00	10.08	27.40	24.80	21.80	18.80	19.50	17.50	15.50	12.00	9.50	8.50	....
13	28.10	24.10	19.40	15.50	16.15	14.40	12.00	9.90	28.20	25.70	22.80	19.00	20.90	18.90	16.50	12.60	9.80	8.50	....
20	27.50	24.30	18.70	14.10	15.65	14.30	12.00	10.25	26.90	25.10	22.60	18.80	20.40	18.70	16.30	13.00	10.00	8.50	....
27	27.50	23.00	17.75	13.00	15.50	13.50	11.50	9.69	24.75	22.75	20.63	17.63	19.50	17.50	15.50	13.00	10.00	8.50	....
Dec. 4	26.50	22.30	17.10	12.50	14.70	12.70	10.70	9.80	24.50	22.50	20.50	17.50	18.70	17.50	15.50	13.00	10.00	8.50	....
11	24.20	21.00	16.50	12.20	13.10	11.90	10.50	9.88	24.90	22.90	20.90	18.10	18.10	17.10	15.10	11.80	9.20	7.70	....
18	23.00	19.50	16.00	12.00	12.50	11.50	10.50	9.63	24.30	22.30	20.20	17.20	17.50	16.50	14.50	11.50	9.00	7.50	....
25	23.00	18.50	16.00	12.00	13.00	10.50	9.50	9.40	23.50	21.50	19.00	16.00	17.50	16.50	14.50	11.50	9.00	7.50	....
1921.																			
Jan. 1	22.70	18.80	16.30	12.60	13.60	11.10	10.10	9.88	24.60	22.10	19.30	16.00	18.10	16.50	14.50	11.50	9.00	7.50	....

TABLE 77.—*Western dressed fresh meats: Beef, lamb, and mutton—Weekly average wholesale price per 100 pounds, 1917 to 1920*—Continued.

NEW YORK.

Week ending—	Beef.										Lamb and mutton.										
	Steer.				Cow.			Bull.			Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1917.																					
June 30	$16.95	$16.43	$15.65	$13.58	$14.95	$14.15	$13.20	$13.75	$12.35	$11.63	$24.90	$24.30	$22.65		$19.20	$16.00	$12.75	$19.60	$17.30	$14.30	$26.50
July 7	16.94	16.31	15.38	12.69	14.25	13.50	12.50	13.75	12.50	11.59	20.75	19.38	17.88	$15.00	18.75	16.88	13.67	17.75	16.25	14.13	22.25
14	17.45	16.88	15.98	13.65	14.90	13.65	12.50	13.95	12.50	11.65	22.20	20.70	19.10	17.25	18.60	17.40	16.00	17.25	15.70	13.90	
21	18.65	18.00	17.00	14.80	15.75	15.00	13.60	14.50	13.65	12.48	22.85	21.90	20.70	18.50	20.25	18.75		19.00	17.00	14.63	
28	19.25	18.53	16.50	13.95	15.42	14.30	12.85	14.25	12.88	11.66	22.31	21.15	20.00	17.83				19.00	16.88	13.94	
Aug. 4	19.50	18.53	16.30	13.25	15.25	13.15	11.85		12.70	11.23	22.50	21.50	20.10	18.20				19.00	17.00	13.75	
11	19.25	18.00	15.60	12.65	14.00	12.50	11.10		12.25	10.15	22.50	21.50	20.50	18.00				19.00	17.13	13.50	
18	19.85	18.90	16.50	14.45	14.38	13.50	12.75		11.70	10.85	24.81	24.20	23.50	21.30				20.00	18.00	16.00	
25	21.00	19.50	17.15	14.70	15.63	14.60	13.80	14.50	12.83	11.35	25.81	24.70	23.60	22.00	21.33			21.50	20.00	17.50	
Sept. 1	21.00	19.55	17.05	14.30	15.50	14.50	13.55	14.50	13.00	11.28	23.80	23.10	22.35	20.94	21.09	20.50		20.50	19.00	17.50	
8	21.50	19.69	17.06	14.50	15.25	14.56	13.56		13.08	11.69	24.50	24.06	23.25	21.50	21.00			20.88	19.38	18.00	
15	22.50	20.50	17.75	15.00	15.50	14.75	13.50	14.56	13.00	12.00	28.45	27.60	26.50	25.00				22.20	20.90	19.60	
22	22.50	29.60	17.70	14.60	16.00	15.00	13.80	14.75	13.35	12.00	28.38	27.05	26.05	24.65	21.00			22.30	21.10	19.55	
29	22.50	20.60	17.25	14.20	15.60	14.70	13.60	14.75	12.85	12.00	24.06	23.05	21.60	19.40	21.50			20.10	18.60	16.60	
Oct. 6	23.00	19.95	16.40	13.55	15.13	14.00	12.70	14.06	12.50	11.60	25.25	24.30	23.00	21.00	21.00	19.50		20.80	19.50	18.00	
13	23.06	19.55	16.10	13.25	15.25	13.70	12.55	14.00	12.56	11.75	25.75	24.70	23.65	21.00	21.25	19.50	18.50	20.50	19.50	18.50	
20		19.25	15.60	13.10	14.88	13.50	12.45			11.60	24.75	23.70	22.95	21.00	21.50			20.60	19.50	18.40	
27		19.10	16.00	13.25	14.31	13.50	12.50		12.50	11.73	23.75	23.15	22.45	20.90	21.13			20.00	18.60	17.00	
Nov. 3		18.80	15.80	13.75	14.63	14.05	12.95			11.88	23.50	22.85	21.75	19.08	20.69	19.58		20.90	18.80	17.50	
10		18.90	16.00	13.75	14.50	13.70	12.75			11.94	23.33	22.65	21.80	20.50	20.50			19.67	18.50	17.00	
17		18.60	15.80	13.55	14.75	13.50	12.70		12.25	11.80	22.60	21.65	20.20	18.50	20.50	19.33		18.90	17.50	16.20	
24		19.00	16.50	13.85	14.75	13.80	12.30	13.25	12.40	11.55	22.85	22.10	20.70	18.60	19.50	18.50		18.75	17.50	16.00	
Dec. 1		19.06	16.50	14.00	14.75	13.50	12.25	13.25	12.50	11.69	22.75	22.00	20.38	17.50	19.50	18.50		19.25	18.31	16.50	
8	20.67	18.35	16.55	14.50	14.75	14.00	13.25		12.50	11.75	23.10	22.40	21.50	19.50				20.00	18.50	17.20	
15	20.50	18.75	17.20	15.35	15.60	14.90	14.10		13.15	12.18	24.65	23.90	22.85		20.50			20.80	19.50	18.33	
22	20.80	18.90	17.45	16.15	16.45	15.70	14.89	14.75	13.60	12.65	26.35	25.60	24.90	22.88	22.50			22.00	20.60	19.00	
29	20.44	18.31	17.00	15.69	15.94	15.19	14.31	15.13	14.38	13.56	24.31	23.44	22.38	21.00	21.50			19.81	18.50	16.83	
1918.																					
Jan. 5	19.63	18.00	17.00	15.50	15.50	14.75	13.81		14.75	14.00	23.25	22.31	21.25	20.25				18.75	17.31	16.00	
12	18.88	17.80	16.80	14.85	15.25	14.30	13.70		14.79	14.30	23.25	22.20	21.10	19.90				19.00	17.50	16.10	
19	18.50	17.70	16.70	15.30	15.45	14.85	14.05		14.75	14.00	24.95	24.05	22.85		20.75			20.30	18.60	18.00	
26	19.20	18.20	17.35	16.50	16.60	15.95	15.35		15.40	14.85	27.50	26.40	25.30	23.25				22.95	21.40	19.50	

Feb. 2	18.55	17.80	17.15	16.25	16.10	15.55	14.60		15.90	15.00	25.65	24.55	23.40					21.45	19.80		
9	18.50	17.70	16.95	16.25	16.40	15.60	14.60		16.00	15.25	24.20	23.30	21.90					20.80	19.35	18.25	
16	18.38	17.70	16.95	16.25	16.10	15.40	14.50		15.90	15.05	21.90	21.10	19.75					19.75	18.60	17.00	
23	18.00	17.38	16.63	15.69	15.38	14.88	14.00	15.50	14.75	14.25	22.17	21.50	20.06	17.67				19.31	18.00	16.63	
Mar. 2	18.05	17.40	16.75	15.70	15.50	14.75	13.75		14.85	13.70	23.30	22.30	21.25	19.55				19.90	18.50	16.70	
9	17.88	17.30	16.65	15.85	15.45	14.70	14.15		14.30	13.40	24.40	23.50	22.50	20.50	21.70			19.95	18.60	17.10	
16	17.58	17.10	16.48	15.60	15.50	14.50	13.55	15.08	14.35	13.30	26.50	25.50	24.50	23.00	22.60			20.70	19.55	18.00	
23	18.78	18.35	17.60	16.75	16.85	16.05	15.30		14.90	14.05	26.70	25.80	24.60	22.00	23.50			22.30	20.90		
30	19.28	18.80	18.30	17.50	17.53	16.95	16.06	16.00	15.45	14.95	25.80	24.80	23.70					22.60	21.00		
Apr. 6	20.25	19.75	19.00	18.00	18.25	17.75	16.81	17.00	16.30	15.30	26.50	25.50	24.10		24.50			23.30	21.60		
13	21.00	20.40	19.85	18.63	18.80	18.30	17.80	17.75	17.25	16.43	28.35	27.60	26.30		25.50			24.70	23.70		
20	22.75	22.25	21.60	20.85	20.50	19.50	18.65	19.25	18.75	18.15	30.44	29.50	28.40					26.50	25.50		
27	23.75	23.25	22.50	21.50	21.60	20.45	19.10	19.75	18.75	18.25	30.07	28.80	27.65	26.00	28.00			26.67	25.50		
May 4	23.29	22.90	22.05	20.15	20.65	19.10	17.30	19.25	18.55	17.65	29.44	28.50	27.10		28.25			26.45	25.50	22.50	
11	23.22	22.60	21.40	19.75	20.95	19.50	17.75	19.25	17.90	16.65	28.78	28.00	27.20	26.13				26.50	25.30	23.25	
18	23.75	23.25	22.65	21.55	20.95	20.20	18.60	18.40	17.40	16.35	28.65	28.05	27.50	26.90				25.90	24.80	23.88	
25	24.95	24.15	23.40	22.80	22.93	22.00	20.90	19.30	18.40	17.55	29.50	28.75	28.25	27.70	28.25	27.50		26.50	25.50		
June 1	25.57	25.00	24.50	23.56	23.38	22.75	21.69	19.93	18.50	17.63	28.71	28.25	27.63	26.63	27.42	26.25		25.25	24.25		31.75
8	25.85	25.35	24.85	23.80	23.00	22.30	21.10	20.70	18.70	17.60	27.80	27.00	26.15	25.05	25.00	24.25		23.63	22.20	21.25	30.40
15	26.25	25.75	25.25	24.00	23.50	22.75	21.85	21.25	19.50	18.05	28.90	27.90	26.50	25.45	25.70	24.70	24.50	24.30	23.30	21.70	30.80
22	26.44	25.90	25.00	22.60	23.17	22.10	20.40	20.70	19.30	18.30	29.50	28.50	27.50	26.20	26.17	25.50		24.50	23.30	21.90	31.50
29	25.38	24.55	23.30	19.90	21.70	20.40	17.90	19.30	18.30	17.20	28.10	27.10	25.70	24.50	24.50	23.50		23.30	22.30	21.00	29.80
July 6	24.50	23.50	22.38	18.75	19.69	18.25	13.00	16.88	15.50	14.50	25.63	24.81	23.88	22.38	24.17	23.17		23.13	20.75	18.13	26.56
13	25.30	23.90	21.65	18.55	19.85	18.15	16.05	17.50	15.50	14.50	26.05	24.40	23.10	21.25	23.50	22.50		23.60	22.60	20.00	27.50
20	26.70	25.00	22.00	18.50	21.80	19.50	16.80	18.50	16.30	14.50	29.40	27.40	24.80	21.70				25.10	23.10	19.00	
27	26.75	24.70	21.10	17.60	21.33	18.10	15.85	18.50	16.44	14.63	26.50	25.40	23.40	20.30				25.25	23.40	20.17	
Aug. 3	26.50	23.90	21.00	17.50	21.00	17.30	15.20	16.67	14.95	13.90	25.14	23.90	22.80	20.00				24.67	22.70	19.00	
10	26.50	24.50	20.60	16.50	20.44	16.40	14.00	16.00	14.38	13.35	25.60	24.50	23.30	21.00				23.80	22.20	18.50	
17	26.95	24.55	20.70	16.10	20.50	16.20	13.50		14.50	13.25	27.65	26.60	24.85	21.75	24.50	23.50		22.90	20.90	17.88	
24	27.50	25.80	23.40	19.70	21.90	19.90	17.00	16.90	15.90	14.20	29.30	27.90	26.25	24.10				24.00	21.00	18.00	
31	28.00	26.00	23.90	21.00	22.10	20.70	19.15	18.50	16.50	15.50	28.44	27.25	25.90	23.10				23.75	21.60	18.20	
Sept. 7	28.21	26.50	24.00	21.50	23.00	21.50	19.50		16.50	15.50	27.31	26.31	25.25	22.75				22.63	21.13	18.75	
14	28.25	26.70	23.75	19.80	23.25	20.90	18.35	18.60	16.50	15.65	28.63	27.10	25.40	22.30				22.80	21.30	18.60	
21	28.45	26.50	22.60	18.60	22.40	18.60	16.25	18.50	16.50	14.85	28.63	27.60	25.50	22.20				21.60	20.20	17.80	
28	28.33	26.40	21.60	16.55	20.00	17.20	14.60	17.50	15.94	13.81	27.15	25.90	23.40	21.30				19.56	18.30	15.30	
Oct. 5	28.33	25.40	20.00	15.60	17.90	15.20	13.40		14.33	12.75	23.40	21.70	20.40	17.35				17.50	15.80	12.30	
12	28.38	24.95	19.00	14.50	17.75	15.00	13.10		14.28	12.80	20.40	18.80	17.30	15.40				16.40	14.80	12.60	
19	27.50	24.50	18.00	13.90	16.88	14.75	13.15		14.00	12.50	22.00	20.00	17.50	15.50				16.70	15.00	11.80	
26	27.50	25.10	19.40	15.75	18.10	15.70	14.30		14.95	13.60	24.30	23.10	21.80	20.50				17.20	15.70	13.20	
Nov. 2	27.50	25.25	20.50	17.50	18.50	16.50	15.50		15.00	13.75	25.56	24.80	23.50	21.50				16.40	15.00	12.40	
9	27.60	25.30	21.20	18.00	19.00	17.50	15.50	17.50	15.50	14.25	26.75	25.60	24.50	22.60				18.50	15.50	13.00	
16	27.50	25.44	22.31	19.25	20.69	18.63	17.50	18.50	15.50	14.38	26.79	25.88	24.31	21.75				19.88	16.88	14.00	
23	28.00	26.50	23.50	20.40	21.50	20.00	17.95		16.40	14.70	25.50	24.80	22.50	21.10				19.50	17.40	14.50	
30	28.21	26.38	23.13	20.06	21.19	19.25	17.63		16.50	15.25	25.00	24.00	22.00	19.63				18.13	15.88	13.38	
Dec. 7	27.75	25.40	21.95	18.00	19.20	17.35	16.05		15.06	13.50	23.43	22.40	21.00	18.90				16.50	14.75	11.80	
14	25.83	23.85	20.80	17.90	18.39	16.70	15.05		14.33	14.25	22.50	21.56	20.50	17.80				15.69	14.00	10.85	
21	25.15	22.50	19.90	17.10	17.70	16.30	14.30		14.67	13.15	22.05	20.50	19.40	16.95				15.70	13.25	10.80	
28		23.75	21.13	17.88	18.63	16.00	1[illegible].63		13.83	12.06	22.86	21.94	20.75	18.25				15.00	13.13	11.00	

TABLE 77.—*Western dressed fresh meats: Beef, lamb, and mutton—Weekly average wholesale price per 100 pounds, 1917 to 1920*—Continued.

NEW YORK—Continued.

Week ending—	Beef.										Lamb and mutton.										
	Steer.				Cow.			Bull.			Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1919.																					
Jan. 4	$27.50	$25.75	$23.50	$20.25	$19.75	$17.19	$15.38	$15.50	$14.50	$13.25	$27.13	$25.63	$23.75	$21.38	$19.67	......	......	$17.63	$16.13	$14.38	......
11	......	27.44	24.70	22.00	22.25	20.20	18.10	16.70	15.50	14.50	33.60	30.70	28.20	......	27.30	$25.40	......	21.80	20.00	18.30	......
18	27.75	25.55	23.40	20.70	21.10	19.60	17.60	16.50	15.50	14.50	29.20	28.10	27.00	24.70	24.80	22.50	......	20.10	19.00	17.10	......
25	......	23.40	21.30	18.00	18.30	16.90	15.60	16.00	14.10	12.70	24.20	22.90	21.90	19.80	19.90	18.50	......	17.40	16.30	14.80	......
Feb. 1	24.50	23.50	22.00	17.70	18.10	16.50	14.90	14.70	13.50	12.50	25.00	23.50	21.90	19.30	18.70	17.00	......	16.00	14.50	13.50	......
8	25.75	24.50	22.40	19.50	19.00	17.00	15.40	15.17	14.30	12.90	28.70	27.60	26.40	23.90	20.80	18.60	$17.50	19.20	17.70	15.80	......
15	26.85	25.75	21.40	21.80	21.50	19.50	18.30	15.70	14.50	13.40	30.00	29.10	28.10	27.00	21.30	19.50	18.50	19.90	18.50	17.00	......
22	26.17	25.50	24.50	22.20	22.30	20.50	19.00	16.40	15.45	14.50	29.20	27.90	26.90	25.83	21.90	20.70	18.80	20.60	19.20	17.90	......
Mar. 1	25.75	24.90	23.85	21.95	22.75	21.20	19.30	16.55	15.50	14.15	31.10	30.10	29.10	28.33	25.60	21.20	22.50	21.90	20.50	19.00	......
8	24.83	24.45	23.00	20.00	21.50	20.20	18.40	17.00	15.50	14.30	31.50	30.50	29.50	28.50	26.40	24.30	23.50	22.60	21.50	20.00	......
15	26.00	24.65	23.25	20.00	22.00	20.50	17.95	17.38	16.50	15.30	32.95	31.90	30.90	30.00	27.30	26.10	25.10	23.10	21.50	19.80	......
22	26.19	25.50	24.10	21.50	21.89	20.20	19.10	17.38	16.30	15.75	34.06	33.30	32.30	31.20	26.90	25.80	23.50	24.00	22.30	20.80	......
29	25.50	24.63	22.63	21.00	......	20.38	18.88	18.00	16.50	15.69	32.75	31.50	30.50	29.00	26.50	25.25	24.25	23.75	22.38	19.88	......
Apr. 5	......	25.50	24.00	22.00	21.50	20.40	18.90	18.70	16.50	15.70	32.33	31.20	30.10	28.70	27.30	25.70	24.20	24.60	23.10	21.20	......
12	26.00	24.30	23.00	21.00	20.89	19.60	18.20	18.50	17.10	15.55	......	30.35	29.00	27.80	26.90	25.70	24.50	25.00	23.50	22.00	......
19	......	23.80	21.95	19.35	20.29	18.50	17.30	17.29	16.10	14.55	......	28.90	27.70	26.30	26.20	24.80	......	25.30	23.80	21.50	......
26	......	24.05	23.00	20.20	20.85	19.20	17.20	17.25	16.20	14.70	31.50	30.50	29.50	28.50	27.50	26.50	......	25.50	24.50	23.00	......
May 3	......	24.50	23.50	22.00	21.00	19.50	18.50	17.60	16.50	15.50	33.30	31.50	30.50	29.50	27.50	26.50	......	25.35	24.30	22.90	......
10	26.00	24.63	23.50	22.00	21.00	19.50	18.50	19.06	17.75	16.56	31.25	29.63	28.38	27.19	26.75	26.50	......	23.44	22.06	21.06	......
17	25.50	23.75	22.40	21.05	21.00	19.50	18.50	18.60	16.60	15.55	29.00	27.20	25.60	24.30	24.30	......	......	21.80	20.50	17.95	$32.00
24	25.00	22.90	21.30	19.40	21.00	19.10	18.10	18.10	16.50	15.50	......	26.95	24.60	23.10	23.50	......	......	19.30	18.10	17.33	30.00
31	23.50	21.75	20.00	18.25	......	18.13	17.00	17.89	16.50	15.44	29.00	27.00	25.50	24.50	......	......	......	18.00	16.50	......	31.50
June 7	......	19.20	17.40	15.70	17.50	15.60	15.25	17.50	15.75	15.00	29.90	28.30	27.20	25.75	......	......	......	18.90	17.30	16.00	31.50
14	......	19.00	17.00	15.00	......	15.50	14.40	......	14.20	13.10	30.70	29.50	28.30	......	......	......	......	19.40	17.00	15.50	33.10
21	......	18.80	16.80	14.90	......	15.50	14.00	......	13.50	12.40	27.90	26.90	25.90	......	......	......	......	19.00	16.90	14.80	29.40
28	19.50	18.30	16.00	14.50	......	14.95	13.45	......	14.85	12.50	25.20	23.90	22.30	20.60	......	......	......	16.40	14.50	12.20	26.60
July 5	20.86	18.75	16.38	14.67	......	14.38	12.50	......	14.25	12.38	26.00	24.50	22.50	17.00	......	......	......	17.00	14.00	11.00	27.00
12	21.50	19.30	17.00	......	17.50	15.70	14.50	16.50	14.35	12.75	30.00	28.40	25.00	23.00	24.60	22.60	20.00	18.50	17.00	14.00	......
19	22.67	21.35	18.95	18.00	17.80	15.90	14.90	17.50	15.00	13.50	29.83	28.40	25.10	21.20	24.20	22.00	......	20.20	18.60	15.30	......
26	23.58	22.38	20.00	17.00	18.50	16.55	14.00	17.50	15.00	......	25.10	23.50	20.80	17.90	22.40	20.40	......	19.25	17.90	15.80	......
Aug. 2	24.60	23.00	17.80	14.30	......	15.44	12.50	......	15.00	12.50	23.30	21.40	18.80	16.40	21.00	19.30	......	19.00	17.20	15.20	......
9	25.00	21.80	16.30	13.30	......	13.80	11.15	......	13.25	11.30	25.40	23.20	18.70	14.60	......	18.50	......	16.83	15.30	13.40	......
16	25.00	23.10	19.80	14.70	17.00	14.60	12.20	......	13.00	10.90	30.20	27.10	21.80	17.80	......	19.00	......	19.38	16.00	13.00	......

	23	24.25	22.80	19.80	14.50	......	14.50	12.65	......	......	10.40	30.25	27.80	23.00	18.80	......	19.00	......	18.20	15.80	13.30	......
	30	23.14	20.50	16.60	12.70	......	13.00	11.00	......	......	10.00	24.80	22.80	20.40	16.90	......	17.60	......	15.60	14.00	11.00	......
Sept.	6	21.50	20.00	17.00	13.50	......	13.63	11.63	......	......	10.13	22.25	19.50	16.75	14.13	......	16.75	......	15.25	13.75	11.75	......
	13	22.50	21.40	18.00	14.60	......	14.50	12.75	......	......	10.50	25.20	22.40	18.90	16.20	......	17.30	......	16.00	14.00	11.90	......
	20	24.50	22.00	19.00	15.70	......	14.50	13.20	......	......	10.30	25.13	23.00	21.30	19.00	......	17.10	......	15.30	13.80	11.70	......
	27	24.50	21.70	18.40	15.25	......	14.50	13.35	......	......	10.00	23.38	22.10	20.40	18.80	......	16.50	......	13.80	12.60	10.00	......
Oct.	4	24.83	22.80	19.20	15.40	16.00	14.50	13.05	......	......	10.50	24.43	22.90	20.70	18.80	......	16.50	......	14.10	12.30	10.70	......
	11	25.50	23.30	19.50	15.50	16.00	14.50	13.15	......	......	10.50	25.71	23.70	22.00	20.00	......	......	......	15.30	13.50	11.00	......
	18	26.00	23.50	19.50	15.13	17.00	15.50	13.25	......	......	10.00	24.67	23.00	21.00	18.38	......	......	......	17.00	15.00	13.00	......
	25	26.50	24.00	19.70	14.85	......	15.00	13.25	......	......	9.85	24.00	22.50	20.00	17.00	......	......	......	17.00	15.00	13.00	......
Nov.	1	......	24.30	19.30	14.25	16.00	14.50	12.40	......	......	9.44	23.29	21.90	20.00	17.00	......	......	......	17.00	15.00	12.20	......
	8	......	24.00	19.00	14.35	......	13.50	12.30	......	......	9.25	23.50	22.50	20.00	17.00	......	......	......	15.50	13.50	11.00	......
	15	......	24.40	19.90	15.10	15.42	14.50	13.30	......	......	9.35	23.14	21.70	20.30	18.40	......	......	......	15.38	13.80	11.30	......
	22	26.00	24.00	19.40	15.10	15.60	14.60	13.40	......	......	9.50	23.00	21.50	20.50	19.00	......	......	......	15.50	14.50	11.70	......
	29	25.50	22.00	18.25	15.00	15.50	14.50	13.06	......	......	9.50	23.00	21.50	20.50	18.38	......	......	......	15.50	14.50	11.50	......
Dec.	6	23.00	20.90	17.70	15.00	15.00	13.90	12.70	......	......	9.50	23.38	21.90	20.70	18.00	......	......	......	15.17	13.70	11.10	......
	13	23.78	20.70	18.30	15.80	15.86	13.90	13.05	......	......	9.60	24.70	23.50	21.50	19.50	......	......	......	15.00	13.50	11.00	......
	20	24.00	20.70	18.50	15.30	16.00	14.50	13.50	......	11.50	9.75	26.60	24.10	21.80	19.90	......	......	......	15.38	14.10	11.00	......
	27	24.00	20.50	18.00	15.00	16.00	14.50	13.38	......	11.50	9.75	28.13	25.50	23.00	20.50	......	......	......	16.00	14.50	11.00	......
1920.																						
Jan.	3	......	20.25	18.00	15.00	16.00	14.50	13.25	......	11.50	10.25	27.88	25.50	23.00	20.50	......	......	......	15.88	14.50	11.00	......
	10	......	20.20	18.00	15.00	16.00	14.50	13.25	13.00	11.50	10.25	28.22	26.10	23.80	20.70	......	......	......	16.10	14.80	11.50	......
	17	24.38	21.80	18.60	16.30	16.90	15.10	14.05	13.90	12.20	11.00	29.10	26.50	23.90	22.00	......	......	......	16.80	14.50	11.00	......
	24	......	22.00	19.00	16.50	17.80	15.90	14.70	14.90	12.90	11.50	31.10	28.40	24.90	23.00	......	......	......	18.70	15.80	13.20	......
	31	......	21.10	18.90	17.50	17.50	16.30	15.30	15.75	13.85	12.67	32.90	29.70	25.80	23.30	......	......	......	20.80	18.00	15.10	......
Feb.	7	......	18.60	16.95	......	15.70	14.70	14.50	......	14.25	13.70	33.40	31.40	27.40	24.90	......	......	......	21.00	18.00	15.50	......
	14	......	19.75	18.13	......	15.50	14.50	12.75	14.75	14.38	13.69	35.50	33.75	30.38	28.75	......	......	......	23.75	21.00	19.00	......
	21	......	18.20	16.50	15.50	14.50	13.90	12.50	13.69	12.55	11.35	34.60	32.80	31.00	26.50	26.50	......	......	22.20	19.70	17.10	......
	28	......	17.75	16.50	14.75	14.38	13.31	11.75	......	10.75	9.81	32.25	30.75	29.25	25.50	......	......	......	20.13	17.50	14.75	......
Mar.	6	......	18.00	16.35	14.70	14.30	12.75	11.70	12.56	10.50	9.60	28.90	27.60	25.80	23.80	......	......	......	19.30	17.30	13.60	......
	13	21.50	19.25	17.50	16.50	16.30	15.10	13.80	12.85	11.10	10.55	27.90	26.60	24.90	22.90	......	......	......	19.30	17.50	14.00	......
	20	21.50	19.95	18.30	17.10	17.35	16.30	14.50	13.30	12.20	11.45	27.70	26.10	24.50	23.50	......	......	......	20.10	18.00	14.50	......
	27	......	20.50	18.50	17.50	17.85	16.50	15.50	14.20	13.25	12.25	31.60	28.70	25.50	24.30	......	......	......	22.60	19.30	15.90	......
Apr.	3	......	20.50	19.50	18.30	17.90	16.65	15.95	14.75	13.38	12.25	33.30	29.60	26.40	24.30	......	......	......	25.80	23.30	20.10	......
	10	......	20.55	19.10	18.10	17.60	16.65	15.95	......	13.35	12.25	36.20	33.40	29.20	27.90	......	......	......	27.90	26.10	24.90	......
	17	......	23.60	21.60	......	20.40	......	......	......	17.00	......	41.00	39.00	......	......	......	......	......	31.00	29.00	24.00	......
	24	......	22.60	20.30	18.10	19.50	17.80	16.50	......	16.60	......	39.10	37.20	32.75	30.50	......	......	......	28.70	25.90	22.25	......
May	1	......	21.00	19.00	15.50	18.10	16.50	14.80	......	17.00	14.40	33.40	31.40	29.40	25.70	......	......	......	23.40	21.00	18.60	......
	8	......	21.60	20.10	17.70	18.20	16.60	15.50	......	16.80	14.00	36.00	33.50	31.50	27.00	......	......	......	24.90	23.00	19.00	......
	15	......	19.50	18.10	16.10	16.90	15.90	14.60	......	15.50	13.50	30.80	29.50	28.30	25.30	......	......	......	20.33	18.70	16.30	......
	22	......	18.05	16.90	15.30	16.50	15.50	13.00	......	15.15	13.30	30.80	29.00	25.50	23.50	......	......	......	18.50	16.90	14.00	......
	29	......	16.85	15.90	13.90	16.25	13.90	12.60	15.75	13.90	12.90	31.00	29.00	25.50	23.50	......	......	......	17.50	16.50	13.00	34.00
June	5	......	18.63	16.75	14.50	15.50	13.50	12.50	......	13.75	12.50	31.25	29.00	25.75	23.75	......	......	......	18.25	16.75	13.00	35.00
	12	......	22.70	20.45	18.00	17.50	15.67	14.00	16.00	13.75	13.25	32.20	29.00	26.50	24.50	......	......	......	19.40	17.40	14.60	36.00
	19	......	26.65	24.40	22.40	......	......	......	......	19.00	16.50	29.90	27.80	25.10	22.00	......	......	......	17.80	16.30	13.20	33.40
	26	......	29.00	26.00	24.10	24.25	22.20	19.00	25.00	20.50	15.83	30.20	26.80	23.30	19.30	......	......	......	18.40	16.40	12.80	32.25
July	3	......	27.10	23.50	17.15	22.00	19.90	15.80	......	15.70	13.10	33.10	27.40	24.50	20.00	......	......	......	19.20	17.00	14.00	......
	10	......	26.25	21.75	15.69	21.00	17.25	14.25	......	12.50	11.00	33.38	29.13	25.13	18.00	......	......	......	21.38	19.00	14.38	......
	17	27.00	25.20	20.90	16.00	21.00	17.75	14.70	......	12.50	11.10	34.00	30.00	25.50	19.20	......	......	......	22.50	19.00	15.50	......

TABLE 77.—*Western dressed fresh meats: Beef, lamb, and mutton—Weekly average wholesale price per 100 pounds, 1917 to 1920*—Continued.

NEW YORK—Continued.

Week ending—	Beef.										Lamb and mutton.										
	Steer.				Cow.			Bull.			Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1920.																					
July 24	$26.50	$24.40	$19.80	$16.50	......	$18.00	$15.50	......	......	$12.40	$34.30	$31.10	$27.30	$22.90	$31.10	$26.00	......	$24.00	$21.00	$16.80	......
31	25.00	23.90	20.80	16.90	......	17.20	14.30	......	......	12.90	31.50	29.10	25.60	20.40	27.50	25.38	......	24.00	21.00	16.20	......
Aug. 7	26.33	24.00	21.00	17.00	......	17.00	14.00	(1)	......	13.10	28.10	26.60	23.40	18.00	23.63	19.00	......	18.50	17.10	13.20	......
14	26.50	23.50	20.40	17.00	......	17.50	14.80	......	$15.00	13.00	26.90	25.00	22.40	18.60	......	19.63	......	16.60	15.50	11.60	......
21	......	23.30	18.90	15.00	......	16.50	14.00	......	......	11.70	27.60	24.90	21.00	16.70	21.00	18.75	......	14.70	13.50	10.00	......
28	27.40	24.30	20.20	16.90	......	16.50	14.50	......	......	12.60	30.40	27.40	23.30	19.80	......	21.00	$19.00	15.30	14.30	10.75	......
Sept. 4	27.00	23.30	19.80	17.00	......	16.20	......	......	......	12.15	30.20	27.40	24.00	21.00	......	21.00	19.00	16.65	14.50	11.05	......
11	28.00	23.00	20.00	17.50	......	16.00	......	......	12.50	12.00	29.50	27.50	25.00	21.00	......	......	......	15.88	14.38	10.75	......
18	27.90	24.50	21.00	18.50	......	17.00	......	......	13.60	12.50	28.70	26.70	24.80	21.00	......	......	......	14.60	13.50	10.00	......
25	28.00	24.20	20.50	18.00	$18.00	17.00	15.33	......	13.50	12.05	29.00	27.00	24.00	21.00	......	......	......	14.50	13.50	10.00	......
Oct. 2	27.50	23.30	18.10	15.10	......	14.10	12.83	$16.50	13.17	10.67	26.70	24.70	22.30	16.90	......	21.50	......	13.70	12.50	9.60	......
9	28.10	22.80	18.40	15.30	15.40	13.65	12.65	......	......	10.55	26.60	24.50	21.50	16.50	......	19.90	......	14.10	12.25	9.75	......
16	28.00	22.88	18.13	14.88	14.88	14.00	12.17	......	......	11.25	25.13	22.88	20.50	15.63	18.50	17.00	......	13.94	12.81	9.25	......
23	26.75	20.70	16.00	13.60	14.10	12.40	10.80	......	......	11.05	24.10	21.00	19.00	13.00	18.50	17.00	......	13.05	11.40	8.90	......
30	27.60	21.60	16.80	14.50	14.50	13.50	12.50	......	......	11.15	27.30	24.20	21.90	17.50	20.50	19.00	......	14.20	12.30	10.00	......
Nov. 6	27.50	22.50	18.25	15.50	16.13	14.00	13.50	......	12.50	11.38	29.88	26.50	23.50	19.00	......	......	......	15.00	13.50	10.50	......
13	27.50	22.40	18.30	15.40	16.30	14.35	13.35	......	12.69	11.95	27.60	25.70	22.90	19.00	22.25	19.80	......	15.30	13.50	10.50	......
20	26.50	20.80	17.00	14.70	15.17	13.55	12.65	......	......	11.40	25.90	24.50	22.50	18.70	21.00	19.00	......	14.30	13.30	10.20	......
27	26.50	18.63	15.88	13.63	14.38	13.50	12.50	......	......	10.92	25.50	24.50	22.50	17.67	......	18.50	......	13.50	12.50	9.00	......
Dec. 4	26.25	18.30	15.60	13.10	13.10	12.10	11.00	......	......	10.15	27.00	24.60	22.50	19.00	......	......	......	13.10	12.10	9.00	......
11	26.00	18.70	15.20	12.90	12.50	11.50	10.50	......	......	8.65	28.50	26.30	23.70	18.70	23.33	20.50	......	12.40	10.80	9.00	......
18	......	18.30	15.00	12.50	12.90	11.50	10.50	......	......	8.50	25.70	24.30	23.20	17.50	21.70	19.20	......	11.70	10.50	9.00	......
25	......	17.20	15.00	11.60	12.50	11.50	9.90	......	11.25	9.30	24.20	22.80	21.30	17.50	21.00	19.00	......	12.00	10.10	8.40	......
1921.																					
Jan. 1	......	18.50	16.70	14.50	13.90	12.50	11.50	......	......	10.65	25.80	23.70	21.20	19.00	22.50	20.25	......	12.00	10.70	9.10	......

PHILADELPHIA.

1917.																					
June 30	$17.25	$16.75	$15.85	$14.10	$14.75	$14.10	$13.30	$13.75	$12.25	$11.90	$24.55	$24.05	$22.80	$20.70	$18.80	$16.80	$14.50	$19.60	$17.60	$14.90	$25.80
July 7	17.25	16.63	15.50	13.13	14.25	13.50	12.38	......	12.25	11.63	22.25	21.25	20.13	18.50	19.00	16.63	13.63	19.63	17.63	14.38	24.00
14	17.80	17.08	16.10	13.60	15.13	14.10	12.85	......	12.25	11.55	24.50	23.50	22.50	18.60	18.50	17.50	16.00	18.90	17.00	14.80	......
21	18.75	18.25	16.80	14.60	16.00	14.60	13.35	14.58	13.00	12.25	25.10	24.10	21.80	19.80	21.40	19.60	17.40	19.00	17.00	14.25	......
28	18.42	17.60	16.05	13.30	14.42	13.60	12.50	......	12.55	11.45	22.10	20.80	19.00	17.00	......	19.00	......	19.00	17.00	15.00	......
Aug. 4	18.75	17.50	15.40	12.45	14.00	12.50	11.25	13.25	11.70	10.50	20.50	19.30	17.80	14.50	18.00	......	......	19.00	17.00	13.67	......
11	18.50	17.50	15.35	12.25	......	12.00	10.55	......	10.50	9.55	22.90	21.70	20.00	16.20	......	......	......	18.80	17.00	13.50	......
18	19.10	18.25	16.50	13.55	......	13.00	11.80	......	11.69	10.13	24.50	23.50	21.10	19.20	21.00	......	......	19.00	17.00	......	......
25	21.50	19.30	17.20	15.15	15.50	14.50	13.50	......	12.00	10.75	25.50	24.50	23.00	......	......	......	......	21.50	20.10	......	......
Sept. 1	......	19.20	16.85	13.80	15.05	13.85	12.10	13.75	12.55	11.50	24.80	23.85	22.20	19.80	21.50	......	......	20.90	19.60	......	......
8	22.50	20.31	17.75	14.75	14.63	13.50	12.50	......	12.50	11.13	24.50	23.50	21.75	19.00	21.50	20.50	......	21.50	20.00	17.50	......
15	22.50	20.50	17.75	14.50	15.50	14.00	12.50	......	12.50	11.50	25.35	24.45	22.80	20.50	22.50	21.00	......	21.40	19.80	17.00	......
22	23.50	21.00	17.90	14.60	16.00	14.40	13.20	13.75	12.50	11.50	27.00	26.35	24.60	20.40	22.50	......	......	21.30	20.20	17.70	......
29	25.00	20.60	16.95	13.40	......	13.45	11.85	......	12.50	11.50	25.10	24.10	21.50	18.30	22.50	......	......	20.50	19.20	16.80	......
Oct. 6	24.67	19.65	15.85	13.10	14.13	12.90	11.85	......	12.45	11.60	24.70	23.70	21.10	18.20	21.50	20.00	......	20.20	18.80	16.31	......
13	......	19.50	15.45	12.55	13.75	12.90	11.80	......	12.50	11.75	25.30	24.30	22.40	20.90	21.10	20.10	......	19.15	18.25	16.20	......
20	24.00	19.55	15.55	12.75	14.00	13.50	12.25	......	12.50	11.60	24.50	23.60	22.40	20.80	20.90	19.50	......	18.50	17.50	15.50	......
27	......	19.40	15.60	12.85	13.92	13.25	11.75	......	12.25	11.50	23.80	22.70	21.10	19.00	20.50	19.50	......	18.50	17.30	15.30	......
Nov. 3	24.00	18.70	15.70	13.00	13.75	13.20	12.00	......	12.25	11.50	23.90	22.90	20.70	17.00	19.90	18.85	......	18.20	17.30	15.50	......
10	23.50	18.50	16.00	12.90	13.75	13.25	12.00	......	12.25	11.50	24.05	23.20	21.00	16.00	19.50	18.50	......	17.50	16.45	14.60	......
17	21.00	17.75	15.90	13.40	13.75	13.20	12.00	......	12.40	11.50	23.10	22.15	20.50	15.90	19.50	18.00	......	17.50	16.45	14.00	......
24	......	18.55	16.00	13.55	13.75	13.25	12.20	......	12.25	11.20	23.15	22.10	20.50	17.50	19.50	18.50	......	18.10	17.10	15.33	......
Dec. 1	......	18.88	16.25	13.56	14.13	13.25	12.25	......	12.25	11.50	23.00	21.94	20.50	19.00	19.31	18.44	......	18.00	17.00	13.00	......
8	22.00	18.50	16.50	14.20	14.45	13.75	12.55	......	12.50	11.50	22.35	21.30	20.10	18.80	19.30	18.30	......	18.00	17.20	14.90	......
15	......	18.80	16.75	14.55	15.20	14.35	12.85	......	13.25	12.05	23.10	21.45	20.30	18.90	19.50	18.50	......	18.20	17.25	15.69	......
22	22.25	19.00	17.05	16.10	15.70	15.15	13.90	15.00	13.50	12.55	23.50	22.45	20.50	......	20.05	19.30	......	18.85	18.00	15.80	......
29	23.67	18.38	16.69	14.75	15.13	14.44	13.38	......	13.31	12.75	22.94	21.63	20.50	19.17	19.69	18.94	......	18.06	17.25	15.56	......
1918.																					
Jan. 5	......	18.38	16.75	14.69	15.20	14.31	13.50	......	13.25	12.75	22.38	21.31	20.50	19.19	19.14	18.38	......	17.44	16.38	14.50	......
12	......	18.35	16.70	14.75	14.60	13.80	12.95	......	13.25	12.75	22.44	21.25	20.25	18.70	18.75	18.28	......	17.65	16.80	15.45	......
19	......	18.40	17.00	15.55	15.10	14.30	13.63	......	14.50	13.65	23.70	22.60	21.50	20.25	20.00	19.00	......	17.80	16.75	14.88	......
26	20.00	19.35	18.10	16.50	17.20	16.25	15.25	......	15.75	15.10	25.55	24.65	23.85	22.25	20.58	19.50	......	19.40	18.35	......	......
Feb. 2	20.00	18.95	17.60	16.40	16.75	16.05	15.25	......	15.81	15.05	24.50	23.75	23.15	......	20.70	......	......	19.70	18.50	15.25	......
9	19.83	18.50	17.35	16.10	16.30	15.55	14.70	......	15.50	14.75	23.10	21.95	21.15	......	21.50	20.50	......	19.50	17.50	15.30	......
16	18.75	18.05	16.95	15.85	15.90	15.25	14.40	......	15.35	14.75	22.40	21.60	20.80	......	20.50	18.50	......	19.30	17.50	15.00	......
23	18.67	17.81	16.63	15.56	15.25	14.69	13.88	......	15.00	14.50	21.88	20.75	19.75	......	19.50	......	......	18.19	17.00	15.13	......
Mar. 2	18.50	17.50	16.50	15.30	14.85	14.25	13.40	14.50	13.90	13.35	22.90	21.65	20.20	18.50	19.90	......	......	17.90	16.90	15.30	......
9	18.50	17.50	16.50	15.50	15.00	13.95	13.05	......	13.25	12.55	23.70	22.70	21.50	......	20.50	......	......	17.50	16.50	15.30	......
16	18.65	17.80	16.75	15.65	15.65	14.50	13.65	......	13.80	13.25	24.90	23.90	22.60	......	21.60	......	......	18.90	17.90	16.50	......
23	19.00	18.30	17.75	16.60	16.75	15.90	14.75	15.00	14.15	13.25	25.70	24.70	23.50	......	22.00	......	......	20.55	19.50	......	......
30	19.14	18.25	17.75	17.25	16.95	15.75	14.80	15.00	14.25	13.75	25.50	24.50	23.31	22.50	22.50	......	......	21.50	20.50	......	......
Apr. 6	19.75	19.25	18.75	17.95	17.75	17.10	16.25	15.50	14.75	14.25	26.35	25.45	24.38	......	23.86	......	......	22.17	21.30	18.50	......
13	21.28	20.50	19.70	18.75	18.95	18.25	17.50	17.80	16.80	15.90	28.72	27.90	27.44	......	24.50	......	......	24.50	......	......	......
20	23.13	22.25	21.75	20.70	20.40	19.75	18.75	19.00	18.25	17.45	30.50	29.75	29.25	......	29.00	......	......	25.50	......	......	......
27	24.38	23.65	23.25	22.40	22.25	21.45	20.20	19.25	18.50	17.65	29.40	28.60	27.83	......	......	......	......	25.50	......	......	......

[1] Kosher chucks, $22.10.

TABLE 77.—*Western dressed fresh meats: Beef, lamb, and mutton—Weekly average wholesale price per 100 pounds, 1917 to 1920*—Continued.

PHILADELPHIA—Continued.

Week ending—	Beef.										Lamb and mutton.										
	Steer.				Cow.			Bull.			Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1918.																					
May 4	$24.40	$23.65	$22.65	$21.40	$21.95	$21.00	$19.10	$18.50	$17.60	$17.05	$27.30	$26.30	$25.30	$23.38	$25.40	......	......	$24.33	......	......	......
11	23.29	22.15	21.10	19.60	19.86	18.30	16.95	18.50	17.75	16.45	26.89	25.70	24.70	......	26.67	......	......	23.00	......	......	......
18	24.90	23.85	22.50	21.20	20.50	19.45	18.45	19.33	18.25	17.55	28.90	27.90	27.50	......	26.50	......	......	25.00	$23.50	......	......
25	26.79	26.10	25.20	23.40	22.50	21.50	19.65	20.44	19.30	17.83	31.22	30.15	29.25	26.00	28.00	......	......	26.00	25.00	......	......
June 1	26.00	25.25	24.50	22.75	21.81	20.50	18.63	20.00	18.50	16.50	29.75	28.75	27.50	25.63	27.50	$26.50	......	24.86	23.50	......	......
8	26.29	25.50	24.55	22.90	22.05	20.90	19.10	18.40	17.57	16.60	29.30	28.10	26.70	25.50	26.38	25.33	......	24.20	23.17	$20.83	$31.60
15	27.25	26.30	25.50	24.20	24.22	23.45	21.90	21.00	19.44	18.65	29.50	28.50	27.50	25.50	27.50	26.50	......	24.50	23.50	22.50	31.50
22	27.08	26.20	24.85	22.10	24.17	23.10	20.20	19.40	18.35	17.75	29.90	28.90	27.50	25.67	27.50	......	......	22.89	21.30	19.30	31.40
29	26.33	25.55	24.60	22.30	22.17	20.50	18.50	19.67	18.30	17.05	30.38	29.40	28.50	26.00	......	......	......	24.44	22.50	20.50	32.50
July 6	25.75	24.69	22.44	20.88	19.75	18.44	16.88	......	17.00	15.81	32.00	30.38	27.67	24.33	28.67	25.50	......	23.38	21.75	20.13	31.50
13	26.69	25.60	21.90	19.20	19.10	16.90	14.35	......	17.50	14.65	29.40	27.10	24.70	23.25	24.00	......	......	22.60	20.90	18.40	29.40
20	27.00	25.50	22.40	18.40	21.30	17.80	15.20	......	16.70	14.00	28.30	26.00	22.10	18.80	24.50	......	......	23.90	21.00	16.80	29.00
27	26.40	24.30	21.10	16.10	18.88	17.10	14.60	......	16.00	14.00	27.50	24.90	22.50	18.88	25.00	22.50	......	23.00	21.00	17.00	......
Aug. 3	26.50	24.20	19.60	15.00	18.50	16.50	13.90	......	15.00	13.50	27.50	24.60	21.40	18.90	......	......	......	24.00	21.00	19.00	......
10	26.50	24.70	19.50	16.00	......	16.50	13.80	......	14.80	13.50	28.70	26.40	24.00	21.00	......	......	......	24.00	21.00	18.20	......
17	27.00	25.00	20.80	16.00	......	16.60	14.00	......	14.50	13.50	30.00	28.00	25.20	21.50	......	......	......	24.00	21.00	19.00	......
24	28.00	26.10	23.80	18.20	21.50	18.90	16.30	15.50	14.50	13.50	31.20	29.40	27.00	24.60	25.50	......	......	24.60	22.70	19.40	......
31	28.57	26.65	25.00	21.50	22.20	20.50	19.30	17.50	15.50	14.50	29.70	27.60	25.40	23.40	26.25	......	......	25.10	23.00	21.00	......
Sept. 7	29.00	27.00	24.25	21.13	21.88	20.25	19.25	17.50	15.50	14.50	28.00	25.38	22.63	20.00	......	......	......	22.88	21.00	18.75	......
14	28.50	27.00	22.80	19.40	21.50	19.20	17.60	17.50	16.10	15.10	27.20	24.80	22.90	20.30	......	......	......	22.10	19.80	18.00	......
21	28.67	27.00	22.50	18.90	19.50	18.20	16.35	......	16.20	14.95	27.50	25.60	23.50	20.40	......	......	......	20.30	18.50	16.90	......
28	29.00	26.50	20.90	17.30	18.83	16.40	14.70	......	15.45	14.20	27.30	24.80	22.90	20.50	......	......	......	19.00	17.40	15.30	......
Oct. 5	29.43	26.50	19.90	16.20	17.40	15.70	13.60	......	14.67	13.10	25.20	23.00	21.00	19.10	......	......	......	18.63	16.30	13.70	......
12	......	26.50	19.70	15.00	17.00	14.90	12.60	......	14.06	12.10	23.00	21.40	20.00	18.20	......	17.50	......	17.10	15.30	12.70	......
19	28.50	26.50	20.20	15.70	16.80	14.60	13.40	......	14.25	12.50	24.40	22.70	20.70	18.40	......	17.50	......	16.80	14.60	12.90	......
26	28.70	26.50	21.20	17.50	19.00	16.80	15.20	16.50	14.35	13.30	25.70	23.70	21.90	20.50	......	......	......	17.80	14.50	12.40	......
Nov. 2	29.00	26.50	21.40	17.50	19.00	16.90	15.50	16.00	15.50	13.90	25.50	23.80	22.30	20.90	......	......	......	17.00	14.90	13.40	......
9	28.80	26.50	21.70	17.70	19.20	17.30	16.10	16.33	15.50	13.50	25.50	24.30	22.50	21.50	21.00	......	......	19.00	16.00	13.80	......
16	29.00	26.50	21.50	17.75	19.25	17.13	15.25	......	15.50	13.88	25.38	24.00	23.00	21.25	......	......	......	19.88	17.50	14.50	......
23	29.00	26.50	22.50	17.10	19.20	16.70	15.05	......	15.50	13.60	25.20	23.50	21.90	20.40	21.50	19.50	......	19.50	17.50	14.40	......
30	29.00	26.50	22.50	18.25	19.00	17.00	15.00	......	15.50	13.50	21.50	23.25	21.75	20.50	......	......	......	19.00	16.63	13.88	......
Dec. 7	29.13	26.30	21.90	18.70	19.00	16.90	15.60	......	15.29	13.50	24.30	22.90	21.70	19.30	20.67	19.00	......	18.40	15.60	12.80	......
14	28.50	25.30	21.50	17.80	19.00	15.80	14.60	......	15.38	13.50	23.63	22.70	21.70	20.20	19.60	17.63	......	16.70	14.20	11.60	......
21	28.10	24.40	20.50	16.00	18.60	15.30	13.70	......	15.00	13.40	23.70	21.90	20.90	19.80	21.00	17.00	......	15.20	13.20	10.70	......
28	28.00	25.00	20.88	16.75	18.00	15.50	14.00	......	14.80	12.88	23.75	22.00	20.50	19.00	17.50	15.50	......	15.50	13.00	10.00	......

1919.																					
Jan. 4	27.50	26.00	22.38	18.50	19.38	17.25	14.75	15.50	14.50	13.50	26.43	25.00	23.63	21.63	21.25	19.00	......	18.13	16.25	13.88	......
11	29.50	27.30	25.00	21.60	22.10	19.90	17.90	16.50	15.50	14.50	31.50	30.30	29.10	26.67	24.00	21.50	......	22.70	20.00	17.10	......
18	29.50	26.30	23.30	20.90	22.00	20.30	18.05	16.50	15.50	14.30	30.89	29.50	28.50	27.00	26.50	25.25	......	22.90	20.80	18.00	......
25	27.00	24.90	21.20	18.40	19.60	17.30	14.80	16.25	15.50	14.30	25.13	24.30	23.30	20.60	......	......	......	19.20	16.50	13.80	......
Feb. 1	26.38	24.20	21.60	19.40	19.20	16.90	15.30	17.00	15.38	14.10	26.50	24.80	23.20	21.60	......	......	......	18.80	16.20	14.60	......
8	27.10	25.00	23.30	20.60	19.90	18.30	15.70	16.50	15.13	13.70	30.20	28.40	27.30	25.25	23.38	22.13	......	20.40	18.20	15.90	......
15	28.25	25.60	23.70	21.00	22.30	20.00	18.50	17.89	15.50	14.50	31.50	30.00	28.30	26.30	24.50	23.00	......	23.00	19.90	17.20	......
22	27.00	24.90	23.50	21.40	23.00	20.50	18.70	18.00	15.50	14.50	29.88	28.20	27.10	25.50	......	......	......	23.00	20.00	18.00	......
Mar. 1	26.50	24.30	23.10	21.60	23.00	21.10	19.20	17.90	15.50	14.50	31.50	30.50	28.00	26.50	......	......	......	23.00	21.00	19.00	......
8	26.50	24.50	23.50	22.00	......	21.50	19.50	......	15.50	14.50	32.10	31.10	28.00	26.50	......	......	......	23.00	21.00	19.00	......
15	27.00	25.50	24.50	22.00	23.50	21.00	18.00	18.00	16.50	14.50	33.50	32.50	29.00	......	......	......	......	24.90	22.90	21.20	......
22	27.00	25.44	24.50	22.60	......	22.00	19.30	18.00	16.50	14.50	34.00	32.70	30.60	28.63	......	......	......	25.50	23.50	21.50	......
29	27.00	25.50	24.50	22.50	......	22.00	19.20	18.43	16.50	15.30	33.50	31.10	30.10	27.80	......	......	......	25.50	23.50	21.00	......
Apr. 5	27.00	25.50	24.50	22.50	22.50	21.70	19.10	18.70	17.50	15.50	32.00	30.90	29.90	28.83	......	......	......	25.25	24.10	21.40	......
12	27.00	25.50	24.50	22.70	22.50	21.50	19.50	19.50	17.50	15.50	33.50	32.50	31.50	30.50	31.50	30.50	......	25.50	24.50	22.50	......
19	......	24.50	23.70	21.60	......	21.10	19.50	18.50	17.50	15.50	......	32.50	31.50	30.50	31.50	30.50	......	26.00	24.50	22.50	......
26	......	23.88	22.50	21.30	21.50	20.50	18.30	17.50	16.90	15.50	......	31.70	30.70	29.75	30.70	30.50	......	26.00	24.50	22.50	......
May 3	......	25.10	24.10	21.60	21.50	20.50	19.50	18.50	17.50	15.50	......	31.30	30.30	28.50	30.30	28.50	......	25.63	24.50	21.70	......
10	......	25.10	23.10	20.90	......	21.10	19.00	19.50	17.50	15.50	......	29.70	28.70	26.67	28.70	26.67	......	24.56	23.30	21.10	......
17	......	25.00	23.50	21.00	21.50	20.50	19.50	19.50	17.50	15.50	30.00	28.75	27.75	25.83	27.75	25.83	......	23.50	22.25	19.88	......
24	......	24.38	23.30	19.80	21.50	20.50	18.50	......	17.50	15.70	32.00	30.50	28.50	24.50	28.50	......	......	21.70	20.60	18.80	......
31	......	22.67	21.75	18.63	......	19.75	17.75	18.50	16.50	15.50	32.00	30.50	29.25	28.50	28.25	27.50	$25.50	20.50	18.50	17.00	......
June 7	......	21.40	19.00	16.50	17.50	16.70	14.80	......	15.70	14.30	31.50	30.50	......	......	29.50	......	......	21.10	19.10	17.00	32.75
14	......	20.30	18.20	15.10	16.10	14.30	13.10	14.75	13.50	12.00	32.50	31.50	30.50	28.50	26.50	25.50	......	21.50	19.50	17.00	33.38
21	......	20.22	18.00	14.80	15.10	13.70	12.50	15.25	12.90	10.80	30.00	28.70	27.10	23.00	29.50	27.50	......	21.50	19.50	16.40	31.00
28	......	21.50	19.70	16.70	16.50	14.70	13.00	15.50	13.50	12.50	28.50	26.50	25.00	19.67	24.38	22.38	......	21.00	19.30	16.50	28.38
July 5	......	21.50	19.50	17.50	16.50	15.50	......	15.50	13.50	12.50	25.25	24.25	21.00	16.50	23.00	......	......	18.25	16.75	13.50	27.25
12	22.50	21.50	19.50	17.50	17.50	15.50	14.50	15.50	14.50	13.50	25.50	24.50	23.75	21.00	23.13	19.00	......	16.50	15.50	13.00	26.50
19	......	22.78	20.70	18.60	17.88	16.90	15.80	16.50	15.50	14.50	29.33	27.90	26.10	22.10	22.25	20.75	......	19.80	17.90	16.50	......
26	......	22.78	20.20	17.60	18.00	16.95	15.50	......	15.67	14.30	28.00	25.80	23.20	20.10	22.50	21.50	21.00	21.50	20.20	17.00	......
Aug. 2	24.33	23.10	18.00	14.10	......	15.10	12.90	......	13.50	12.00	25.38	22.90	21.00	16.80	......	18.88	17.38	19.00	16.70	14.60	......
9	24.20	22.00	18.30	14.10	16.50	14.00	12.00	......	......	10.90	27.75	25.50	23.10	20.00	......	......	......	18.00	16.20	14.20	......
16	24.50	22.70	19.60	16.80	15.50	14.80	13.20	......	12.50	11.50	29.75	28.70	25.50	22.10	......	19.67	......	19.10	16.40	13.50	......
23	25.50	24.20	20.50	17.50	16.50	15.50	13.60	......	12.25	10.70	30.60	29.50	27.00	22.20	......	......	......	19.00	17.00	13.00	......
30	......	22.70	18.00	15.80	......	14.10	12.20	......	......	10.05	28.86	27.00	24.60	20.90	......	23.00	......	18.75	16.10	13.00	......
Sept. 6	24.00	21.50	17.38	14.75	......	13.25	11.25	......	......	9.75	25.00	23.00	20.63	17.38	......	20.50	......	17.60	15.50	13.00	......
13	25.00	22.89	17.10	14.60	15.50	13.50	11.40	......	......	10.00	23.86	21.15	19.20	17.00	......	20.50	......	15.70	14.30	12.56	......
20	......	23.90	17.20	14.40	......	14.44	12.60	......	11.50	10.50	24.10	23.10	21.80	19.80	21.00	18.40	......	16.10	15.10	12.20	......
27	25.00	23.00	16.40	14.10	14.50	13.30	11.70	......	10.50	9.50	23.90	22.70	21.30	19.40	......	17.33	......	14.50	13.10	11.70	......
Oct. 4	25.25	23.40	19.60	15.70	15.50	14.25	12.70	......	......	9.90	24.44	22.70	20.90	19.30	19.00	......	......	15.50	14.50	12.50	......
11	26.50	24.00	20.70	17.00	16.70	15.70	13.70	......	......	10.50	25.50	24.50	22.50	20.50	......	......	......	17.50	15.70	13.70	......
18	26.50	24.00	20.10	16.70	17.50	16.30	14.30	......	......	10.40	25.70	24.10	22.70	21.10	......	......	......	16.75	15.70	14.70	......
25	27.50	23.90	19.80	15.60	......	14.90	13.40	......	......	10.10	25.50	24.50	22.50	21.00	21.75	18.00	......	17.33	15.50	13.30	......
Nov. 1	......	23.60	18.70	14.40	15.33	13.40	11.60	......	11.67	9.65	24.40	23.10	21.50	19.40	21.00	18.75	......	16.90	14.70	12.10	......
8	27.50	23.40	18.50	14.10	14.10	13.10	11.40	......	11.25	10.10	24.20	23.10	21.40	19.60	......	......	......	15.70	14.50	12.00	......
15	26.50	24.00	20.00	14.60	15.00	13.50	12.50	......	......	9.50	24.33	23.30	21.90	19.40	......	......	......	16.29	14.10	12.20	......
22	......	24.00	19.80	15.40	16.38	14.50	13.00	......	......	10.25	24.56	23.50	21.10	18.60	......	......	......	15.50	13.60	11.80	......
29	......	23.29	18.00	14.63	15.43	14.00	12.50	......	......	9.88	23.71	22.00	20.00	16.63	......	......	......	14.25	13.00	11.25	......
Dec. 6	27.50	22.78	17.80	13.55	15.17	13.50	12.50	......	......	9.50	24.40	22.50	21.00	17.80	17.75	15.75	......	14.38	13.40	11.00	......
13	......	23.50	19.00	14.60	15.50	13.50	12.50	......	......	9.50	25.44	23.90	22.70	21.00	......	......	......	15.50	13.50	12.10	......
20	......	23.50	19.80	15.50	16.00	14.50	13.40	......	11.63	9.80	26.29	24.50	23.50	21.00	......	......	......	16.00	14.50	13.40	......
27	......	22.50	18.75	15.25	16.20	14.50	13.50	......	......	10.13	27.63	26.50	24.50	21.75	21.50	20.50	......	16.50	15.50	14.00	......

TABLE 77.—*Western dressed fresh meats: Beef, lamb, and mutton—Weekly average wholesale price per 100 pounds, 1917 to 1920*—Continued.

PHILADELPHIA—Continued.

Week ending—	Beef.										Lamb and mutton.										
	Steer.				Cow.			Bull.			Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1920.																					
Jan. 3		$21.50	$18.50	$15.00	$16.00	$4.50	$13.38			$10.19	$28.71	$27.25	$25.25	$21.88	$22.50	$20.50		$16.86	$15.25	$12.63	
10		21.50	19.20	16.00	16.44	15.50	13.90			10.50	30.00	28.50	27.00	22.99				18.00	16.30	13.50	
17		21.30	19.00	17.00	17.38	15.70	14.70		$12.50	11.00	30.56	29.50	27.40	23.40				18.57	17.00	13.70	
24		20.90	19.00	17.30	17.44	16.50	15.40		14.50	12.50	32.20	30.50	29.00	26.50	25.50			18.40	16.10	14.00	
31		20.00	18.30	17.00	17.00	16.10	15.10		14.50	12.50	33.50	32.00	30.00	27.00	27.50			20.78	19.00	16.50	
Feb. 7		18.90	17.30	16.10	16.50	15.30	14.40		14.50	12.50	34.56	33.50	30.70	28.40				21.80	19.00	17.00	
14		17.80	16.50	15.50	16.00	14.50	13.50		13.25	11.90	34.50	33.50	31.00	29.00				22.00	19.00	17.00	
21		18.00	16.50	15.50	16.00	14.50	13.50			11.00	34.78	33.40	32.00	30.00				23.60	21.50	19.00	
28		18.00	16.75	15.63	15.50	14.50	13.38			10.00	33.57	32.25	30.88	28.75				22.50	20.63	18.50	
Mar. 6		18.50	17.50	16.40	16.00	14.50	13.50			9.90	30.50	28.90	27.30	25.70				20.70	19.00	17.20	
13		19.50	18.50	17.50	17.00	15.50	14.50			10.80	30.60	28.80	26.50	25.00				21.30	18.10	15.40	
20		20.50	19.50	18.50	17.00	16.30	15.30		13.00	11.00	31.10	29.70	28.50	26.20				22.50	19.50	15.50	
27		20.35	19.35	18.45	17.75	16.90	16.25		13.90	13.50	32.67	31.00	29.10	26.60	30.50	29.50		24.40	21.50	18.40	
Apr. 3		19.80	18.70	17.65	17.75	16.70	15.95		14.30		33.30	31.70	29.90	28.30	30.50	29.50		24.50	22.50	19.00	
10		19.50	18.30	17.20	17.63	16.50	15.50		13.00		34.11	32.70	31.50	29.20	31.00	29.50		26.00	22.20		
17		23.50	22.50	20.13		19.50	18.20		16.50	15.50	40.44	38.50						31.13	29.00		
24		22.10	20.60	19.00		18.50	16.80			14.00	33.80	34.90	32.63		33.88			30.13	26.00	23.00	
May 1		20.80	19.50	18.50	19.00	17.50	16.50			14.00	33.50	32.30	31.10	28.60	31.10			25.67	24.80	22.13	
8	$22.00	20.90	19.50	18.30		17.50				14.00	35.00	33.50	32.30	29.70	32.50			25.33	23.30	21.20	
15		20.13	18.70	17.60		17.50	16.30		14.50	13.70	35.29	33.50	31.30	26.50	32.10			21.20	19.70	18.75	
22		18.67	17.50	16.40		16.25	15.10			13.00	34.25	32.30	30.20	28.00	31.13			19.38	18.00	16.10	
29		17.60	16.50	15.30		14.50	13.90			11.60	33.30	31.70	29.40	26.50				18.30	16.50	14.50	$34.00
June 5		18.38	16.50	15.00		14.50	13.25			11.00		31.63	29.00	26.50				19.00	17.00	15.00	34.63
12	25.00	22.65	20.40	18.60		17.00	16.00		14.00	12.50	36.00	34.83	32.50	29.67				22.40	19.25	17.25	36.80
19		27.29	24.50	22.20	23.00	21.50	20.00		19.00		36.00	34.80	32.40	29.10				24.30	22.70	20.00	36.70
26	29.50	27.78	25.50	23.50	23.00	21.50	20.50			15.50	34.50	32.60	30.20	26.20				23.55	21.00	17.40	34.30
July 3		27.30	23.40	18.60		18.50	17.13			14.13	32.10	29.40	26.80	22.90	30.50	28.50	$24.75	22.50	18.20	15.20	
10		27.00	22.00	16.13		17.00	14.13			11.88	33.13	30.00	27.00	24.25				20.00	17.50	15.00	
17		26.20	22.40	17.10		16.50	14.60			11.00	34.30	31.00	28.90	23.70				23.00	19.00	14.50	
24		24.20	20.50	16.50	18.50	16.50	14.00			11.00	32.90	29.90	28.00	24.50	29.17	27.50		23.00	19.00	16.33	
31		24.10	20.70	16.50	18.00	16.10	13.70			11.00	32.40	30.00	28.50	25.80				23.00	19.00	16.00	
Aug. 7	26.00	24.50	21.50	17.50	18.00	16.50	15.50			11.88	31.40	29.20	27.30	25.10	27.67			22.00	18.90	16.00	
14	26.33	24.30	20.50	17.50	18.00	16.50	15.50			13.25	30.75	28.00	25.30	22.40		24.50		20.40	18.20	15.00	

21	26.00	24.00	20.50	16.20	......	16.00	14.20	......	......	11.60	27.30	25.30	22.20	17.80	......	20.63	......	16.71	14.90	11.90	......
28	26.80	24.60	20.50	16.50	18.00	16.50	14.10	......	......	11.00	29.80	27.60	24.80	21.60	......	......	......	16.63	14.50	12.50	......
Sept. 4	27.50	25.50	21.60	17.50	18.00	16.50	15.20	......	......	12.00	31.22	29.90	28.20	24.90	......	22.50	20.50	18.00	15.80	12.60	......
11	27.50	25.50	22.50	18.75	19.00	17.50	16.25	......	14.00	12.69	31.25	29.25	27.75	24.50	......	24.00	......	19.00	16.50	13.50	......
18	27.50	25.50	22.50	18.90	......	17.50	16.00	......	......	12.50	30.70	28.50	26.70	23.80	......	24.50	21.00	19.00	16.50	13.50	......
25	27.50	25.00	21.40	17.20	......	17.00	14.70	......	......	12.10	29.90	27.40	24.90	21.70	......	24.50	21.00	19.00	16.20	12.60	......
Oct. 2	27.67	23.70	19.50	15.50	......	15.30	13.10	......	......	11.60	28.90	27.50	25.80	22.60	......	24.50	21.00	18.00	15.30	12.30	......
9	28.00	24.00	20.00	15.70	16.00	14.80	12.70	......	......	11.10	27.80	26.30	24.90	22.10	21.00	......	......	16.40	14.50	11.80	......
16	......	23.63	18.75	15.50	16.00	14.50	12.75	......	......	10.75	27.63	26.13	25.00	22.63	......	......	......	16.67	14.50	12.88	......
23	26.00	20.30	17.00	14.30	15.00	13.50	11.80	......	......	10.50	27.00	25.30	24.20	19.90	......	......	......	16.00	14.50	12.20	......
30	......	22.00	18.50	15.50	16.00	14.50	13.10	......	......	11.00	27.70	26.50	24.00	19.40	22.50	......	......	16.63	14.50	12.00	......
Nov. 6	28.00	23.10	19.60	16.30	16.50	15.50	13.70	......	12.50	11.50	30.89	29.30	27.20	22.50	25.50	......	......	18.40	16.00	13.80	......
13	28.00	23.30	19.50	16.40	16.22	15.10	13.80	......	......	11.50	31.70	30.00	27.80	22.33	24.75	......	......	19.33	16.90	14.40	......
20	......	20.70	18.10	15.38	15.15	14.25	13.30	......	......	11.50	29.11	27.70	25.70	21.50	23.67	21.00	......	17.00	15.50	13.40	......
27	......	18.38	15.75	13.67	14.25	13.25	12.13	......	......	10.50	27.86	25.88	23.25	18.63	24.00	......	......	17.00	15.50	12.38	......
Dec. 4	20.00	17.90	15.30	12.60	13.00	11.90	10.70	......	......	9.50	28.00	26.00	24.10	19.25	......	......	......	14.33	12.70	10.00	......
11	......	18.60	15.70	12.10	13.83	12.50	11.00	......	10.50	8.50	29.50	27.00	24.00	21.50	24.00	......	......	14.80	13.60	11.40	......
18	25.50	19.10	16.30	12.80	13.80	12.30	11.10	......	......	8.50	28.00	26.30	24.50	21.50	22.17	19.00	......	14.70	12.90	11.00	......
25	26.00	18.30	16.40	13.00	13.80	12.30	10.90	......	......	9.50	26.44	24.40	21.80	20.00	21.00	......	......	14.33	12.50	11.00	......
1921.																					
Jan. 1	23 67	18.40	16.10	14.50	14.60	13.50	12.50	......	11.50	......	27.00	25.60	24.30	22.00	21.50	19.50	......	14.75	12.90	10.40	......

BOSTON.

1917.																					
June 30	$16.53	$16.23	$15.83	$12.85	$14.75	$14.30	$12.73	$13.60	......	$12.50	$26.50	$25.50	$24.10	......	$17.90	$16.90	$13.20	$17.70	$16.70	$14.00	$28.25
July 7	16.53	15.97	15.44	12.25	14.38	13.75	11.88	13.38	$12.69	11.83	21.75	20.75	19.33	$17.63	15.50	14.38	13.00	15.50	14.00	11.88	23.13
14	17.83	17.19	16.53	13.60	14.75	14.15	12.19	......	12.20	11.33	22.25	21.50	18.00	15.75	15.50	......	12.83	15.50	......	10.90	24.00
21	18.70	18.20	17.00	14.50	15.55	14.80	13.50	......	13.25	......	26.30	24.80	22.80	16.50	19.00	17.00	......	16.15	14.50	11.00	......
28	18.05	17.50	16.53	13.70	14.88	14.10	12.85	14.13	13.75	12.00	24.40	23.00	21.00	17.50	17.33	......	......	17.25	15.75	......	......
Aug. 4	18.22	17.38	16.20	13.15	14.20	13.20	12.10	......	12.25	11.44	24.10	22.20	20.10	16.50	16.00	15.50	......	19.50	17.50	......	......
11	18.78	17.75	16.25	12.80	......	12.50	10.55	......	12.05	11.00	25.50	23.50	21.40	18.63	18.50	......	......	18.50	16.50	......	......
18	20.05	19.25	17.60	15.00	14.70	13.50	12.55	13.13	11.50	10.60	27.50	26.10	24.50	......	19.83	18.50	......	20.50	19.70	19.50	......
25	20.88	20.25	17.85	11.85	15.50	14.50	13.45	14.00	11.85	10.90	23.75	25.40	23.10	19.25	20.00	18.50	......	22.00	20.67	19.00	......
Sept. 1	21.38	19.80	17.15	14.65	14.70	13.90	12.95	14.75	12.60	11.50	25.30	24.00	21.60	18.75	20.50	19.00	17.17	21.50	20.50	......	......
8	21.88	20.63	17.06	14.56	14.38	13.50	12.13	......	12.25	11.31	25.75	24.50	23.00	20.00	......	18.50	13.17	21.50	20.50	19.00	......
15	22.40	20.60	17.90	15.50	15.00	14.10	12.90	......	12.65	11.70	26.10	25.10	23.25	20.50	20.50	18.00	......	21.50	20.50	19.50	......
22	22.65	20.85	17.55	16.13	15.60	14.70	13.81	......	12.53	11.58	26.25	25.45	24.12	......	20.50	19.50	......	21.30	20.30	19.25	......
29	22.15	20.30	16.55	......	15.05	14.18	13.25	12.75	12.20	11.58	24.85	23.65	22.20	......	19.80	18.75	13.50	19.30	17.70	16.50	......
Oct. 6	21.81	19.10	15.60	......	13.75	13.00	12.75	......	12.00	11.25	24.10	23.20	22.38	21.50	16.83	15.67	13.00	19.30	17.83	15.17	......
13	21.44	18.25	15.81	......	13.75	12.75	11.75	11.75	11.31	......	25.50	24.56	24.25	......	18.75	17.67	15.50	18.75	17.50	16.00	......
20	20.50	17.85	16.00	......	13.60	12.75	11.75	12.25	11.30	......	25.55	25.07	24.08	......	21.00	17.70	14.50	19.30	18.50	......	......
27	20.88	17.55	15.55	14.50	13.85	13.00	......	......	11.50	......	25.05	24.30	22.88	......	20.05	16.95	13.83	18.30	17.30	16.50	......
Nov. 3	22.00	17.20	14.95	......	13.65	12.58	......	......	11.50	......	24.50	23.50	22.05	......	20.20	16.80	13.20	17.50	16.40	......	......
10	21.08	16.50	14.55	......	13.90	12.80	12.05	......	11.50	10.75	24.65	23.50	21.90	......	19.80	16.10	13.00	17.40	15.75	......	......
17	19.38	16.50	14.70	......	13.80	12.90	11.95	......	11.50	......	25.00	23.50	22.50	......	19.80	16.50	15.33	17.70	16.60	......	......
24	20.50	16.70	14.80	......	13.40	12.50	11.75	12.25	11.50	......	24.90	23.75	22.45	......	20.33	15.90	12.50	17.50	16.50	15.50	......

TABLE 77.—*Western dressed fresh meats: Beef, lamb, and mutton—Weekly average wholesale price per 100 pounds, 1917 to 1920.*—Continued.

BOSTON—Continued.

Week ending—	Beef.										Lamb and mutton.										
	Steer.				Cow.			Bull.			Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1917																					
Dec. 1	$19.88	$16.75	$15.00	....	$13.31	$12.50	$11.69	$12.25	$11.50	....	$23.75	$21.50	$19.50	....	$18.50	$14.50	$12.00	$17.50	$16.50	$15.00	....
8	20.00	17.25	15.75	....	14.10	13.30	12.85	12.25	11.65	$11.25	22.80	21.00	19.00	....	....	14.50	12.00	17.13	16.38	15.50	....
15	19.75	18.20	16.65	....	15.13	14.45	13.67	12.33	11.75	....	23.80	22.00	20.20	....	18.75	15.50	....	18.30	17.60	....	....
22	20.56	18.90	17.35	$15.85	15.75	15.00	13.83	12.95	12.25	....	24.90	24.20	22.50	....	19.90	17.10	13.00	19.88	18.50	....	....
29	19.75	18.25	17.19	16.25	15.19	14.56	13.75	13.00	12.25	....	23.19	22.25	20.38	....	18.50	15.38	12.13	17.83	17.25	....	....
1918.																					
Jan. 5	18.06	17.38	16.50	....	14.78	14.25	13.50	13.75	13.25	12.50	22.75	21.38	19.38	....	18.25	14.88	13.00	17.81	17.06	....	....
12	17.65	17.15	16.63	....	14.75	14.18	13.45	13.25	12.75	....	22.90	21.00	19.00	....	18.50	15.17	13.00	17.75	17.15	....	....
19	18.05	17.55	16.95	....	15.38	14.78	14.06	13.80	13.15	....	24.55	23.00	21.95	....	21.17	17.67	....	18.75	18.25	....	....
26	17.85	17.43	17.00	16.75	15.81	15.25	14.70	14.55	14.06	13.75	25.80	24.95	23.95	....	21.50	18.75	17.63	20.50	20.00	....	....
Feb. 2	17.83	17.40	16.98	16.50	15.75	15.25	14.33	14.75	14.25	13.75	21.70	23.70	21.75	$20.50	20.63	17.50	15.50	19.95	19.05	16.75	....
9	18.15	17.78	17.25	....	15.75	15.23	14.75	14.73	14.25	....	24.25	22.95	21.00	....	....	18.00	16.00	19.75	18.50	....	....
16	18.43	18.05	17.55	....	15.93	15.25	14.25	14.75	14.25	....	23.90	22.90	20.80	....	....	17.40	14.50	19.10	18.00	....	....
23	17.94	17.44	16.81	....	15.75	15.00	....	14.56	14.16	....	22.50	21.25	18.88	....	17.33	16.00	....	17.94	17.31	....	....
Mar. 2	17.73	17.43	17.13	....	15.85	15.25	14.50	14.30	13.73	....	23.50	21.40	19.00	....	17.50	16.40	15.00	17.75	17.25	....	....
9	17.43	17.10	16.75	....	15.60	15.10	14.41	13.47	13.25	....	24.10	22.40	20.70	....	....	15.90	14.60	19.40	18.60	....	....
16	17.53	17.28	17.08	....	15.85	15.05	14.38	13.63	13.13	....	24.45	23.25	21.55	....	20.00	16.80	15.13	20.50	19.45	....	....
23	18.08	17.78	17.63	....	16.23	15.63	15.21	13.90	13.63	....	24.80	24.10	22.30	....	19.50	18.50	15.00	20.50	19.50	....	....
30	18.53	18.28	18.08	....	16.73	16.25	15.70	11.63	14.28	....	24.65	23.50	21.35	....	20.83	18.50	16.10	20.50	19.50	....	....
Apr. 6	19.07	18.88	18.48	....	17.28	16.83	16.05	15.38	15.08	....	26.60	25.70	24.00	....	21.90	20.25	17.80	22.50	....	....	....
13	20.53	20.18	20.03	....	18.65	18.15	17.65	16.44	16.18	....	28.30	27.30	26.30	....	23.17	22.00	....	24.25	22.50	....	....
20	22.50	22.25	22.25	....	21.00	20.44	18.88	19.25	18.50	17.25	29.19	28.25	27.13	....	25.75	22.50	....	25.33	....	....	....
27	22.80	22.60	22.35	....	21.05	20.35	19.45	19.41	19.13	18.75	27.25	2[illegible].30	24.80	....	25.50	22.50	....	25.58	....	....	....
May 4	22.50	22.23	22.23	....	20.45	19.50	18.00	18.13	17.73	17.25	27.05	25.50	24.50	....	....	22.17	....	25.50	....	....	$32.50
11	22.80	22.69	22.56	....	20.35	18.50	17.25	16.94	16.34	....	28.10	27.10	25.70	....	23.50	21.50	....	25.00	....	....	....
18	23.00	22.75	22.75	....	20.35	18.50	17.65	16.15	15.68	....	29.50	27.90	26.80	....	....	24.00	....	26.00	....	....	....
25	23.85	23.58	23.48	....	21.67	20.20	19.75	17.40	16.60	....	28.80	27.70	26.70	....	....	22.25	....	25.50	....	....	....
June 1	25.00	24.78	24.38	....	22.75	21.94	20.50	18.81	18.19	17.25	28.50	27.13	26.13	....	....	....	....	25.33	....	....	31.50
8	25.69	25.61	25.39	....	24.05	23.30	22.28	20.30	19.30	17.50	28.30	26.40	25.30	....	24.17	19.70	18.25	24.60	22.50	....	30.10
15	25.84	25.83	25.55	....	24.45	23.45	....	21.50	20.50	18.50	28.45	26.90	25.90	....	....	22.50	21.50	....	22.83	21.63	29.80
22	25.14	24.88	24.09	20.88	23.38	22.00	19.13	21.17	19.31	18.31	29.50	28.69	28.06	....	24.83	23.50	21.50	25.50	21.00	16.83	31.06
29	23.80	23.53	22.20	20.50	20.10	18.75	16.75	19.25	17.85	16.75	29.50	29.00	....	....	24.83	23.50	....	25.50	24.00	....	31.70
July 6	24.14	23.88	21.75	17.25	18.63	16.38	15.38	....	16.38	15.50	29.25	28.00	26.13	25.38	24.50	23.50	....	24.50	23.50	....	30.88
13	25.50	25.20	22.45	17.40	20.56	17.55	15.90	15.92	15.00	14.40	28.10	26.10	25.10	22.00	22.00	19.25	14.00	24.25	23.67	....	28.70

20	26.63	26.00	23.40	....	22.45	19.95	16.65	16.50	14.75	14.25	30.22	28.50	26.00	20.50	23.50	20.00	14.21	24.75	23.40	....	....
27	25.67	25.10	21.55	....	21.88	17.50	15.30	15.50	14.65	14.10	28.90	27.90	26.00	21.17	24.17	21.00	15.21	24.75	23.50	....	....
Aug. 3	25.75	25.25	22.75	18.80	21.38	16.40	13.70	15.50	13.65	13.05	29.25	28.50	26.00	21.00	23.83	19.88	14.09	24.75	23.50	....	....
10	26.69	26.25	23.30	20.00	21.88	16.40	14.80	....	13.80	13.25	28.60	27.30	25.50	19.25	23.83	22.50	....	22.60	21.10	....	....
17	27.30	26.58	24.10	21.00	22.05	17.00	15.55	15.00	14.25	13.55	28.10	26.70	24.20	20.67	24.50	22.50	19.67	20.80	18.00	....	....
24	27.31	26.60	23.30	20.50	22.42	17.90	15.95	14.75	14.25	13.75	30.15	28.95	27.75	....	23.00	21.50	14.63	20.83	18.33	....	....
31	27.60	25.50	22.50	20.50	23.15	20.30	18.50	15.83	14.75	14.08	29.70	28.75	27.50	25.00	24.90	23.30	14.75	23.00	22.10	20.50	....
Sept. 7	27.31	25.50	21.94	20.50	20.75	19.56	17.94	16.50	15.50	14.25	29.00	27.69	25.38	22.00	21.00	19.63	16.00	20.75	19.25	16.38	....
14	27.50	25.85	22.75	20.50	20.90	18.60	17.35	16.50	15.81	15.25	28.10	26.80	25.00	....	22.50	19.00	15.50	20.50	18.50	16.60	....
21	27.80	25.90	22.85	....	18.75	17.10	16.05	....	15.45	14.25	26.65	25.40	24.00	20.13	23.50	21.00	12.00	20.50	17.80	15.80	....
28	....	26.00	22.65	20.90	18.44	15.95	15.00	....	14.95	14.25	25.75	24.20	23.10	21.00	22.00	19.10	16.90	18.90	16.50	14.88	....
Oct. 5	28.33	25.60	22.35	20.50	18.44	15.95	14.98	....	14.35	13.50	24.70	23.50	22.50	21.00	21.50	19.00	16.00	18.50	16.50	14.50	....
12	27.50	25.00	22.50	20.50	18.80	16.95	15.35	15.25	13.72	13.25	24.10	23.10	22.10	20.40	21.00	....	....	17.80	16.70	14.50	....
19	27.50	25.00	21.90	20.00	18.33	16.25	14.75	14.50	13.75	13.25	23.50	22.50	21.50	19.70	....	....	....	17.50	16.30	14.50	....
26	27.80	25.00	21.35	19.10	17.17	15.75	14.30	15.00	13.65	13.05	24.42	23.70	22.60	20.90	....	15.00	13.00	17.10	15.70	14.50	....
Nov. 2	....	25.00	22.20	19.30	17.38	15.40	14.25	....	13.50	12.75	24.60	23.80	22.90	21.25	20.63	15.00	13.00	16.50	15.50	14.50	....
9	27.56	25.00	22.40	19.30	17.35	15.65	14.95	14.50	14.00	13.45	24.55	23.55	22.50	21.00	21.88	....	....	16.70	15.50	14.50	....
16	27.92	25.50	23.50	21.00	18.80	16.67	15.80	15.50	14.75	14.25	25.00	24.17	22.83	....	21.50	14.50	13.00	17.50	15.50	14.50	....
23	28.25	26.50	23.90	21.17	19.50	17.70	17.00	15.50	14.75	14.25	25.14	24.50	22.70	20.75	21.00	15.50	13.00	17.50	15.50	14.50	....
30	28.00	26.38	22.88	20.50	18.83	16.88	15.94	15.43	14.75	14.25	24.44	23.50	21.50	20.50	20.50	15.50	13.00	16.80	15.50	14.50	....
Dec. 7	27.43	24.80	22.30	20.00	17.11	15.55	14.65	15.45	14.60	13.95	23.25	22.50	20.80	19.30	19.30	14.60	13.00	16.22	15.10	13.90	....
14	....	24.50	22.50	20.80	17.83	15.70	15.15	15.08	14.65	14.05	23.35	22.50	21.00	19.43	19.30	14.50	12.80	15.43	14.50	13.00	....
21	27.63	24.60	22.50	19.10	16.71	14.33	13.68	14.00	13.75	13.50	23.00	22.05	21.10	19.40	18.60	13.50	11.00	14.83	13.70	12.60	....
28	27.00	24.50	21.75	19.25	15.94	14.13	13.38	14.00	13.13	12.75	22.50	21.25	21.25	18.88	18.25	13.25	11.00	14.25	12.75	11.00	....
1919.																					
Jan. 4	27.00	25.38	22.50	19.50	17.50	15.47	14.69	14.50	13.50	12.66	24.57	24.00	22.63	20.67	19.17	13.50	10.75	14.25	13.13	11.75	....
11	28.38	27.00	23.30	21.00	20.80	18.15	16.94	15.20	14.40	13.56	30.11	28.88	27.88	....	26.50	16.50	13.50	18.10	16.50	14.50	....
18	27.61	25.95	23.30	21.00	20.80	17.40	16.40	15.08	14.35	13.50	28.75	27.80	26.89	25.50	24.40	17.50	....	19.00	16.50	14.70	....
25	25.40	23.80	21.80	20.10	18.17	15.65	14.85	14.75	14.25	13.50	24.56	23.85	22.80	....	20.50	16.50	13.50	17.80	16.00	14.30	....
Feb. 1	24.71	23.50	21.50	19.00	17.25	15.20	14.50	14.55	13.85	13.30	25.05	24.15	22.50	....	20.30	....	....	17.50	15.50	13.20	....
8	25.50	24.15	21.50	19.50	17.80	15.95	14.80	14.19	13.40	12.85	27.64	27.30	26.10	....	20.50	17.25	16.75	18.57	16.35	13.67	....
15	26.42	25.50	23.00	19.00	20.39	18.50	17.65	15.29	14.50	13.50	29.81	29.10	28.10	26.00	24.50	17.50	15.60	19.00	17.50	16.00	....
22	26.13	25.20	23.00	....	21.70	20.15	19.20	16.50	14.95	14.10	29.15	28.00	27.35	26.00	....	17.50	16.40	18.78	17.50	16.20	....
Mar. 1	25.60	24.40	23.15	....	21.60	20.50	19.50	16.50	15.50	14.50	30.14	29.55	28.35	26.17	25.38	20.00	18.40	19.70	18.50	16.30	....
8	25.67	24.45	23.50	....	21.10	19.85	18.55	16.75	16.25	15.50	29.56	28.70	27.70	25.85	....	21.00	19.00	20.90	19.10	16.50	....
15	25.55	24.50	23.50	....	21.15	19.50	17.65	16.60	15.95	15.35	31.30	30.30	29.20	28.33	....	24.00	21.38	21.10	19.50	18.50	....
22	26.44	25.50	24.25	....	22.25	20.45	18.75	17.50	16.50	15.50	32.17	31.45	30.50	....	....	24.50	21.50	23.40	21.40	19.00	....
29	26.10	25.00	24.10	....	21.60	19.50	18.69	17.38	16.05	15.30	30.80	30.11	29.60	28.00	....	....	....	23.60	21.70	20.50	....
Apr. 5	25.60	25.00	24.20	23.03	21.60	19.95	18.80	17.50	15.15	14.40	30.44	29.70	28.95	28.20	27.50	24.83	23.83	25.75	24.00	23.00	....
12	24.94	23.75	23.05	21.50	21.67	20.70	19.15	18.50	15.50	14.75	30.50	29.50	28.50	27.50	27.80	25.10	....	25.80	24.20	22.50	....
19	24.50	23.55	22.95	22.30	21.25	20.25	18.90	17.50	15.75	15.25	29.75	29.20	28.40	27.50	27.50	25.50	23.33	25.50	24.50	....	....
26	23.90	23.22	22.72	22.25	21.50	20.25	19.38	17.50	15.75	15.25	29.90	29.38	28.50	27.50	27.50	25.50	....	25.50	24.50	23.50	....
May 3	24.45	23.80	23.18	21.75	21.75	20.75	20.25	17.50	16.45	15.50	30.38	29.60	28.95	28.35	28.50	24.50	22.10	24.50	23.10	21.10	....
10	25.00	24.30	23.68	22.10	22.40	21.50	20.50	18.60	17.50	16.50	30.19	29.40	28.65	27.63	27.90	24.90	22.50	24.50	23.30	22.50	....
17	23.83	23.38	22.83	21.10	21.25	20.05	18.85	18.35	17.55	16.50	29.50	28.60	27.75	26.65	26.80	22.50	19.00	23.30	22.30	20.63	....
24	....	21.89	21.43	20.05	20.07	19.30	17.72	17.50	16.50	15.50	28.14	26.90	25.40	24.10	24.60	18.00	16.33	20.00	17.80	16.30	....
31	20.25	19.89	19.13	17.94	17.43	16.50	15.56	16.57	15.81	14.94	25.83	25.00	23.13	20.88	23.00	16.17	15.17	17.50	16.25	15.25	....
June 7	20.22	19.25	18.10	17.25	16.90	15.05	13.55	15.10	14.00	13.25	27.25	26.30	24.70	23.00	23.13	16.00	14.50	17.50	16.20	14.13	29.88
14	19.69	19.13	17.75	17.25	16.45	14.50	12.80	14.50	13.45	12.50	29.65	28.95	28.10	26.83	25.33	20.50	....	17.50	16.50	14.70	31.50

TABLE 77.—*Western dressed fresh meats: Beef, lamb, and mutton—Weekly average wholesale price per 100 pounds, 1917 to 1920*—Continued.

BOSTON—Continued.

Week ending—	Beef.										Lamb and mutton.										
	Steer.				Cow.			Bull.			Lamb.				Yearling.			Mutton.			Spring lamb.
	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	Choice.	Good.	Medium.	Common.	Good.	Medium.	Common.	Good.	Medium.	Common.	
1919.																					
June 21	$18.28	$17.63	$16.81	$15.75	$15.56	$14.50	$13.13	$12.94	$12.38	$11.88	$30.00	$29.50	$28.13	$25.88	$19.00	$16.50	$15.00	$18.43	$16.50	$13.38	$31.63
28	17.94	17.30	16.50	15.50	15.50	14.50	13.50	13.50	12.50	11.75	30.00	28.89	26.80	22.40	....	....	....	16.78	15.80	12.20	30.30
July 5	18.50	17.63	16.50	15.50	16.00	14.81	13.94	....	12.75	12.00	27.60	27.25	26.25	23.00	24.33	19.00	14.83	16.50	14.50	11.25	28.75
12	20.15	19.70	18.30	16.70	17.50	16.50	15.65	14.60	14.05	13.92	27.67	26.40	24.50	19.10	21.00	18.50	13.10	16.00	14.50	11.40	28.50
19	21.85	21.48	20.35	19.25	18.79	18.10	17.55	17.33	16.75	16.05	30.11	29.40	26.80	22.50	22.25	19.63	....	16.50	14.50	13.00	....
26	22.80	22.25	21.05	19.30	20.00	18.30	16.65	18.50	17.75	16.85	29.20	28.10	25.70	21.10	19.70	18.10	16.50	19.70	15.50	14.50	....
Aug. 2	24.20	22.85	19.80	17.50	....	14.70	12.45	....	14.10	12.00	27.56	26.40	23.70	18.40	19.30	17.30	15.50	19.22	15.50	13.00	....
9	24.61	23.00	19.60	16.30	16.50	14.65	13.65	14.00	12.50	11.00	25.90	24.90	21.50	17.50	18.25	16.88	14.88	17.71	15.40	12.80	....
16	23.29	21.90	18.50	16.10	16.00	14.50	13.15	....	12.50	10.50	29.20	28.00	24.70	20.13	21.00	17.50	....	16.50	15.50	13.30	....
23	22.88	21.75	18.20	15.60	....	12.75	11.45	....	11.20	8.70	30.25	29.40	28.50	25.20	21.40	19.40	16.50	....	15.50	13.00	....
30	21.19	19.00	16.20	14.30	13.75	13.25	12.25	....	11.00	8.50	27.25	25.70	23.00	19.90	19.90	17.80	15.00	15.50	14.70	13.00	....
Sept. 6	20.86	18.94	16.75	15.06	....	13.50	12.44	....	....	8.50	23.67	22.50	21.50	19.38	17.00	15.00	12.75	13.00	12.00	10.75	....
13	23.63	22.30	19.60	17.50	....	15.10	14.35	....	....	10.10	24.44	22.50	21.50	19.60	16.10	14.50	13.00	13.00	12.40	11.50	....
20	23.65	21.90	19.20	16.40	....	13.50	12.63	....	....	10.50	24.00	22.70	21.70	20.50	16.40	14.80	13.00	....	13.00	11.50	....
27	23.25	21.70	18.60	15.30	14.75	12.90	11.75	....	11.50	10.50	24.38	23.50	21.70	20.50	18.10	15.60	13.00	....	12.70	10.60	....
Oct. 4	23.25	21.55	18.40	15.35	15.25	13.55	12.70	12.50	11.50	10.35	23.63	22.90	21.90	20.50	16.80	14.80	13.00	....	12.50	10.20	....
11	23.25	21.65	19.00	15.80	15.42	14.30	13.35	....	12.10	11.10	23.60	22.55	21.65	20.50	18.50	15.83	14.50	....	12.90	11.00	....
18	24.00	22.00	18.50	14.19	15.44	13.94	12.75	....	....	11.50	24.25	23.63	22.44	20.50	16.50	15.50	14.50	....	14.31	12.13	....
25	24.50	23.20	19.50	15.15	15.55	13.80	12.93	....	11.50	11.25	25.50	24.95	23.80	21.60	....	16.50	15.00	16.88	15.60	13.10	....
Nov. 1	26.29	23.90	20.00	15.10	15.35	13.15	12.15	....	11.75	10.90	24.20	23.55	22.70	21.70	20.50	....	....	16.30	14.70	11.40	....
8	25.88	22.70	19.00	13.90	15.00	12.40	11.50	....	11.50	9.90	22.95	22.15	21.40	19.80	18.00	14.50	11.00	13.75	12.80	10.40	....
15	24.50	21.00	17.25	14.00	15.00	13.25	12.63	....	11.50	9.50	22.69	22.06	21.25	19.00	19.50	15.50	....	11.50	10.50	9.63	....
22	23.60	21.50	17.30	14.60	15.00	13.60	13.03	....	10.50	9.15	22.90	22.05	21.25	19.00	18.40	15.50	....	12.00	10.50	9.00	....
29	24.00	21.50	17.38	13.75	14.20	12.44	11.31	....	10.50	9.00	21.38	20.25	19.25	18.13	16.50	14.67	....	12.38	11.25	9.38	....
Dec. 6	24.50	22.00	18.70	14.85	14.65	13.30	12.35	11.50	10.50	9.60	22.00	21.20	20.30	19.10	16.60	14.50	....	12.50	10.50	9.50	....
13	25.50	22.00	19.00	15.00	15.30	14.08	13.25	....	....	10.50	24.60	23.65	22.50	20.50	18.00	15.25	....	13.30	11.10	10.00	....
20	24.90	22.20	18.90	16.00	15.50	14.30	13.40	....	12.25	11.05	24.55	23.95	22.50	20.70	19.50	17.67	13.50	13.80	12.50	10.50	....
27	23.88	21.50	18.63	16.00	15.00	13.38	12.38	....	12.56	11.50	24.44	23.50	22.50	20.50	19.00	17.50	....	12.88	11.50	10.50	....
1920.																					
Jan. 3	23.17	21.25	18.50	16.00	15.00	13.25	12.63	13.50	12.56	11.69	24.56	23.69	22.50	20.63	19.00	17.50	....	12.88	11.50	10.50	....
10	....	21.00	18.70	16.20	15.70	14.40	13.25	13.50	12.75	12.25	27.90	26.95	25.45	22.80	....	....	....	14.30	12.70	11.70	....
17	22.33	20.50	18.95	16.88	16.50	15.35	14.85	14.30	13.20	12.40	29.20	28.50	27.80	26.00	....	....	....	15.90	14.10	12.80	....
24	21.50	20.50	19.50	18.25	17.45	16.25	15.55	14.60	13.55	12.60	29.90	28.90	27.90	26.90	....	....	....	16.60	15.50	13.90	....
31	....	20.40	18.95	18.17	16.50	15.85	15.35	14.20	13.55	13.00	31.05	30.35	29.50	28.20	....	....	....	18.10	16.90	15.20	....

Feb. 7		19.50	18.10	17.25	15.90	14.85	14.20	13.55	12.85	12.35	32.17	31.50	30.50	28.90				19.00	17.50	15.50	
14		19.25	17.95	17.15	15.55	14.65	13.50	13.45	12.75	12.25	33.00	32.40	31.40	29.50				20.10	18.30	16.70	
21		19.20	18.05	17.55	15.55	14.55	13.75	12.95	12.25	11.35	32.78	32.25	31.25	30.00				21.00	18.50	17.50	
28		19.50	18.50	17.69	15.75	14.63	13.50	12.75	12.25	11.25	32.63	32.13	31.38	29.50				21.25	19.38	18.25	
Mar. 6		19.45	18.25	17.65	15.75	14.55	13.75	12.35	11.85	10.65	31.33	30.65	29.85	28.70				20.90	18.70	17.00	
13		19.65	18.65	17.90	16.40	15.35	14.65	12.55	12.05	11.00	29.17	28.00	27.10	25.90	27.00	24.50		20.50	18.50	16.50	
20		19.10	18.15	17.50	16.58	15.75	14.85	13.50	12.70	11.70	28.05	27.20	25.90	24.70				20.60	18.50	16.50	
27		19.35	18.55	18.05	17.11	16.55	16.05	14.30	13.00	12.05	29.20	28.10	27.10	26.10				19.50	18.50	17.50	
Apr. 3		20.05	19.25	18.45	18.39	17.85	17.35	14.50	13.50	12.55	32.50	31.70	30.85	29.90				22.83			
10		20.35	19.35	18.70	18.65	18.15	17.45	14.35	13.50	12.60	33.70	33.05	32.35	30.30					24.50		
17		23.85	23.05	21.50	21.70	20.95	19.25	16.70	15.83	14.50	39.25	38.45	37.60	35.50							
24		22.38	21.56	20.38	20.25	19.63	18.50	15.83	15.25	14.27	35.56	34.69	33.38	30.50							
May 1	21.25	20.55	19.55	18.35	18.55	17.85	16.85	14.75	13.90	12.81	32.10	31.10	29.80	28.40	27.50						
8	21.25	20.00	19.20	18.38	18.63	18.00	17.05		15.30	13.67	32.50	31.50	30.50	27.90	27.90	25.50		25.50	24.50		
15		18.48	17.65	16.75	16.71	16.35	15.60		14.25	13.50	32.10	30.80	29.40	25.50	27.50			24.17	22.50		
22		17.58	16.85	15.80	15.75	15.25	14.65		14.22	13.44	31.50	29.50	27.00					20.30	18.90	15.50	33.00
29	18.25	17.60	16.75	16.00	15.95	15.40	14.75	14.44	13.75	13.25	30.75	29.70	28.20	25.80				19.40	18.30	16.25	31.20
June 5		18.50	17.56	16.63	16.75	15.75	15.25	14.25	13.63	11.50	30.50	29.50	27.25	25.38				19.13	17.13	15.17	32.13
12	24.80	22.55	21.10	19.88	19.17	18.00		20.00	17.63		31.50	30.30	28.20	25.50	21.50			18.20	15.70	13.50	32.70
19		26.50	25.00	23.42	23.42	22.25			20.00	18.00	31.50	28.63	25.88	24.50	23.50	21.67	20.50	18.88	17.00	13.25	33.50
26	29.75	29.35	27.80	24.50	26.20	25.00	23.40		22.25	20.50		29.60	27.70	24.30	27.63	25.63	23.63	18.00	16.00	12.75	31.80
July 3		24.30	22.70	20.17	20.75	19.30	17.83		16.70	14.75	30.70	28.50	24.70	19.80	23.75	21.50	17.75	15.50	13.00	11.30	
10		24.13	22.00	19.88	20.50	19.50	17.63	16.50	15.50		33.88	32.50	30.63	28.75				15.50	13.00	11.00	
17		24.17	22.80	20.10	20.50	18.83	18.06		15.50	14.50	33.90	32.70	30.90	26.50	24.50	22.50		17.63	13.00	11.00	
24		22.35	19.70	17.50		17.50	16.50		13.50	12.30	33.78	32.90	31.00	26.90	26.50	24.08		23.50	18.25		
31		24.40	22.30	19.70	19.67	17.80	16.80		14.00	12.10	33.00	31.90	30.40	26.30	30.50	25.75		21.67	19.00	17.00	
Aug. 7	26.33	24.95	22.95	20.55		17.85	16.60		14.50	12.50	29.80	28.00	26.10	23.00	26.50	23.60		20.00	17.40	15.20	
14	27.15	25.55	22.95	19.80		15.75	14.50		14.50	12.50	28.40	26.10	23.80	21.00	24.90	21.70		16.50	15.50	13.40	
21	27.75	26.10	22.40	18.30		15.06	13.70			11.95	29.00	26.70	23.40	20.60		20.80	18.25	15.30	14.10	11.70	
28	27.75	26.50	23.50	19.30	19.50	16.98	15.50		13.75	11.20	30.10	29.10	25.40	21.13		21.00	19.00	15.60	13.40	10.80	
Sept. 4	27.38	25.90	22.55	19.35	18.17	17.15	15.75			12.50	30.50	29.50	26.00		23.50	21.10		16.90	13.40	11.00	
11	27.17	26.06	21.50	18.56	16.50	15.38	14.38		13.50	11.00	29.83	28.50	26.13	21.00	21.50	20.13	19.00	15.50	12.88	11.38	
18	27.75	26.80	22.50	18.70	18.00	16.45	15.25		14.50	12.38	27.30	26.30	24.20	21.00	20.50	18.25		14.10	12.50	11.00	
25	28.43	26.45	21.80	18.80	16.83	15.50	14.75		12.70	11.56	26.70	25.60	23.00	21.00	22.00	19.00		14.50	12.50	11.40	
Oct. 2	27.25	24.85	19.25	16.10	15.50	13.20	12.42	15.00	13.50	11.75	26.10	24.70	21.70	19.20	20.86	18.40		14.30	12.60	9.80	
9	27.43	25.25	19.90	16.40	16.13	14.15	13.35		13.50		26.50	24.50	21.50	19.00	19.50	17.00		14.70	12.50	9.00	
16	27.00	25.13	18.50	16.00	16.17	14.50	13.75				25.43	24.25	21.38	19.00	19.00	17.00		14.50	12.50	10.50	
23	27.00	24.05	18.30	15.50	15.50	14.55	14.00				25.63	23.90	21.20	19.00	21.63	20.50	18.50	14.44	12.50	11.00	
30	27.00	24.05	18.90	16.30	15.19	14.30	13.75				26.29	24.90	22.20	18.67		19.10		14.44	12.50	10.90	
Nov. 6	27.00	24.00	18.80	16.35	15.50	14.40	13.88				26.90	25.90	23.40	20.50	20.25	18.50		15.10	13.00	10.50	
13		23.60	18.50	16.55	15.42	14.65	13.85				29.50	28.50	25.60	19.00	23.50	21.00		17.10	14.90	12.50	
20		22.35	18.00	16.30	15.80	14.75	14.00				27.22	25.70	23.60		21.60	20.10		16.80	14.80	11.20	
27		19.71	16.63	15.50	14.29	13.25	12.25				25.75	24.50	21.63		19.63	17.38		14.88	13.25	10.75	
Dec. 4		19.22	16.05	15.25	12.69	11.25	10.67				25.70	24.70	22.00	19.00	20.00	18.00		13.00	11.90	9.20	
11	23.00	19.20	15.90	13.00	11.75	10.68	10.25	12.50	11.50	10.25	27.11	26.10	23.70	21.00	20.40	18.75		11.80	10.50	8.50	
18	22.67	19.20	15.10	13.00	12.33	11.00	9.95		9.75	9.25	26.50	25.50	23.30		21.20	19.00		12.40	10.50	8.50	
25	20.00	16.20	14.10		12.00	11.05	9.85		10.25	9.75	25.22	24.10	22.10		18.80	17.10		11.50	9.50	8.50	
1921. Jan. 1	20.38	18.45	17.10	14.63	15.35	14.30	14.00	12.50	11.50	10.50	25.50	24.50	22.00	16.50	20.20	17.30		12.89	10.50	9.10	

TABLE 78.—*Western dressed fresh meats: Pork cuts and veal—Weekly average wholesale price per 100 pounds, 1919 and 1920.*

CHICAGO.

Week ending—	Pork cuts. Loins. 8 to 10 pounds.	Loins. 10 to 12 pounds.	Loins. 12 to 14 pounds.	Loins. 14 pounds and over.	Shoulders, skinned.	Picnics. 4 to 6 pounds.	Picnics. 6 to 8 pounds.	Picnics. 8 pounds and over.	Butts. Boneless.	Butts. Boston style.	Veal. Choice.	Veal. Good.	Veal. Medium.	Veal. Common.
1919.														
July 19	$33.38	$31.81	$29.81	$28.06	$25.56	$26.00	$25.50	$24.50	$31.50	$27.50	$29.31	$28.56	$26.75	$23.75
26	35.85	33.85	31.80	29.80	26.80	26.00	25.50	24.50	32.50	29.50	29.10	27.75	24.70	21.00
Aug. 2	34.50	32.60	30.70	28.35	26.90	26.00	25.50	24.50	32.40	29.10	28.50	26.00	20.50	15.10
9	35.80	33.70	31.30	28.50	27.25	26.00	25.50	24.50	32.90	29.70	29.20	27.20	22.90	16.50
16	38.70	37.00	34.30	31.50	28.70	26.40	25.90	24.90	34.20	32.00	31.40	29.40	26.50	20.60
23	36.90	35.40	32.70	30.90	27.80	26.50	25.80	24.80	34.00	32.10	31.00	29.00	26.30	21.60
30	37.10	35.25	32.50	29.80	27.50	26.50	25.75	24.75	34.00	31.90	29.05	26.65	22.60	17.40
Sept. 6	38.13	36.50	33.25	28.63	27.50	26.50	25.75	24.75	34.44	33.06	29.25	26.56	21.25	15.13
13	38.75	36.80	33.60	27.50	26.80	24.95	24.15	23.05	34.50	33.35	30.70	28.75	23.40	16.80
20	37.70	35.40	31.95	27.05	26.80	22.50	21.70	20.60	33.90	32.00	30.80	29.20	25.00	17.80
27	37.60	35.10	32.00	27.50	25.50	21.00	20.20	19.30	33.05	31.00	31.75	30.00	25.95	17.80
Oct. 4	37.80	35.75	32.15	27.35	25.05	19.35	18.80	18.25	34.80	30.45	31.00	29.25	25.10	17.25
11	36.80	34.65	31.00	26.35	23.85	18.15	17.55	17.00	32.70	29.70	29.85	27.85	23.15	16.25
18	34.85	32.55	29.50	25.10	23.45	17.50	16.95	16.35	31.10	28.60	28.15	25.90	21.50	15.00
25	32.50	30.20	27.20	24.00	22.20	17.00	16.00	15.20	......	25.00	27.60	24.85	20.70	14.60
Nov. 1	29.80	28.05	25.65	22.75	21.40	17.70	17.10	16.40	......	23.60	27.50	24.50	20.80	16.30
8	30.60	29.20	27.45	24.95	21.80	19.50	18.50	17.50	......	24.60	27.10	24.60	19.90	15.80
15	31.15	30.20	28.40	26.20	22.25	20.05	19.05	17.80	......	25.55	27.35	24.90	20.30	16.40
22	28.60	27.50	26.35	25.00	21.10	20.55	19.55	18.50	......	23.40	27.95	25.25	21.50	17.95
29	27.13	26.31	25.25	24.13	20.56	20.50	19.50	18.25	......	22.38	26.88	24.50	21.50	18.00
Dec. 6	27.00	26.15	25.05	23.90	20.75	21.00	20.00	18.40	......	22.30	27.20	24.85	21.80	18.30
13	25.60	24.95	24.35	23.60	20.30	20.40	19.40	17.45	......	21.70	26.20	23.25	19.70	15.70
20	24.30	23.65	23.00	21.65	19.70	19.25	18.50	16.75	......	20.85	25.50	22.60	19.10	15.20
27	23.81	23.44	22.63	21.25	19.25	19.06	18.19	16.75	......	21.00	24.63	21.69	18.50	15.25
1920.														
Jan. 3	23.42	22.83	21.58	20.25	19.00	19.25	18.50	16.92	......	20.83	25.50	23.92	21.08	18.08
10	26.30	25.15	23.85	22.15	20.00	19.55	18.55	17.00	......	22.45	27.70	26.60	24.65	21.60
17	24.90	24.05	22.65	21.20	19.20	18.95	17.95	16.70	......	21.35	28.30	26.80	24.35	21.35
24	24.65	24.15	22.35	21.05	19.40	19.65	18.65	17.25	......	21.25	28.65	26.70	24.00	21.00
31	24.70	23.90	22.25	21.00	19.45	19.95	18.95	17.45	......	21.20	29.25	27.30	25.05	21.90
Feb. 7	24.65	23.60	22.10	20.75	19.10	19.95	18.90	17.45	......	21.00	29.40	27.80	25.60	22.65
14	27.40	26.35	24.40	22.40	20.20	19.80	18.75	17.45	......	22.85	28.25	26.50	24.50	21.70
21	29.15	28.20	26.25	24.45	21.25	19.55	18.70	17.70	......	25.00	27.30	26.80	25.00	22.35
28	26.31	25.38	23.38	21.44	19.63	18.56	17.56	16.56	......	23.00	27.50	25.56	23.19	20.06
Mar. 6	26.30	25.20	23.50	21.50	19.60	18.50	17.50	16.30	......	22.55	26.60	24.40	21.90	18.85
13	30.40	29.10	26.50	23.60	21.30	18.90	17.50	16.90	......	24.80	26.40	23.90	21.40	18.40
20	30.35	29.15	26.95	24.75	21.60	18.80	17.80	16.65	......	24.65	28.65	26.55	23.75	20.25
27	30.00	29.00	26.50	24.25	21.50	18.50	17.50	16.50	......	24.70	28.90	27.05	24.65	21.20
Apr. 3	33.60	31.60	28.90	27.10	23.30	20.70	19.50	18.35	......	28.20	30.30	28.35	25.35	22.80
10	34.60	32.60	30.00	28.10	22.80	20.75	19.50	18.50	......	28.40	28.40	26.40	23.65	21.60
17	36.50	34.50	32.30	30.40	22.60	21.50	20.50	19.20	......	28.60	26.30	24.20	21.70	19.00
24	35.10	33.30	30.60	28.50	22.90	19.90	19.05	18.20	......	28.70	26.10	24.10	21.40	17.90
May 1	32.20	30.80	29.40	27.00	22.50	19.00	18.00	17.00	......	27.00	24.10	22.20	19.60	16.90
8	30.70	29.40	28.00	26.20	21.50	19.17	18.17	17.17	......	26.00	22.00	20.00	18.00	16.00
15	29.00	27.50	26.50	24.90	20.50	19.50	18.50	17.50	......	24.10	22.30	20.00	18.00	16.00
22	28.00	26.90	25.70	23.70	20.10	19.10	18.00	16.90	......	23.30	22.10	20.00	18.00	16.00
29	25.60	24.10	22.30	20.70	19.10	19.50	18.00	16.50	......	21.90	21.70	20.00	18.00	15.70
June 5	28.25	26.75	24.75	22.50	20.50	20.25	18.75	17.25	......	23.25	22.88	21.25	19.75	16.38
12	27.20	25.90	24.30	21.90	20.30	20.50	19.00	17.50	......	22.00	24.00	22.50	21.00	17.60
19	25.50	24.50	22.50	20.50	19.50	19.50	18.50	17.50	......	20.00	24.00	22.50	21.00	18.50
26	28.40	26.70	24.70	22.70	20.60	20.50	19.50	18.50	......	22.10	24.00	22.50	21.00	18.50
July 3	29.60	27.10	24.70	22.50	20.40	20.10	19.10	18.10	......	23.10	23.80	22.50	20.60	18.30
10	31.88	30.00	27.38	23.75	21.13	20.50	19.50	18.50	......	23.63	23.50	22.50	20.00	18.00
17	35.70	34.70	31.80	27.80	22.30	21.30	20.30	19.30	......	25.90	24.80	23.00	20.30	18.60
24	35.10	33.20	30.20	26.80	31.50	20.50	19.50	18.50	......	25.00	25.00	23.00	20.50	19.00
31	35.10	32.60	29.60	26.30	21.50	20.50	19.50	18.50	......	25.20	26.40	24.20	21.70	19.60
Aug. 7	34.70	32.10	28.70	25.30	21.50	19.70	18.70	17.70	......	25.00	26.00	23.70	21.70	19.20
14	36.40	33.80	30.40	26.20	21.50	19.70	18.70	17.60	......	26.20	24.70	22.20	19.90	17.40
21	37.80	35.80	32.80	29.00	22.10	22.15	21.10	20.00	......	27.90	23.50	21.30	17.70	14.70
28	38.80	36.60	33.20	28.60	22.10	21.50	20.50	19.00	......	28.70	24.40	21.50	17.50	14.50
Sept. 4	38.90	36.30	32.30	28.60	22.50	21.50	20.50	19.00	......	28.50	26.10	22.60	18.60	15.20
11	39.75	37.88	34.00	30.13	24.00	21.50	20.50	19.00	......	29.75	27.50	24.00	20.50	16.50
18	40.50	39.00	35.50	32.00	24.00	21.50	20.50	19.00	......	31.30	27.90	24.40	20.50	16.70
25	41.80	40.10	38.10	35.10	25.80	22.50	21.50	19.50	......	32.70	28.10	25.00	20.10	16.60
Oct. 2	42.50	41.50	38.50	35.50	26.50	22.50	21.50	19.50	......	34.00	27.50	25.00	19.50	16.00
9	41.20	39.50	37.10	34.50	26.70	22.50	21.50	19.50	......	33.30	25.90	23.60	19.30	15.00
16	38.70	36.70	34.70	31.90	26.10	22.40	21.10	19.10	......	31.40	25.60	22.60	19.00	13.50

TABLE 78.—*Western dressed fresh meats: Pork cuts and veal—Weekly average wholesale price per 100 pounds, 1919 and 1920*—Continued.

CHICAGO—Continued.

Week ending—	Pork cuts. Loins. 8 to 10 pounds.	Loins. 10 to 12 pounds.	Loins. 12 to 14 pounds.	Loins. 14 pounds and over.	Shoulders, skinned.	Picnics. 4 to 6 pounds.	Picnics. 6 to 8 pounds.	Picnics. 8 pounds and over.	Butts. Boneless.	Butts. Boston style.	Veal. Choice.	Veal. Good.	Veal. Medium.	Veal. Common.
1920.														
Oct. 23	$36.40	$34.50	$32.70	$30.30	$25.50	$21.95	$20.50	$18.50	......	$29.90	$24.60	$22.00	$19.00	$13.50
30	32.90	31.10	28.30	26.30	23.80	21.25	19.90	18.50	......	26.40	24.50	22.00	19.00	13.50
Nov. 6	32.40	30.50	27.50	25.50	22.90	20.75	19.50	18.50	......	25.90	25.20	23.00	20.50	16.10
13	33.00	30.50	27.50	25.50	23.50	21.35	19.50	18.50	......	27.10	23.50	21.50	19.50	16.00
20	30.50	28.50	25.70	23.50	22.50	20.20	19.10	18.10	......	25.90	23.30	21.30	19.30	15.80
27	22.25	20.75	18.75	17.50	20.25	18.00	16.75	15.75	......	22.00	21.50	19.50	18.50	15.00
Dec. 4	20.80	19.30	17.50	16.50	17.60	17.75	16.50	15.50	......	18.90	20.30	18.50	17.20	14.40
11	20.50	19.00	17.50	16.50	16.30	16.70	15.90	14.50	......	17.60	18.80	16.30	14.20	11.70
18	18.70	17.70	15.70	13.70	15.00	14.50	13.50	12.50	......	15.40	17.70	14.80	13.50	11.00
25	18.60	17.30	15.80	14.30	13.50	13.10	12.10	11.10	......	14.90	17.50	15.00	13.50	11.00
1921.														
Jan. 1	26.60	24.80	22.20	19.00	17.60	14.70	13.70	12.70	......	21.70	18.10	15.40	13.90	11.30

NEW YORK.

Week ending—	Loins. 8 to 10 pounds.	Loins. 10 to 12 pounds.	Loins. 12 to 14 pounds.	Loins. 14 pounds and over.	Shoulders, skinned.	Picnics. 4 to 6 pounds.	Picnics. 6 to 8 pounds.	Picnics. 8 pounds and over.	Butts. Boneless.	Butts. Boston style.	Veal. Choice.	Veal. Good.	Veal. Medium.	Veal. Common.
1919.														
July 5	$31.67	$29.50	$27.50	$25.00	$24.83	......	$22.50	......	$29.00	$26.00	$26.67	$25.00	$23.00	$17.17
12	34.90	33.30	31.30	29.30	26.20	......	24.90	......	31.00	28.50	28.50	26.80	23.00	15.50
19	37.50	36.50	35.50	33.10	27.70	......	25.50	......	32.70	30.70	31.60	29.00	25.40	22.20
26	36.40	34.60	32.40	29.80	27.50	......	25.50	......	32.90	30.60	29.00	27.10	24.40	20.60
Aug. 2	36.30	34.00	32.00	29.80	27.30	......	25.90	......	34.30	30.00	24.90	23.50	21.80	19.00
9	35.50	34.00	31.80	28.40	26.90	......	25.10	......	33.70	29.30	24.90	23.00	20.20	17.20
16	36.50	33.00	30.00	26.00	26.80	......	23.50	......	32.50	29.50	28.00	26.70	23.00	18.90
23	36.60	33.00	30.00	26.00	27.00	......	24.00	......	33.10	30.10	31.25	28.20	25.40	22.10
30	38.20	35.80	32.70	29.80	27.00	......	25.50	......	33.00	30.00	32.40	29.70	26.50	23.40
Sept. 6	37.25	34.75	32.75	29.63	28.50	......	26.50	......	34.13	31.75	31.83	29.00	25.63	20.75
13	38.00	35.00	33.00	30.00	28.10	......	26.10	......	33.60	31.00	31.00	29.00	25.50	20.60
20	38.00	36.10	33.20	30.20	26.50	......	25.30	......	33.30	31.50	......	29.50	24.70	18.80
27	37.40	35.70	33.00	29.30	26.20	......	24.00	......	33.80	30.90	32.00	29.00	25.50	20.90
Oct. 4	37.40	35.50	33.00	29.00	25.50	......	23.20	......	33.40	31.00	32.60	29.30	25.50	20.50
11	37.80	35.30	32.60	28.60	25.00	......	21.50	......	33.30	30.80	32.30	29.30	25.50	20.50
18	37.38	35.00	32.00	28.00	22.75	......	20.25	......	33.00	30.00	30.13	27.50	24.25	19.50
25	36.40	34.40	31.40	28.30	22.90	......	20.60	......	31.70	28.80	29.00	26.00	23.00	18.90
Nov. 1	34.80	32.60	30.00	28.00	21.60	......	19.80	......	31.10	27.20	28.90	25.80	22.70	18.50
8	34.20	32.00	30.00	27.70	21.30	......	19.10	......	29.20	26.20	28.50	25.00	21.50	18.00
15	36.90	34.60	32.40	29.40	22.80	......	21.30	......	29.00	26.00	29.00	25.80	22.10	18.60
22	38.00	36.50	34.00	32.20	23.00	......	22.20	......	32.10	28.30	28.70	26.00	23.50	19.10
29	33.00	30.88	29.25	26.83	23.00	......	23.00	......	31.13	26.63	27.50	24.50	22.38	18.13
Dec. 6	28.70	26.90	24.90	22.90	22.70	......	22.70	......	27.80	25.70	27.30	24.10	21.00	16.60
13	27.80	26.30	24.30	22.10	21.20	......	21.00	......	26.80	24.10	28.00	24.70	21.20	16.50
20	26.60	24.80	23.10	21.10	21.50	$23.50	21.00	......	25.60	22.90	28.00	25.00	21.50	16.50
27	25.38	23.50	22.50	20.88	22.25	23.00	21.00	......	25.00	22.50	28.00	25.00	21.50	16.50
1920.														
Jan. 3	24.75	23.50	22.50	20.50	21.00	20.50	20.25	......	24.50	21.50	28.00	25.00	21.50	16.50
10	25.00	23.50	22.50	20.70	21.50	21.50	19.00	......	24.00	22.50	28.90	25.80	22.20	17.30
17	25.60	23.80	22.50	21.00	20.90	20.90	19.20	......	24.60	23.10	30.50	27.00	23.30	19.10
24	26.40	24.30	22.80	21.00	20.50	20.50	19.00	......	25.00	22.20	30.80	27.00	23.50	19.70
31	26.70	25.30	23.30	21.00	20.90	20.50	19.50	......	26.10	24.20	31.90	28.00	25.20	21.90
Feb. 7	24.80	22.70	21.70	20.60	20.50	......	19.50	......	25.70	23.10	30.90	27.60	24.90	21.30
14	24.75	23.50	21.50	20.50	20.50	......	19.50	......	25.50	22.75	31.50	28.50	25.50	21.00
21	25.40	23.70	21.70	20.50	19.70	......	18.70	......	24.40	21.70	30.67	27.90	25.50	21.00
28	28.00	25.88	24.13	21.63	20.50	......	18.75	......	25.75	23.75	31.00	27.50	25.50	21.00
Mar. 6	28.90	27.50	25.50	23.30	20.90	......	19.50	......	28.00	25.20	31.00	27.50	25.50	21.00
13	29.30	27.70	25.70	23.40	20.50	......	19.50	......	28.50	25.20	......	27.70	25.50	21.00
20	29.80	28.50	26.50	24.20	20.70	......	19.50	......	28.50	25.00	......	27.90	25.50	21.00
27	30.55	28.70	27.20	24.30	21.60	......	19.50	......	28.70	25.00	......	28.90	25.50	21.00
Apr. 3	30.50	28.50	26.80	25.30	22.00	......	19.50	......	29.56	25.40	......	29.00	25.20	21.00
10	30.70	28.30	26.80	25.20	21.70	......	19.90	......	29.90	25.50	......	26.90	24.20	21.40
17	36.50	32.20	29.60	28.50	24.30	......	23.10	......	33.70	30.10	......	32.10	30.00	......
24	36.88	33.63	31.38	29.50	24.50	......	23.50	......	34.67	30.50	......	31.20	28.10	25.20
May 1	34.20	31.70	30.60	28.20	24.50	......	24.00	......	31.50	27.40	......	27.80	25.00	22.10
8	36.50	34.10	32.00	29.00	24.50	......	23.00	......	33.00	28.60	......	21.90	19.90	16.90
15	32.70	30.30	28.70	25.50	22.40	......	22.00	......	31.20	26.60	21.88	19.30	17.50	15.30
22	29.30	26.80	24.90	22.50	19.70	......	20.13	......	28.60	25.00	22.90	20.90	17.50	15.10
29	27.50	25.80	24.00	22.60	19.70	......	17.80	......	27.25	23.70	23.40	21.00	18.70	16.50
June 5	28.00	26.50	24.75	22.75	20.75	21.00	19.50	......	28.00	23.50	24.00	21.00	19.00	16.50
12	30.00	27.50	25.50	23.50	20.50	......	19.40	......	28.25	24.70	25.60	22.30	19.50	18.50

TABLE 78.—*Western dressed fresh meats: Pork cuts and veal—Weekly average wholesale price per 100 pounds, 1919 and 1920*—Continued.

NEW YORK—Continued.

Week ending—	Pork cuts. Loins.				Pork cuts.	Pork cuts. Picnics.			Pork cuts. Butts.		Veal.			
	8 to 10 pounds.	10 to 12 pounds.	12 to 14 pounds.	14 pounds and over.	Shoulders, skinned.	4 to 6 pounds.	6 to 8 pounds.	8 pounds and over.	Boneless.	Boston style.	Choice.	Good.	Medium.	Common.
1920.														
June 19	$29.10	$27.30	$25.20	$23.50	$20.50	......	$19.50	......	$28.30	$24.00	$25.10	$23.30	$20.50	$18.50
26	29.60	27.50	25.80	23.80	21.10	......	19.33	......	28.00	24.20	24.80	23.50	21.00	18.50
July 3	27.80	26.30	25.00	23.00	21.70	$20.50	19.00	......	28.83	23.60	23.25	21.60	20.30	16.80
10	29.25	26.75	24.75	22.75	20.75	......	19.25	......	......	22.00	......	23.25	19.25	14.38
17	30.00	27.50	25.50	23.10	21.50	......	19.30	......	......	22.00	26.75	24.20	20.30	16.50
24	31.60	29.10	26.70	24.20	23.00	......	19.50	......	29.00	24.00	29.40	27.00	24.60	21.00
31	32.00	29.70	26.60	24.40	22.20	......	19.50	......	30.13	25.30	29.80	27.70	25.40	22.50
Aug. 7	34.40	31.90	28.60	26.30	22.10	......	19.50	......	31.50	26.00	29.00	27.00	24.60	20.90
14	33.90	31.90	28.80	25.70	22.00	......	20.00	......	32.30	26.10	28.25	24.50	22.20	17.40
21	32.40	30.30	27.70	24.50	21.70	......	20.00	......	31.90	25.00	25.00	21.20	17.60	14.00
28	36.20	33.60	31.00	27.30	22.10	21.50	20.00	......	32.00	25.80	24.00	20.70	16.80	14.30
Sept. 4	37.00	35.00	32.00	28.40	22.50	21.50	20.17	......	......	26.50	28.75	24.80	20.50	17.00
11	39.00	37.00	35.00	30.50	23.00	......	21.00	......	33.67	28.88	30.63	28.88	25.63	21.50
18	41.40	38.80	36.50	32.30	24.33	......	21.80	......	35.50	29.60	31.00	28.00	24.10	19.40
25	42.90	41.50	38.60	34.50	26.00	......	23.50	......	37.83	33.00	30.25	28.20	23.50	17.70
Oct. 2	42.10	40.60	38.20	34.40	26.00	......	23.10	......	......	32.50	......	27.00	21.80	15.50
9	42.90	41.40	39.90	35.80	27.80	23.50	22.50	......	38.00	32.80	29.00	25.00	19.00	14.90
16	39.75	38.38	36.00	34.13	26.38	......	22.00	......	37.00	31.38	27.50	24.38	19.00	14.13
23	35.30	33.70	32.40	30.20	24.50	......	21.50	......	......	30.40	27.60	23.40	19.00	14.00
30	32.10	30.20	28.40	26.00	25.40	......	21.50	......	......	29.10	27.00	23.50	20.70	15.50
Nov. 6	33.88	31.63	30.00	27.25	26.00	......	21.50	......	......	29.00	28.00	25.25	20.38	15.88
13	35.50	33.40	32.00	28.50	25.90	23.50	20.90	......	34.50	29.20	29.00	26.20	23.00	18.50
20	35.50	33.50	32.50	28.90	25.50	23.50	20.50	......	34.50	29.40	29.00	26.60	22.60	18.50
27	32.13	30.50	29.50	26.88	24.50	......	19.75	......	......	28.13	25.50	23.00	18.88	15.00
Dec. 4	22.90	21.00	19.90	18.60	19.00	......	18.20	......	23.00	21.20	21.83	19.80	15.80	12.80
11	21.20	19.70	18.10	16.80	16.50	......	15.70	......	23.00	19.00	21.60	18.30	15.00	11.40
18	21.40	19.80	18.10	16.50	15.60	......	14.40	......	17.67	16.50	21.17	17.80	15.00	11.40
25	21.30	19.50	17.50	16.40	15.00	......	13.70	......	20.50	17.30	21.75	18.00	15.00	11.50
1921.														
Jan. 1	24.80	23.50	21.50	19.30	15.70	......	14.50	......	20.38	19.00	22.00	20.50	19.00	15.50

PHILADELPHIA.

Week ending—	8 to 10 pounds.	10 to 12 pounds.	12 to 14 pounds.	14 pounds and over.	Shoulders, skinned.	4 to 6 pounds.	6 to 8 pounds.	8 pounds and over.	Boneless.	Boston style.	Choice.	Good.	Medium.	Common.
1919.														
July 5	$32.50	$30.50	$29.50	$28.50	......	$26.50	$23.50	$22.50	......	$29.50	$22.50	$21.50	$19.50	$17.50
12	35.38	32.80	31.50	30.50	......	27.50	25.50	24.50	......	29.50	23.50	21.50	20.30	18.00
19	37.25	35.70	33.80	32.30	......	29.10	......	......	......	30.60	24.50	22.75	20.90	19.10
26	37.00	35.10	33.30	30.90	......	29.10	......	......	......	31.70	......	21.88	19.10	17.10
Aug. 2	36.10	34.50	33.00	30.10	......	27.40	......	......	......	29.70	......	18.20	15.40	11.80
9	37.00	35.50	33.00	27.30	......	28.20	......	......	......	31.00	......	18.40	15.20	12.80
16	37.29	35.70	33.60	29.30	......	27.50	......	......	......	30.90	......	18.75	15.20	13.10
23	36.70	34.30	33.30	29.10	......	28.30	......	......	......	31.40	......	24.00	19.10	17.00
30	36.71	34.80	33.10	29.40	......	28.20	......	......	......	30.80	......	23.60	19.30	16.30
Sept. 6	36.43	34.50	33.00	28.63	......	28.50	......	......	......	30.75	......	21.50	16.50	14.13
13	37.00	34.25	31.80	28.70	......	27.80	......	......	......	29.10	......	19.17	15.90	12.30
20	36.70	34.50	32.80	28.10	......	27.50	......	......	......	31.70	......	19.20	15.00	12.90
27	35.00	32.70	30.40	27.50	......	26.00	23.30	21.60	......	31.80	......	19.33	15.00	13.00
Oct. 4	36.50	34.50	32.50	28.40	......	26.50	25.00	22.50	......	30.78	22.75	18.25	15.90	14.10
11	36.50	34.50	32.50	27.50	......	25.50	25.00	22.50	......	29.60	24.50	21.20	19.00	16.00
18	35.90	33.60	31.50	27.10	......	25.00	22.33	21.00	......	29.00	25.33	23.00	19.80	15.40
25	35.78	33.20	31.00	26.80	......	24.40	20.80	19.60	......	28.70	......	21.25	17.40	13.00
Nov. 1	33.30	31.40	29.80	27.00	......	22.70	20.60	18.70	......	27.20	......	20.89	17.20	13.20
8	31.30	30.10	28.00	25.30	......	21.90	20.60	18.50	......	25.60	......	20.20	17.40	12.70
15	32.50	31.40	29.00	27.10	......	22.80	20.70	18.90	......	26.80	......	19.67	16.00	11.70
22	33.30	32.10	30.60	28.70	......	23.50	22.10	20.10	......	26.30	......	20.00	16.00	11.70
29	30.25	28.75	27.63	27.00	......	23.50	22.75	21.50	......	26.38	......	19.50	14.63	11.50
Dec. 6	28.80	27.50	26.50	24.90	......	22.50	21.30	20.10	......	24.20	......	19.00	15.00	12.60
13	27.10	26.30	25.30	24.30	......	22.10	20.90	19.60	......	24.20	......	19.75	15.00	13.50
20	25.30	24.50	23.10	21.80	......	21.70	20.50	19.50	......	24.20	......	19.50	15.70	13.50
27	24.88	24.50	23.50	21.00	......	21.38	20.50	19.50	......	24.13	......	21.50	17.00	14.13
1920.														
Jan. 3	25.13	24.00	22.50	21.00	......	21.50	20.50	19.00	......	22.75	......	22.86	19.00	14.50
10	25.50	24.50	23.50	21.10	......	21.20	20.80	19.10	......	24.10	......	23.20	19.10	15.10
17	26.20	24.40	23.30	21.60	......	21.50	20.70	19.50	......	24.10	......	25.10	21.20	16.70
24	26.50	24.80	23.50	21.50	......	22.00	21.00	18.50	......	24.00	......	25.00	22.00	18.60
31	25.10	24.30	23.10	20.90	......	20.60	20.20	18.40	......	23.45	......	24.10	21.30	18.70
Feb. 7	24.70	23.10	22.10	20.30	......	20.70	20.20	18.90	......	23.35	......	24.50	21.40	17.80
14	24.20	22.70	21.60	19.60	......	20.60	20.20	19.00	......	23.10	......	24.00	21.40	17.30

TABLE 78.—*Western dressed fresh meats: Pork cuts and veal—Weekly average wholesale price per 100 pounds, 1919 and 1920*—Continued.

PHILADELPHIA—Continued.

Week ending—	Pork cuts. Loins. 8 to 10 pounds.	Pork cuts. Loins. 10 to 12 pounds.	Pork cuts. Loins. 12 to 14 pounds.	Pork cuts. Loins. 14 pounds and over.	Pork cuts. Shoulders, skinned.	Pork cuts. Picnics. 4 to 6 pounds.	Pork cuts. Picnics. 6 to 8 pounds.	Pork cuts. Picnics. 8 pounds and over.	Pork cuts. Butts. Boneless.	Pork cuts. Butts. Boston style.	Veal. Choice.	Veal. Good.	Veal. Medium.	Veal. Common.
1920.														
Feb. 21	$26.80	$24.90	$23.30	$21.40	......	$21.10	$20.50	$19.50	......	$23.50	......	$22.70	$19.90	$16.00
28	27.50	26.50	25.50	22.00	......	21.00	20.50	19.25	......	24.50	......	22.75	19.25	15.50
Mar. 6	28.00	26.10	25.10	23.20	......	21.40	20.10	19.00	......	24.50	......	22.00	18.50	15.60
13	28.00	26.50	25.50	23.50	......	21.80	19.30	18.50	......	24.50	......	23.30	20.40	16.10
20	29.40	27.50	25.50	22.60	......	22.00	19.30	17.90	......	25.40	$26.50	24.30	21.30	17.30
27	30.40	28.70	27.00	25.00	......	22.00	19.80	18.60	......	25.10	27.10	24.80	21.80	18.50
Apr. 3	29.80	27.90	25.90	23.90	......	21.40	18.60	18.50	......	25.00	26.71	23.80	20.80	17.10
10	30.10	28.50	27.00	25.00	......	21.00	18.60	......	......	25.70	......	20.00	16.70	13.75
17	39.22	37.30	36.30	34.30	......	24.50	24.20	......	......	29.90	......	24.50	21.50	18.30
24	35.44	34.50	33.10	31.70	......	23.63	23.83	......	......	28.30	......	23.30	20.10	17.10
May 1	34.20	32.50	30.20	28.00	......	23.00	......	......	......	26.90	......	24.88	22.10	18.17
8	33.90	32.00	30.50	27.40	......	23.30	20.50	......	......	27.83	......	25.00	22.50	19.00
15	32.50	30.50	28.60	26.50	......	22.75	20.50	19.50	......	27.50	......	21.30	19.00	16.00
22	29.90	28.00	26.30	24.30	......	21.00	19.90	......	......	25.30	......	18.44	16.20	13.40
29	26.40	24.30	22.70	20.90	......	20.65	19.20	......	......	23.30	......	19.20	17.00	14.80
June 5	24.13	22.25	20.50	18.50	......	18.50	18.50	......	......	21.38	23.00	20.25	17.00	14.00
12	26.60	25.40	23.30	21.20	......	19.50	20.38	19.50	......	22.75	26.00	24.20	20.90	17.80
19	28.20	26.10	24.60	22.30	......	20.80	19.90	......	......	23.30	27.00	25.00	22.50	19.60
26	29.60	27.80	25.80	22.00	......	21.50	21.00	......	......	23.10	......	23.10	20.50	17.60
July 3	30.20	28.40	26.00	22.80	......	20.70	19.80	......	......	......	......	17.70	15.30	12.50
10	29.25	27.75	26.50	24.25	......	19.50	18.25	......	......	24.50	......	20.67	18.00	14.00
17	31.00	29.90	28.00	24.60	......	21.10	20.00	......	......	23.60	28.00	26.00	22.40	17.10
24	31.50	29.20	27.00	24.40	......	21.00	21.30	......	......	23.00	......	26.00	22.60	18.10
31	32.80	31.60	29.00	25.70	......	21.10	19.20	......	......	24.50	......	25.70	22.70	18.20
Aug. 7	33.70	31.20	29.00	26.00	......	22.00	20.30	......	......	24.80	26.00	24.90	22.20	18.30
14	33.30	31.60	29.50	25.90	......	22.00	20.50	......	......	26.20	......	23.25	20.00	15.70
21	33.40	31.20	29.10	25.40	......	21.30	19.30	......	......	25.00	......	20.25	16.90	14.00
28	35.30	33.50	31.00	27.10	......	22.10	20.40	......	......	27.00	25.00	20.75	17.40	14.10
Sept. 4	35.67	34.50	32.50	29.00	......	22.00	21.50	......	......	27.00	......	24.17	20.80	16.50
11	38.50	37.50	35.50	31.00	......	23.50	23.63	20.50	......	29.00	26.50	24.00	21.00	17.17
18	40.90	38.50	36.50	32.60	......	25.80	24.70	22.30	......	30.90	27.50	24.40	21.00	18.50
25	41.00	38.80	37.00	34.40	......	26.00	25.00	22.50	......	31.00	26.50	24.33	21.00	18.50
Oct. 2	42.20	40.90	39.10	35.50	......	27.30	25.30	22.80	......	31.60	26.50	23.40	20.20	17.40
9	40.90	39.50	37.70	33.90	......	27.10	24.70	23.70	......	32.10	......	22.25	18.60	15.00
16	38.25	36.63	35.38	32.50	......	26.50	24.50	22.50	......	31.50	26.00	22.50	20.25	16.00
23	37.50	35.70	33.60	30.20	......	25.60	24.00	21.90	......	30.90	26.50	22.50	20.00	16.00
30	32.70	31.40	28.80	25.30	......	24.80	23.50	21.60	......	28.80	24.75	22.30	19.60	16.10
Nov. 6	31.10	29.60	28.00	25.20	......	24.90	23.00	21.00	......	28.60	26.00	23.00	19.70	16.30
13	35.50	33.60	31.40	28.50	......	25.50	24.00	21.30	......	29.00	27.25	24.50	21.50	18.33
20	34.70	33.40	32.30	29.50	......	24.40	22.50	20.83	......	28.90	27.50	25.50	22.90	19.10
27	29.63	29.00	29.50	26.83	......	23.25	21.50	......	......	26.88	......	23.88	21.00	15.38
Dec. 4	21.60	20.90	19.70	17.40	......	19.20	17.40	......	......	21.60	24.25	20.30	16.40	12.20
11	20.10	18.80	16.90	15.50	......	17.10	15.10	......	......	18.90	......	21.50	16.70	11.10
18	20.30	19.00	17.90	15.90	......	15.90	14.55	12.17	......	17.40	23.33	20.40	16.00	11.40
25	20.50	19.00	17.90	16.10	......	15.50	13.90	12.20	......	17.00	23.00	19.00	15.00	13.00
1921.														
Jan. 1	23.80	22.50	20.90	18.80	......	16.40	15.00	13.20	......	18.60	24.50	22.00	18.00	15.00

BOSTON.

Week ending—	Loins. 8 to 10 pounds.	Loins. 10 to 12 pounds.	Loins. 12 to 14 pounds.	Loins. 14 pounds and over.	Shoulders, skinned.	Picnics. 4 to 6 pounds.	Picnics. 6 to 8 pounds.	Picnics. 8 pounds and over.	Butts. Boneless.	Butts. Boston style.	Veal. Choice.	Veal. Good.	Veal. Medium.	Veal. Common.
1919.														
July 5	$30.75	$29.42	$27.50	$25.83	......	$26.17	$25.25	$24.25	......	......	......	......	$14.17	$12.50
12	33.60	32.50	29.30	27.10	......	26.60	25.75	24.65	......	......	......	$15.50	14.50	13.20
19	36.70	35.50	30.90	28.60	......	27.50	26.50	25.10	......	......	......	16.50	15.60	14.88
26	35.50	34.30	31.40	28.90	......	27.50	26.50	24.75	......	......	......	16.80	15.45	14.80
Aug. 2	34.40	32.50	30.80	28.20	......	27.50	26.50	24.50	......	......	......	15 50	14.30	12.40
9	35.40	34.50	32.05	28.60	......	25.95	25.30	24.50	......	......	......	......	13.40	10.00
16	35.40	33.30	31.50	27.90	......	26.05	25.35	24.60	......	......	......	......	12.50	9.50
23	36.00	33.90	31.90	27.40	......	26.90	25.50	24.75	......	......	......	......	13.00	11.50
30	37.50	35.50	33.40	29.10	......	27.50	25.50	24.60	......	......	......	17.00	15.00	12.90
Sept. 6	37.50	35.00	32.50	29.50	......	27.50	25.50	24.50	......	......	......	17.00	15.00	13.00
13	37.50	35.40	33.50	28.30	......	27.50	25.50	24.50	......	......	......	......	15.40	13.20
20	38.10	36.20	34.20	27.50	......	26.95	25.25	24.30	......	......	......	......	14.50	12.20
27	38.50	37.50	34.80	28.60	......	24.05	23.15	23.50	......	......	......	15.50	12.60	10.70

TABLE 78.—*Western dressed fresh meats: Pork cuts and veal—Weekly average wholesale price per 100 pounds, 1919 and 1920*—Continued.

BOSTON—Continued.

Week ending—	Pork cuts.										Veal.			
	Loins.				Shoulders, skinned.	Picnics.			Butts.					
	8 to 10 pounds.	10 to 12 pounds.	12 to 14 pounds.	14 pounds and over.		4 to 6 pounds.	6 to 8 pounds.	8 pounds and over.	Boneless.	Boston style.	Choice.	Good.	Medium.	Common.
1919.														
Oct. 4	$38.50	$37.50	$35.10	$28.60		$23.30	$22.30	$21.50				$14.50	$12.10	$10.10
11	38.50	37.50	35.20	29.00		22.50	21.50	20.50				14.50	12.50	11.00
18	37.75	36.81	34.63	29.00		22.50	21.50	20.50					12.63	11.00
25	37.50	36.50	33.90	29.20		22.50	21.50	20.50					11.70	10.70
Nov. 1	35.30	34.10	31.90	28.30		21.40	20.60	19.60				14.50	11.50	10.50
8	34.35	33.15	30.70	26.90		21.25	20.55	19.60					11.00	9.80
15	34.50	33.50	31.25	27.25		22.63	21.50	19.25					10.63	9.13
22	35.50	34.50	32.00	28.60		22.50	21.50	19.80					10.50	9.30
29	34.63	33.38	31.25	27.88		21.50	20.69	19.50						9.00
Dec. 6	27.70	26.50	25.50	23.60		20.90	19.90	18.90					12.50	9.50
13	27.00	26.05	24.45	21.90		20.55	19.50	18.50					13.50	11.15
20	25.55	24.85	23.40	21.30		20.20	19.35	18.40					14.50	11.50
27	24.75	24.25	22.13	19.38		19.88	18.69	17.88					14.50	11.25
1920.														
Jan. 3	24.06	23.31	21.75	18.50		19.50	18.50	17.56					14.50	11.38
10	25.05	24.10	22.30	19.00		19.05	17.90	17.05					14.90	11.70
17	25.25	24.25	22.50	20.10		19.55	18.55	17.25					15.40	13.60
24	26.05	24.80	23.70	21.50		19.50	18.40	17.50					16.50	14.80
31	26.10	25.30	23.65	21.80		18.75	18.25	17.55					15.70	14.50
Feb. 7	24.90	24.00	22.75	20.80		18.95	18.25	17.50					15.50	14.00
14	24.65	23.85	22.50	20.10		19.30	18.35	17.55					15.60	14.00
21	26.50	24.50	23.50	21.40		19.75	18.75	17.15				19.00	16.00	14.00
28	27.13	25.38	24.19	21.25		19.63	18.75	17.19				19.00	15.63	13.38
Mar. 6	28.05	27.10	25.40	22.30		19.35	18.35	16.95					15.90	14.20
13	29.70	28.50	26.50	23.60		19.55	18.55	17.25					16.00	14.30
20	29.35	28.20	26.80	24.70		19.30	18.35	17.00					16.30	14.50
27	29.45	27.45	26.45	24.10		19.35	18.15	16.50					16.50	15.50
Apr. 3	29.50	27.70	25.70	22.35		18.95	17.85	16.55					16.70	15.50
10	30.70	28.90	26.80	23.80		19.90	18.55	17.10					15.40	13.90
17	35.40	33.70	31.50	29.30		22.50	21.50	20.50					17.50	15.20
24	35.25	33.75	30.88	28.63		22.17	20.67						15.00	13.00
May 1	33.20	31.30	28.15	26.20		21.50	20.90	19.75					15.50	13.50
8	32.00	30.30	28.10	24.90		20.60	19.85						14.90	13.50
15	30.95	29.60	27.50	24.55		21.00	20.00	18.58					14.50	13.50
22	29.50	28.30	26.90	23.80		20.30	19.10	18.75					13.90	12.20
29	28.30	26.70	25.00	21.50		20.10	18.90	17.75					12.90	11.60
June 5	27.50	26.50	23.75	20.63		20.50	18.50	17.25					15.08	14.17
12	27.90	26.90	24.50	21.70		20.50	19.50	18.10					18.11	15.50
19	28.00	26.75	24.13	21.63		20.50	19.50	18.50					21.00	19.75
26	28.25	26.70	24.20	21.50		20.90	19.90	18.10					21.50	19.00
July 3	30.40	28.50	26.30	22.70		20.80	19.70	18.50					16.10	13.70
10	29.63	27.81	25.50	21.50		21.50	19.50	18.50					14.75	11.13
17	31.20	29.40	27.20	22.30		21.50	19.90	18.50					15.80	12.88
24	32.63	30.70	27.50	22.50		21.50	20.50	18.94						17.40
31	33.30	31.40	28.10	23.50		21.63	20.50	19.50					18.50	16.67
Aug. 7	33.00	31.50	27.50	23.20		21.50	20.50	19.50				23.00	19.75	17.50
14	33.50	31.50	28.00	23.50		21.50	20.50	19.50				17.90	16.20	14.60
21	34.50	32.50	29.60	24.70		21.50	20.50	19.50				15.50	14.40	12.20
28	35.30	34.10	31.00	26.50		21.50	20.50	19.50					14.70	12.50
Sept. 4	37.60	35.50	32.90	28.90		22.30	21.30	19.50				19.50	16.30	14.50
11	38.50	36.38	33.38	29.13		22.50	21.50	19.50					18.75	16.83
18	40.10	37.50	35.50	30.00		22.70	21.50	20.30				20.50	19.00	17.40
25	42.30	39.50	37.10	31.60		23.05	21.90	20.90					18.40	16.20
Oct. 2	43.10	41.00	38.50	32.50		24.50	23.50	22.50						14.00
9	42.50	40.80	38.90	34.60		24.40	23.40	22.50					14.90	12.50
16	42.88	40.50	39.13	34.50		24.50	23.50	22.50					14.50	12.50
23	42.10	40.10	38.50	33.50		24.50	23.50	22.00					15.40	13.00
30	35.00	33.50	31.40	28.00		22.90	21.90	20.50					15.50	13.40
Nov. 6	32.30	30.40	28.20	25.50		23.45	22.40	20.90					15.70	13.70
13	37.00	35.30	32.70	30.00		24.00	22.75	21.85					16.50	14.30
20	37.90	36.90	34.60	31.80		23.50	22.50	20.50					19.00	16.83
27	34.38	33.00	31.13	27.75		22.63	21.81	20.25					16.13	14.75
Dec. 4	23.10	21.90	20.40	18.00		18.30	17.50	16.50					13.90	11.90
11	22.15	21.30	19.90	17.20		14.90	14.35	14.08					12.80	10.90
18	20.85	20.00	19.00	17.00		14.70	13.30	11.92					12.90	10.50
25	20.35	19.45	18.45	16.90		14.60	13.30	11.75					13.50	10.50
1921.														
n. 1	25.20	24.10	22.90	21.30		16.55	15.10	14.08					18.50	16.00

PART II.—WOOL.

TABLE 79.—*Wool: Monthly and yearly average price per pound, Boston market, 1910 to 1920.*[1]

OHIO, PENNSYLVANIA, AND WEST VIRGINIA—FINE CLOTHING, UNWASHED.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920[2]	11 yr. av.
January	$0.28	$0.23	$0.22	$0.24	$0.21	$0.25	$0.28	$0.39	$0.65	$0.57	$0.70	$0.37
February	.28	.22	.22	.24	.21	.29	.28	.42	.65	.56	.75	.37
March	.27	.21	.22	.23	.22	.29	.29	.45	.65	.54	.76	.38
April	.25	.20	.22	.22	.22	.26	.31	.44	.67	.53	.70	.37
May	.24	.19	.22	.21	.23	.26	.31	.47	.64	.53	.65	.36
June	.22	.19	.22	.21	.24	.26	.31	.55	.62	.58	.60	.36
July	.22	.20	.24	.21	.25	.27	.31	.58	.67	.68	.57	.38
August	.21	.20	.24	.21	.25	.27	.31	.63	.64	.70	.54	.38
September	.21	.21	.24	.21	.25	.27	.31	.66	.62	.70	.54	.38
October	.23	.21	.24	.21	.24	.27	.33	.63	.67	.67	.42	.37
November	.23	.21	.24	.21	.24	.27	.34	.65	.64	.68	.38	.37
December	.23	.22	.24	.21	.24	.27	.37	.65	.62	.70	.38	.38
Yearly average	.24	.21	.23	.22	.23	.27	.31	.54	.65	.62	.58	.37

OHIO, PENNSYLVANIA, AND WEST VIRGINIA—FINE DELAINE, UNWASHED.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920[2]	11 yr. av.
January	$0.32	$0.27	$0.26	$0.28	$0.22	$0.27	$0.33	$0.46	$0.75	$0.66	$0.94	$0.43
February	.32	.26	.26	.28	.23	.31	.33	.49	.75	.64	.98	.44
March	.30	.25	.26	.26	.23	.33	.34	.51	.75	.64	1.00	.44
April	.27	.24	.26	.26	.24	.30	.34	.54	.75	.70	.90	.44
May	.26	.23	.26	.23	.25	.30	.34	.56	.75	.70	.80	.43
June	.25	.23	.26	.23	.27	.29	.34	.71	.74	.73	.70	.43
July	.26	.24	.28	.23	.28	.30	.35	.74	.75	.78	.72	.44
August	.26	.24	.28	.23	.28	.31	.35	.75	.75	.83	.70	.44
September	.26	.25	.29	.23	.27	.31	.36	.76	.74	.83	.65	.44
October	.27	.25	.29	.23	.25	.31	.37	.75	.75	.83	.60	.44
November	.27	.25	.28	.23	.26	.31	.40	.75	.75	.85	.53	.44
December	.27	.26	.28	.22	.26	.32	.43	.75	.74	.88	.50	.45
Yearly average	.28	.25	.27	.24	.25	.31	.36	.65	.75	.76	.75	.44

TERRITORY—STAPLE, FINE AND FINE MEDIUM, SCOURED.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920[2]	11 yr. av.
January	$0.74	$0.61	$0.61	$0.66	$0.52	$0.63	$0.74	$1.13	$1.80	$1.60	$2.00	$1.00
February	.73	.59	.61	.64	.56	.73	.77	1.23	1.80	1.52	2.05	1.02
March	.71	.54	.61	.59	.57	.73	.77	1.28	1.83	1.58	2.05	1.02
April	.68	.53	.61	.56	.59	.71	.79	1.33	1.85	1.65	2.00	1.03
May	.63	.52	.61	.55	.60	.69	.79	1.38	1.80	1.65	2.00	1.02
June	.61	.52	.61	.54	.61	.71	.81	1.74	1.80	1.75	1.75	1.04
July	.61	.55	.63	.54	.61	.71	.82	1.74	1.85	1.85	1.60	1.05
August	.62	.56	.68	.54	.63	.71	.85	1.78	1.80	1.85	1.45	1.04
September	.62	.59	.68	.54	.61	.71	.89	1.81	1.80	1.85	1.50	1.04
October	.63	.60	.68	.53	.59	.71	.89	1.80	1.85	2.00	1.20	1.04
November	.63	.61	.67	.53	.61	.71	.97	1.80	1.80	2.00	.95	1.03
December	.63	.61	.67	.52	.61	.73	1.05	1.80	1.80	2.00	.90	1.03
Yearly average	.65	.57	.64	.56	.59	.71	.85	1.57	1.82	1.78	1.60	1.03

TERRITORY—FINE AND MEDIUM CLOTHING, SCOURED.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920[2]	11 yr. av.
January	$0.68	$0.56	$0.52	$0.60	$0.47	$0.58	$0.70	$0.93	$1.70	$1.45	$1.65	$0.89
February	.67	.54	.52	.59	.47	.69	.73	1.05	1.70	1.45	1.75	.92
March	.65	.49	.52	.54	.49	.69	.73	1.18	1.73	1.40	1.75	.92
April	.62	.46	.52	.52	.53	.67	.74	1.15	(3)	1.40	1.70	.83
May	.57	.46	.52	.50	.55	.65	.74	1.20	(3)	1.50	1.60	.83
June	.56	.46	.52	.49	.55	.67	.76	1.45	(3)	1.55	1.50	.85
July	.56	.48	.56	.49	.56	.68	.76	1.55	(3)	1.65	1.50	.88
August	.56	.49	.61	.49	.57	.68	.78	1.68	(3)	1.65	1.30	.88
September	.56	.52	.61	.49	.55	.68	.80	1.68	(3)	1.60	1.20	.87
October	.56	.52	.61	.48	.55	.68	.84	1.65	(3)	1.85	1.00	.87
November	.56	.52	.61	.48	.57	.68	.93	1.70	(3)	1.85	.90	.88
December	.56	.53	.61	.47	.57	.69	.98	1.70	(3)	1.90	.75	.88
Yearly average	.59	.50	.56	.51	.54	.67	.79	1.41	[4] 1.71	1.60	1.38	.93

[1] From National Association of Wool Manufacturers.
[2] Prices from June to December, 1920, largely nominal.
[3] No quotations.
[4] Average for January to March, inclusive.

TABLE 79.—*Wool: Monthly and yearly average price per pound, Boston market, 1910 to 1920* [1]—Continued.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920 [2]	11 yr. av.
OHIO, PENNSYLVANIA, AND WEST VIRGINIA—ONE-HALF BLOOD, UNWASHED.												
January	$0.37	$0.30	$0.27	$0.30	$0.23	$0.31	$0.36	$0.47	$0.76	$0.74	$0.85	$0.45
February	.37	.29	.28	.30	.23	.35	.36	.52	.77	.67	.85	.45
March	.36	.28	.28	.29	.24	.37	.37	.54	.80	.66	.85	.46
April	.34	.27	.28	.26	.24	.34	.38	.54	.78	.67	.75	.44
May	.32	.25	.28	.24	.26	.34	.38	.57	.78	.67	.70	.44
June	.29	.25	.28	.24	.27	.34	.38	.67	.76	.69	.65	.44
July	.29	.25	.29	.24	.28	.35	.38	.72	.78	.80	.62	.45
August	.29	.25	.30	.24	.28	.36	.39	.74	.78	.80	.61	.46
September	.29	.26	.30	.24	.28	.36	.40	.77	.76	.81	.55	.46
October	.29	.26	.30	.24	.28	.35	.40	.75	.78	.80	.42	.44
November	.29	.26	.30	.23	.29	.36	.42	.76	.78	.81	.40	.45
December	.30	.26	.30	.23	.30	.36	.48	.76	.76	.83	.35	.45
Yearly average	.35	.29	.29	.25	.27	.35	.39	.65	.77	.75	.63	.45
TERRITORY—ONE-HALF BLOOD, SCOURED.[3]												
January						$0.58	$0.71	$1.08	$1.70	$1.63	$1.83	$1.26
February						.69	.74	1.13	1.70	1.42	1.87	1.26
March						.69	.74	1.18	1.75	1.48	1.90	1.29
April						.67	.74	1.23	1.78	1.45	1.85	1.29
May						.65	.74	1.28	1.68	1.55	1.70	1.27
June						.67	.79	1.48	1.68	1.60	1.50	1.29
July						.69	.78	1.63	1.78	1.80	1.40	1.35
August						.69	.80	1.68	1.68	1.80	1.30	1.33
September						.69	.82	1.73	1.68	1.75	1.20	1.31
October						.69	(4)	1.68	1.78	1.70	.90	1.35
November						.69	(4)	1.68	1.68	1.70	.80	1.31
December						.70	(4)	1.68	1.68	1.80	.75	1.32
Yearly average						.68	[5] .76	1.46	1.71	1.64	1.42	1.28
OHIO, PENNSYLVANIA, AND WEST VIRGINIA—THREE-EIGHTHS BLOOD, UNWASHED.												
January	$0.37	$0.29	$0.27	$0.31	$0.23	$0.31	$0.39	$0.48	$0.77	$0.75	$0.70	$0.44
February	.37	.28	.28	.31	.23	.37	.40	.53	.77	.66	.70	.45
March	.36	.27	.28	.30	.24	.38	.40	.54	.80	.60	.70	.44
April	.34	.26	.28	.27	.24	.35	.40	.57	.78	.60	.66	.43
May	.31	.24	.28	.24	.26	.35	.40	.61	.76	.60	.61	.42
June	.28	.24	.28	.24	.27	.35	.40	.71	.76	.62	.54	.43
July	.28	.25	.29	.24	.28	.37	.41	.75	.78	.72	.50	.44
August	.28	.25	.30	.24	.28	.38	.42	.75	.76	.70	.45	.44
September	.28	.25	.31	.24	.27	.37	.42	.77	.76	.70	.43	.44
October	.29	.25	.31	.24	.27	.37	.41	.75	.78	.67	.40	.44
November	.29	.26	.31	.23	.29	.37	.44	.76	.76	.68	.32	.43
December	.29	.26	.31	.23	.30	.38	.49	.76	.76	.70	.30	.43
Yearly average	.31	.26	.29	.26	.26	.36	.42	.67	.77	.67	.53	.44
TERRITORY—THREE-EIGHTHS BLOOD, SCOURED.[6]												
January						$0.56	$0.69	$0.89	$1.55	$1.30	$1.35	$1.06
February						.66	.71	.98	1.55	1.20	1.35	1.08
March						.66	.71	1.03	1.58	1.10	1.30	1.06
April						.65	.71	1.08	1.55	1.05	1.30	1.06
May						.63	.71	1.13	1.45	1.10	1.20	1.04
June						.65	.73	1.33	1.45	1.20	.95	1.05
July						.67	.72	1.41	1.55	1.38	1.00	1.12
August						.67	.74	1.41	1.45	1.38	.90	1.09
September						.67	.78	1.48	1.45	1.35	.80	1.09
October						.67	(4)	1.42	1.55	1.35	.75	1.15
November						.67	(4)	1.45	1.45	1.35	.60	1.10
December						.68	(4)	1.45	1.45	1.40	.55	1.11
Yearly average						.65	[5] .72	1.26	1.50	1.26	1.00	1.07

[1] From National Association of Wool Manufacturers.
[2] Prices from June to December, 1920, largely nominal.
[3] No territory in one-half blood previous to 1915. (Averages are for 6-year period.)
[4] No quotations.
[5] Average for January to September, inclusive.
[6] No territory in three-eighths blood previous to 1915. (Averages are for 6-year period.)

TABLE 79.—*Wool: Monthly and yearly average price per pound, Boston market, 1910 to 1920* [1]—Continued.

OHIO, PENNSYLVANIA, AND WEST VIRGINIA—ONE-FOURTH BLOOD, UNWASHED.

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920 [2]	11-yr. av.
January	$0.35	$0.28	$0.27	$0.31	$0.23	$0.31	$0.39	$0.48	$0.77	$0.78	$0.62	$0.44
February	.35	.27	.29	.31	.23	.37	.40	.52	.77	.63	.67	.44
March	.34	.26	.29	.30	.23	.38	.40	.54	.80	.58	.66	.43
April	.32	.25	.29	.26	.24	.35	.39	.54	.77	.54	.60	.41
May	.30	.23	.29	.24	.25	.35	.39	.60	.75	.54	.55	.41
June	.27	.23	.29	.24	.26	.35	.39	.69	.75	.58	.47	.41
July	.27	.24	.29	.24	.27	.37	.40	.74	.77	.70	.46	.43
August	.27	.24	.30	.24	.27	.38	.41	.75	.75	.68	.43	.43
September	.27	.25	.31	.24	.26	.37	.41	.75	.75	.68	.40	.43
October	.28	.25	.31	.24	.26	.36	.41	.75	.77	.64	.38	.42
November	.28	.25	.31	.23	.29	.37	.43	.76	.75	.65	.30	.42
December	.28	.25	.31	.23	.30	.38	.46	.76	.75	.67	.28	.42
Yearly average	.30	.25	.30	.26	.26	.36	.41	.66	.76	.64	.49	.43

TERRITORY—ONE-FOURTH BLOOD, SCOURED. [3]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920 [2]	11-yr. av.
January	......	......	......	......	......	$0.54	$0.65	$0.78	$1.30	$1.28	$1.12	$0.95
February	......	......	......	......	......	.61	.66	.88	1.33	1.05	1.12	.94
March	......	......	......	......	......	.61	.66	.93	1.35	1.00	1.12	.95
April	......	......	......	......	......	.61	.68	.98	1.40	.95	1.15	.96
May	......	......	......	......	......	.59	.68	1.05	1.25	.95	1.00	92
June	......	......	......	......	......	.61	.70	1.18	1.25	1.07	.80	.94
July	......	......	......	......	......	.63	.68	1.27	1.40	1.18	.75	.99
August	......	......	......	......	......	.63	.70	1.30	1.25	1.18	.65	.95
September	......	......	......	......	......	.63	.72	1.35	1.25	1.13	.55	.94
October	......	......	......	......	......	.63	(4)	1.28	1.40	1.15	.55	1.00
November	......	......	......	......	......	.63	(4)	1.32	1.25	1.15	.50	.97
December	......	......	......	......	......	.64	(4)	1.32	1.25	1.15	.40	.95
Yearly average	......	......	......	......	......	.61	[5] .68	1.14	1.31	1.10	.81	.94

[1] From National Association of Wool Manufacturers.
[2] Prices from June to December, 1920, largely nominal.
[3] No territory in one-fourth blood previous to 1915. (Averages are for 6-year period.)
[4] No quotations.
[5] Average for January to September, inclusive.

TABLE 80.—*Wool: Monthly and yearly average price per pound, on farms for States of Ohio, Pennsylvania, and West Virginia, 1910 to 1920.*

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	$0.32	$0.22	$0.20	$0.24	$0.20	$0.23	$0.28	$0.36	$0.67	$0.63	$0.64	$0.36
February	.30	.21	.20	.24	.20	.23	.29	.38	.69	.61	.62	.36
March	.30	.21	.20	.23	.20	.25	.30	.40	.71	.62	.65	.37
April	.28	.20	.21	.22	.20	.26	.30	.42	.72	.60	.64	.37
May	.29	.18	.21	.18	.21	.26	.32	.47	.67	.57	.64	.36
June	.25	.19	.24	.19	.23	.27	.33	.56	.68	.57	.45	.36
July	.24	.20	.24	.19	.23	.27	.34	.63	.67	.62	.34	.36
August	.23	.19	.24	.20	.24	.28	.35	.65	.67	.63	.31	.36
September	.23	.20	.24	.20	.23	.28	.34	.65	.67	.63	.33	.36
October	.22	.20	.24	.20	.23	.28	.34	.66	.67	.62	.31	.36
November	.23	.20	.24	.20	.23	.28	.35	.66	.67	.63	.29	.36
December	.22	.20	.23	.19	.23	.28	.35	.67	.66	.65	.26	.36
Yearly average	.26	.20	.22	.21	.22	.26	.32	.54	.68	.62	.46	.36

TABLE 81.—*Wool: Quarterly average price per pound on farms, by leading districts, 1910 to 1920.*

Year and month.	Ohio, Pennsylvania, and West Virginia.	Michigan, Wisconsin, and New York.	Kentucky and Indiana.	Missouri, Iowa, and Illinois.	Texas.	California.	Montana, Wyoming, Utah, Idaho, Oregon, Nevada, and Arizona.	New Mexico.	Florida, Alabama, Mississippi, Louisiana, and Georgia.
1910.									
January	$0.31	$0.29	$0.29	$0.28	$0.21	$0.16	$0.22	$0.20	$0.29
April	.27	.24	.26	.24	.20	.17	.19	.20	.25
July	.23	.22	.24	.21	.19	.16	.17	.15	.23
October	.22	.22	.22	.20	.17	.14	.17	.14	.20
1911.									
January	.22	.20	.21	.19	.16	.12	.16	.13	.20
April	.19	.17	.19	.17	.15	.12	.14	.12	.18
July	.20	.18	.18	.17	.15	.12	.15	.12	.18
October	.20	.19	.19	.17	.14	.11	.15	.13	.18
1912.									
January	.20	.19	.20	.18	.15	.13	.15	.13	.18
April	.22	.20	.21	.19	.15	.14	.17	.13	.17
July	.24	.23	.22	.21	.16	.15	.17	.14	.20
October	.24	.22	.22	.20	.15	.15	.17	.15	.19
1913.									
January	.24	.21	.22	.20	.15	.15	.17	.15	.19
April	.20	.18	.19	.18	.14	.14	.15	.13	.17
July	.20	.19	.19	.17	.13	.15	.14	.12	.17
October	.20	.19	.19	.17	.13	.12	.14	.12	.17
1914.									
January	.20	.18	.19	.17	.13	.12	.15	.13	.17
April	.21	.20	.21	.18	.15	.15	.16	.15	.16
July	.23	.21	.22	.20	.16	.15	.17	.16	.17
October	.23	.21	.20	.19	.14	.15	.17	.15	.17
1915.									
January	.24	.23	.23	.20	.15	.16	.21	.17	.17
April	.26	.26	.26	.24	.18	.20	.22	.18	.18
July	.28	.29	.28	.26	.19	.20	.22	.19	.21
October	.28	.28	.27	.26	.18	.17	.21	.19	.20
1916.									
January	.29	.29	.28	.26	.20	.18	.24	.21	.20
April	.32	.32	.33	.30	.23	.24	.27	.22	.25
July	.34	.34	.34	.31	.24	.24	.27	.24	.25
October	.35	.34	.34	.31	.25	.21	.28	.24	.26
1917.									
January	.38	.37	.35	.33	.26	.31	.35	.27	.25
April	.48	.48	.48	.45	.35	.45	.44	.37	.32
July	.64	.61	.59	.57	.44	.52	.53	.46	.44
October	.66	.64	.62	.58	.47	.51	.56	.48	.46
1918.									
January	.69	.65	.62	.59	.50	.53	.57	.47	.45
April	.69	.65	.66	.61	.51	.49	.55	.54	.49
July	.67	.65	.65	.61	.52	.50	.55	.49	.53
October	.67	.65	.64	.60	.51	.50	.54	.44	.54
1919.									
January	.62	.58	.62	.56	.45	.42	.51	.35	.50
April	.58	.52	.53	.49	.42	.43	.48	.42	.44
July	.63	.58	.55	.53	.46	.47	.49	.46	.45
October	.63	.57	.55	.51	.44	.42	.48	.48	.44
1920.									
January	.63	.58	.54	.52	.46	.45	.50	.45	.48
April	.58	.50	.48	.44	.45	.44	.44	.44	.41
July	.33	.30	.34	.28	.30	.28	.28	.25	.25
October	.28	.26	.27	.22	.24	.23	.26	.22	.19

TABLE 82.—*Wool (unmanufactured): Imports into the United States, by classes, 1910 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Imported from—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
CLASS 1.											
Argentina	22,222	13,333	26,180	18,709	33,110	86.827	133,749	180,766	203,238	118,854	71,910
Chile	230	60	141	56	218	3,261	9,148	16,870	10,887	11,959	14,514
Ecuador	....	....	....	....	....	....	....	614	1,162	176	(2)
Peru	....	....	....	1	368	2,142	1,519	3,924	3,900	2,273	884
Uruguay	6,503	561	3,216	2,285	7.875	15,824	11,990	36,623	17,655	49,931	29,768
United Kingdom	21,247	17,604	43,922	19,026	52,257	43,489	8,868	1,703	39	14,704	28,968
Australia	28,310	9,201	13,937	5,800	29,484	101,930	115,355	6,981	65,118	46,035	37,372
British South Africa	176	44	....	5	483	37,354	48,343	47,461	51,064	51,466	17,296
New Zealand	5,397	2,000	3,377	6,088	4,646	836	15,955	262	6,276	14,234	26
Other countries	511	49	524	742	19,250	3,903	11,474	25,597	14,572	24,466	11,654
Total, Class 1.	84,596	42,852	91,297	52,712	147,691	295,566	356,401	320,801	373,911	334,100	212,392
CLASS 2.											
Argentina	1,324	1,837	823	117	386	591	3,215	9,391	2,357	2,087	1,347
Peru	1,179	805	1,192	459	259	....	125	345	57	63	(2)
United Kingdom	12,349	6,997	17,763	7,544	15,534	4,841	998	50	(3)	3,221	2,020
Other countries	2,637	1,615	1,949	3,061	7,320	7,832	5,744	12,541	1,809	2,363	3,276
Total, Class 2.	17,489	11,254	21,727	11,181	23,499	13,264	10,082	22,333	4,223	7,734	6,643
CLASS 3.											
Argentina	2,649	4,356	4,060	2,915	4,054	12,878	14,185	21,288	15,068	14,045	1,765
Brazil	45	26	76	61	10	592	8	1	30	9	(2)
Chile	25	31	21	65	107	909	3,712	3,677	8,197	13,274	3,715
Peru	....	....	....	....	....	....	....	....	3,136	1,541	(2)
Uruguay	....	....	390	20	1,216	306	141	3,179	1 026	7,031	487
Venezuela	27	37	20	21	19	4	4	7	11	128	(2)
United Kingdom	19,070	20,374	29,089	14,026	19,783	25,312	5,260	2,821	(3)	19,045	6,380
Russia in Europe	[4] 13,022	[4] 17,418	30,339	16,397	[4] 16,677	806	542	74	22	411	2,651
China	29,973	35,800	28,428	37,631	29,159	41,453	35,328	26,602	31,199	29,814	11,763
British India	[5] 1,901	[5] 3,031	[5] 5,575	1,710	2,600	2,439	1,166	212	10	66	366
British South Africa	19	127	393	289	10	2,703	6,116	3,978	4,442	2,386	674
Other countries	11,319	20,616	26,703	14,553	11,676	6,380	9,705	11,164	6,151	9,198	8,069
Total, Class 3.	78,050	101,816	125,094	87,688	85,311	93,782	76,167	73,003	69,292	96,948	35,870

[1] Compiled from Monthly Summary of Foreign Commerce.
[2] Included in "Other countries."
[3] None stated.
[4] Data for whole Russian Empire.
[5] Classified as East Indies.

TABLE 83.—*Wool (unmanufactured): Imports of hair of the Angora goat, alpaca, and other like animals into the United States, 1915 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Imported from—	1915	1916	1917	1918	1919	1920
United Kingdom	4,850	343	308	60	161	1,043
Peru	696	2,597	1,154	1,255	1,046	1,248
China	170	234	401	228	157	489
British South Africa	4,370	3,318	2,983	4,736	3,977	263
Other countries	24	48	11	22	1,770	1,669
Total	10,110	6,540	4,857	6,301	7,111	4,712

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 84.—*Wool (unmanufactured): Imports, by certain ports, 1918 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Imported into—	Class 1.			Class 2.			Class 3.			Hair of the Angora goat, alpaca, and other like animals.		
	1918	1919	1920	1918	1919	1920	1918	1919	1920	1918	1919	1920
Massachusetts	293,854	225,929	153,747	777	3,323	2,924	4,379	6,797	3,726	5,162	4,272	1,802
New York, N. Y.	65,471	85,614	47,818	1,912	3,622	2,931	51,809	78,245	26,591	959	2,677	2,419
Philadelphia	3,427	1,852	2,700	21	162	147	11,951	11,750	5,420	98	155	439
Total	362,752	313,395	204,265	2,710	7,107	6,001	68,139	96,792	35,737	6,219	7,104	4,660

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 85.—*Wool (manufactured): Imports into the United States, 1910 to 1920.*[1]

[In thousands of pounds and square yards; i. e., 000 omitted.]

Year.	Worsted cloths.	Woolen cloths.	Dress goods.	Carpets and carpeting.	Yarns.
	Pounds.	*Pounds.*	*Sq. yds.*	*Sq. yds.*	*Pounds*
1910	[2]	5,431	41,610	1,136	[2]
1911	[2]	4,153	21,517	908	[2]
1912	[2]	4,309	14,788	1,003	[2]
1913	[2]	4,858	16,268	1,011	[2]
			Pounds.		
1914	[2]	16,253	10,216	1,203	[2]
1915	[2]	7,026	3,320	850	[3] 103
1916	[2]	5,808	1,066	770	23
1917	[2]	4,707	775	899	332
1918	[3] 249	[4] 1,945	485	353	821
1919	311	[4] 1,827	310	463	469
1920	642	5,052	1,727	1,666	3,670

[1] Compiled from Monthly Summary of Foreign Commerce.
[2] Not stated.
[3] Beginning July 1.
[4] Includes woolens and cloth made of the hair of the Angora goat, alpaca, etc.

TABLE 86.—*Wool: Yearly production in the United States and the leading producing States, 1910 to 1920.*

[In thousands of pounds; i. e., 000 omitted.]

State.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
United States[1]	321,363	318,548	304,043	296,175	290,192	285,726	288,490	281,892	298,870	313,638	302,207
Pennsylvania	6,300	4,225	4,095	4,212	3,959	4,030	4,225	4,225	4,774	4,863	4,560
Ohio	16,900	18,850	16,875	14,950	13,844	13,600	13,650	12,000	12,600	13,104	12,449
Indiana	5,850	5,525	5,280	5,200	4,961	4,690	4,420	4,332	4,765	5,337	5,306
Michigan	11,475	10,880	10,125	8,400	8,098	8,075	8,275	8,192	8,765	9,554	10,223
Iowa	5,400	6,075	5,738	5,535	5,319	5,325	4,875	4,500	4,600	5,060	4,908
Missouri	6,020	8,050	7,425	7,088	7,179	4,890	4,625	4,810	7,183	8,492	8,296
Texas	8,944	9,450	9,100	8,775	8,643	9,750	10,250	10,045	11,800	14,986	17,600
Montana	33,600	34,875	31,175	31,500	30,177	26,950	24,570	23,342	18,685	17,450	15,800
Wyoming	36,038	34,000	32,175	29,880	28,476	29,200	31,000	30,380	32,760	31,580	28,422
Colorado	9,100	9,100	8,040	7,256	7,111	7,800	8,400	8,820	9,261	8,800	8,184
New Mexico	19,200	20,250	18,850	17,550	19,077	18,620	18,240	18,422	17,132	15,076	15,528
Arizona	4,950	5,950	5,695	5,038	5,521	5,985	5,950	5,831	5,630	5,580	5,970
Utah	14,175	13,500	11,550	13,775	13,100	15,000	15,000	14,800	15,800	17,000	16,150
Nevada	5,950	5,775	5,775	6,000	5,502	9,500	10,000	9,000	10,000	10,500	9,000
Idaho	18,980	16,500	15,540	14,250	14,792	15,285	15,000	17,500	21,500	22,145	21,702
Washington	4,050	3,700	3,600	3,413	3,638	4,560	4,750	4,813	5,504	5,779	5,490
Oregon	14,438	15,300	18,270	16,575	15,763	14,820	13,200	12,000	13,500	14,040	14,040
California	13,300	11,900	11,900	11,200	11,480	11,590	11,600	12,180	12,545	13,298	13,165

[1] Includes pulled wool.

TABLE 87.—*Wool: Yearly estimated production, by countries and grand divisions.*[1]

[In millions of pounds; i. e., 000,000 omitted.]

Country.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Australia	834	820	833	750	827	767	645	742	742	825	852
South America	586	500	555	531	455	477	480	470	470	484	487
North America	341	338	322	315	309	308	307	304	318	336	328
United Kingdom	142	143	143	133	125	121	121	121	125	118	99
Russia in Europe	320	320	320	320	320	320	320	320	320	320	150
France	78	78	78	78	80	75	75	65	65	50	50
Germany	26	26	26	26	26	26	26	26	26	26	37
Italy	21	22	21	22	22	22	22	22	22	22	35
All other in Europe	225	225	225	225	227	239	240	240	240	236	380
Asia	218	273	273	273	273	273	273	273	273	327	327
Africa	162	175	175	208	208	208	208	208	208	150	220
Total	2,953	2,920	2,971	2,881	2,872	2,836	2,717	2,791	2,809	2,894	2,965

[1] From Annual Wool Review of the National Association of Wool Manufacturers.

TABLE 88.—*Wool (unmanufactured): Imports, by principal importing countries, 1910 to 1920.*

[In thousands of pounds; i. e., 000 omitted. All classes wool and hair included.]

Imported into—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Austria-Hungary	61,263	65,148	67,425	58,650	......	......	......	......	......	......	......
Belgium	355,585	340,040	345,758	329,074	......	......	......	......	......	102,764	[1] 90,000
British India	20,702	22,469	26,066	29,116	22,749	39,286	31,289	29,513	29,495	27,344	......
Canada	6,435	6,877	8,836	8,587	9,518	16,611	19,921	11,744	19,396	8,035	......
France	608,248	603,739	579,624	593,781	457,059	144,577	172,753	134,362	89,661	347,690	......
Germany	471,055	468,712	517,120	481,571	......	......	......	......	......	......	[1] 90,000
Japan	9,844	8,323	13,451	11,741	12,736	52,771	40,758	47,305	49,590	56,552	[1] 75,000
Netherlands	25,868	29,376	37,681	38,419	17,323	15,715	12,696	8,536	274	16,303	14,256
Russia	110,496	104,326	99,431	121,691	97,763	46,109	19,609	......	......	......	......
Sweden	4,964	5,791	6,703	6,022	4,669	10,142	14,124	2,951	754	17,816	......
Switzerland	11,154	11,635	11,295	10,444	9,152	17,414	29,121	19,363	7,959	10,249	......
United Kingdom	548,445	568,230	555,161	582,618	498,192	889,133	634,640	636,195	444,687	987,411	[2] 893,513
United States	180,135	155,923	238,118	130,183	260,165	412,721	449,190	420,995	453,727	[3] 445,893	[3] 259,618

[1] Consular Report.
[2] Trade and Navigation of the United Kingdom, Dec., 1920.
[3] Monthly Summary of Foreign and Domestic Commerce.

TABLE 89.—*Wool (unmanufactured): Exports, by leading producing countries, 1910 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported from—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Grease:										
Australia	587,090	578,824	557,833	531,435	443,954	408,631	333,214	242,902	458,034	552,334
Argentina	332,010	291,087	363,681	264,728	258,533	259,416	259,387	280,939	229,025	309,069
New Zealand	170,590	136,601	152,499	155,343	183,985	154,521	147,058	145,779	84,713	......
Uruguay	103,595	134,286	178,441	150,883	98,298	83,563	67,465	86,754	76,309	(2)
British South Africa	117,449	126,909	157,777	173,258	129,527	161,275	125,898	105,710	100,392	158,263
China	26,337	42,343	35,298	37,368	40,401	50,362	44,605	45,247	42,405	48,777
Scoured and washed:										
Australia	77,055	68,258	60,236	60,888	60,853	74,897	51,817	62,829	106,313	84,903
Argentina	......	......	......	......	......	......	[3] 8,603	17,834	27,585	30,138
New Zealand	15,086	15,287	14,749	14,440	13,795	16,707	15,756	14,003	10,382	......
British South Africa	4,223	5,313	4,213	3,729	4,458	8,750	10,500	11,947	15,243	26,665
Slipe:										
New Zealand	18,693	17,537	21,114	16,750	22,693	25,342	22,693	18,493	13,630	......
Camels' hair:										
China	3,228	3,676	3,712	4,401	3,359	4,138	3,971	4,498	5,109	5,304
Goats' hair:										
China	1,527	1,257	2,659	1,558	1,312	1,369	1,737	1,819	1,681	2,625
Mohair:										
British South Africa	17,817	21,067	23,480	17,356	18,866	16,304	17,374	3,691	19,646	16,942

[1] Compiled from official publications of the respective countries.
[2] Data unavailable.
[3] Not separately reported previous to 1916.

TABLE 90.—*Wool (unmanufactured): Exports from British South Africa, by countries of destination, 1910 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	1910 [2]	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920 [3]
Grease:											
United Kingdom.	60,355	67,784	92,292	92,448	83,164	115,923	85,902	20,621	34,406	68,091	....
Canada..........	12	2	....	....	....	33	39	172	233	131	....
Belgium..........	8,266	14,108	16,122	17,462	9,510	....	....	....	....	7,749	....
France..........	2,963	3,482	3,781	4,895	1,970	....	....	60	262	8,040	....
Germany..........	45,438	39,945	43,658	57,309	33,748	....	....	....	....	....	....
Holland..........	255	340	635	1	....	....	....	....	....	232	....
Italy..........	136	1,233	1,191	925	....	52	....	....	1,229	43	....
United States....	19	14	42	214	1,134	45,251	39,904	48,517	35,292	43,559	....
Argentina..........	....	....	....	....	....	....	....	....	334	....	....
Japan..........	....	....	....	....	....	16	53	36,340	28,635	30,417	....
Other countries...	5	1	56	4	1	....	....	....	....	1	....
Total..........	117,449	126,909	157,777	173,258	129,527	161,275	125,898	105,710	100,391	158,263	[3] 106,396
Washed:											
United Kingdom.	14	30	49	71	120	87	203	11	....	67	....
United States....	....	....	....	....	....	....	....	....	....	121	....
Total..........	14	30	49	71	[4] 134	87	203	11	....	188	[3] 121
Scoured:											
Japan..........	....	....	....	....	....	....	11	1,039	785	3,284	....
United Kingdom.	1,979	2,189	2,188	1,188	1,827	6,179	7,370	931	491	9,864	....
Canada..........	....	....	16	....	....	....	....	161	1,371	290	....
Belgium..........	178	451	509	1,131	423	....	....	....	....	1,719	....
France..........	5	9	....	1	....	....	....	....	....	542	....
Germany..........	2,046	2,616	1,451	1,335	2,040	....	....	....	....	....	....
Holland..........	....	19	....	....	....	....	....	....	....	119	....
United States....	....	....	....	3	33	2,394	2,916	9,805	12,491	10,659	....
Italy..........	....	....	....	....	....	90	....	....	105	....	....
Total..........	4,208	5,284	4,164	3,658	4,323	8,663	10,297	11,936	15,243	26,477	[3] 12,988
Mohair:											
United Kingdom.	17,662	20,877	23,284	17,138	18,845	12,261	11,648	2,020	14,724	14,415	....
Germany..........	154	177	129	140	20	....	....	....	....	....	....
United States....	1	1	36	....	....	4,037	5,726	1,671	4,699	2,502	....
Belgium..........	....	12	31	77	....	....	....	....	....	....	....
Japan..........	....	....	....	....	....	....	....	....	204	24	....
Other countries...	....	....	....	1	1	6	....	....	18	1	....
Total..........	17,817	21,067	23,480	17,356	18,866	16,304	17,374	3,691	19,645	16,942	....

[1] From Annual Statement of the Trade and Shipping of the Union of South Africa and of Southern and Northwest Rhodesia.

[2] Calendar years 1910–1913, inclusive; fiscal years 1914–1920, inclusive.

[3] Unavailable by countries.

[4] Total includes 9,000 pounds to Germany and 5,000 pounds to Russia.

TABLE 91.—*Wool (unmanufactured): Exports from New Zealand, by countries of destination, 1910 to 1919.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Grease:										
United Kingdom	161,140	128,820	137,520	137,811	160,310	142,912	125,955	137,157	59,474	181,066
Australia.......	658	358	548	1,262	226	1,513	530	....	131	....
France..........	1,189	967	2,873	4,254	5,687	....	4,368	6,562	11,184	1,482
Germany.......	3,869	3,297	5,777	6,908	10,267	....	....	....	....	....
Belgium........	585	721	557	309	696	....	....	....	....	....
United States...	3,027	2,263	5,086	4,682	4,631	5,782	12,728	....	8,178	13,295
Gibraltar.......	....	....	....	....	129	....	....	....	....	....
Japan...........	10	....	20	62	1,822	2,964	2,182	....	....	....
Canada..........	....	175	112	55	189	1,350	1,295	2,060	5,746	....
Other countries.	112	....	11	....	28	....	....	....	....	1,002
Total.........	170,590	136,601	152,499	155,343	183,985	154,521	147,058	145,779	84,713	196,845

[1] From Statistics of the Dominion of New Zealand.

TABLE 91.—*Wool (unmanufactured): Exports from New Zealand, by countries of destination, 1910 to 1919*—Continued.

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Scoured:										
United Kingdom	14,559	14,931	14,218	13,542	12,951	15,671	14,156	13,691	9,207	37,896
Japan						30				
Canada	3		2	350	120	221	85		225	50
France	2	1	13				1	30		
Germany	1	1	10		39					
United States	7		1		79	181	600			
Australia	6			8	16	19	6			
India										30
Total	14,578	14,933	14,244	13,900	13,205	16,122	14,848	13,721	9,432	37,976
Slipe:										
United Kingdom	18,248	17,013	20,269	16,277	21,788	23,841	21,455	16,932	10,871	39,002
Australia	13		19	22	29	47	21		392	
Japan						2				
Canada	418	373	795	451	574	1,302	1,106	1,561	2,221	
United States	14	83	18		302	150	111		1	
France		68	13						145	
Total	18,693	17,537	21,114	16,750	22,693	25,342	22,693	18,493	13,630	39,002
Washed:										
United Kingdom	508	348	505	524	564	574	885	282	950	424
Canada		4		16	24	9	23			
Other countries		2			2	2				
Total	508	354	505	540	590	585	908	282	950	424

TABLE 92.—*Wool (unmanufactured): Exports from China, by countries of destination, 1910 to 1919.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Camel's hair—										
Great Britain	2,926	3,219	3,520	3,805	2,925	2,704	1,826	2,545	3,476	2,814
Germany	129	298	33	64	76					41
Belgium	56	112		12						
France	72	17	130	38	65		14		36	11
Russia and Siberia	45	26	15	420	67	24	2	4	4	
Japan (inc. Formosa)			5	6	32	137	835	1,112	916	1,108
United States				49	194	1,157	1,294	822	499	1,305
Other countries		4	9	7		116		15	178	25
Total	3,228	3,676	3,712	4,401	3,359	4,138	3,971	4,498	5,109	5,304
Goat's hair—										
Great Britain	1,513	1,238	2,648	1,489	1,290	581	859	1,299	438	1,706
France		1	1	37	11			103	31	
Japan (inc. Formosa)			6	1	2	313	424	255	975	359
United States					9	474	454	25	165	560
Other countries	14	18	4	31		1		137	72	
Total	1,527	1,257	2,659	1,558	1,312	1,369	1,737	1,819	1,681	2,625
Sheep's (grease)—										
Great Britain	1,178	1,572	555	783	427	74	53	96	371	788
Germany	97	230	140	147	14					17
Belgium	15	78	21	37						
France		104	33	68	10		2		184	401
Russia and Siberia (by land)	878	992	679	1,382	1,279	71	90			
Russia and Siberia (by sea)	543	325	31	15	98	129	1	224	161	249
Japan (inc. Formosa)	803	1,815	1,463	1,377	6,174	11,757	11,013	15,446	20,941	15,405
United States	22,815	37,105	32,363	33,472	32,367	38,241	33,444	29,141	19,542	31,845
Canada		119	11					340	1,202	69
Other countries	8	3	2	87	33	90	2		4	3
Total	26,337	42,343	35,298	37,368	40,402	50,362	44,605	45,247	42,405	48,777

[1] From Returns of Trade and Trade Reports.

TABLE 93.—*Wool (unmanufactured): Exports from Australia, by countries of destination, 1910 to 1919.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	Fiscal year beginning July 1.					
					1914	1915	1916	1917	1918	1919
Grease:										
United Kingdom	222,880	230,014	211,387	185,385	319,615	202,384	283,446	139,114	352,283	397,688
Canada	208	52	127	89	951	454	728	4,726	3,152	....
Egypt	....	....	....	151	....	....	....	15,522	10,951	....
India	486	478	391	502	443	198	297	778	796	....
New Zealand	1,123	154	148	101	542	11				
Belgium	63,306	58,469	54,680	51,882	2,985	....	....	....	....	39,190
France	154,089	155,347	151,556	159,783	12,788	11,139	6,246	4,775	3,719	32,243
Germany	122,297	105,674	107,523	94,069	3,036	....	....	....	....	....
Italy	3,711	5,644	4,857	5,778	18,192	43,167	25,608	17,642	10,037	44,597
Japan	7,870	6,584	9,340	7,200	22,670	34,712	16,840	2,920	5,320	8,929
Netherlands	25	410	152	69	....	....	....	....	....	....
United States	11,079	10,154	8,686	14,667	61,732	115,113	16	57,425	71,776	28,326
Austria Hungary	....	5,837	7,908	11,732	830	....	....	....	....	....
Switzerland	....	....	315	21	....	....	....	....	....	1,361
Russia	....	....	753	....	170	1,453	32	....	....	....
Other countries	17	7	10	6	....	....	1	....	....	....
Total	587,091	578,824	557,833	531,435	443,954	408,361	333,214	242,902	458,034	552,334
Scoured and washed:										
United Kingdom	35,389	34,885	28,230	26,137	48,154	37,502	46,896	59,247	103,261	26
Canada	....	....	....	....	96	180	170	132	353	68,049
India	42	29	27	45	112	241	299	52	216	....
New Zealand	32	3	43	8	....	105	....	....	....	....
Belgium	11,397	7,568	5,487	5,241	921	....	....	....	....	13,932
France	15,861	13,990	15,038	18,804	2,154	1,164	1,016	26	26	105
Germany	14,146	11,495	10,524	10,136	1,748	....	....	....	....	....
Italy	180	261	353	188	655	4,920	2,652	476	....	....
Japan	....	....	48	129	2,088	2,605	236	213	725	636
United States	5	....	50	124	4,558	27,934	154	1,446	1,365	2,047
Austria-Hungary	....	17	89	63	148	....	....	....	....	....
Russia	....	....	328	....	216	246	394	163	....	....
Other countries	3	10	19	13	3	....	....	1,074	366	108
Total	77,055	68,258	60,236	60,888	60,853	74,897	51,817	62,829	106,313	84,903

[1] From Trade Customs and Excise Revenue of the Commonwealth of Australia.

TABLE 94.—*Wool (grease): Exports from Uruguay, by countries of destination, 1910 to 1918.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	1914 [2]	1915	1916	1917	1918 [2]
Germany	15,704	32,770	42,112	46,573	....	....	....	....	....
Argentina	10,247	9,231	19,731	10,787	....	14,443	15,715	17,339	....
Austria-Hungary	2,143	5,142	5,130	5,349	....	....	....	....	....
Belgium	22,382	23,575	31,754	21,119	....	....	....	....	....
Brazil	64	81	46	94	....	85	753	600	....
Chile	....	....	....	....	....	....	8	....	....
Spain	....	....	27	21	....	3,975	5,696	5,263	....
United States	3,447	416	5,127	4,277	....	16,046	19,784	39,544	....
France	41,233	46,250	37,218	37,280	....	1,580	1,646	3,819	....
Italy	4,562	4,466	6,646	9,116	....	37,736	18,839	19,485	....
Portugal	....	....	7,426	5,691	....	20	....	....	....
United Kingdom	3,701	12,285	23,224	10,576	....	3,763	....	641	....
Sweden	....	70	....	....	....	2,214	1,201	....	....
Australia	112	....	....	....	....	....	3,727	....	....
Denmark	....	....	....	....	....	1,909	....	....	....
Netherlands	....	....	....	....	....	1,792	96	64	....
Total	103,595	134,286	178,441	150,883	[2] 98,298	83,563	67,465	86,755	[2] 76,309

[1] From Anuario Estadistico de la Republica Oriental del Uruguay.
[2] Not available by countries.

TABLE 95.—*Wool (unmanufactured): Exports from Argentina, by countries of destination, 1910 to 1919.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Grease:										
Germany	89,898	76,226	106,809	87,551	66,989	....	....	....	....	11,429
Austria - Hungary	3,849	1,795	3,536	4,022	2,765	....	....	....	....	....
Belgium	36,776	30,227	35,069	22,249	19,373	....	....	....	....	24,947
Spain	1	15	161	136	4	6,734	4,782	3,494	4,092	392
United States	23,140	17,002	37,035	19,520	37,699	113,781	158,297	196,011	154,097	114,831
France	129,997	113,572	112,859	81,271	52,456	39,603	24,830	28,135	38,794	83,268
Italy	4,195	4,467	8,059	6,486	15,068	43,505	23,486	19,345	15,445	13,631
Japan	....	....	....	....	....	....	....	5,258	3,849	774
Netherlands	2,866	1,830	2,433	2,208	3,189	10,036	5,381	2,731	....	15,465
Portuguese possessions	5,191	68	121	....	....	7	40	....	....	....
United Kingdom	35,132	44,930	56,903	40,627	59,290	36,156	28,431	20,011	4,171	32,033
Uruguay	965	952	694	653	155	1,423	813	....	....	....
Denmark	....	....	....	....	150	281	966	22	1,239	697
Norway	....	....	....	....	866	2,795	1,127	174	256	110
Sweden	....	....	....	....	527	4,500	10,617	481	1,332	4,096
Switzerland	....	....	....	....	....	....	496	2,899	....	....
Other countries	....	3	2	5	2	595	121	2,378	5,750	7,396
Total	332,010	291,087	363,681	264,728	258,533	259,416	259,387	280,939	229,025	309,069
Washed:[2]										
Brazil	....	....	....	....	....	....	131	505	563	26
Canada	....	....	....	....	....	....	....	....	116	....
Chile	....	....	....	....	....	....	13	26	51	52
Denmark	....	....	....	....	....	....	286	....	947	1,012
Spain	....	....	....	....	....	....	318	520	1,951	1,492
United States	....	....	....	....	....	....	2,366	10,389	18,279	10,467
France	....	....	....	....	....	....	45	69	969	2,628
Italy	....	....	....	....	....	....	2,931	3,306	3,486	5,133
Netherlands	....	....	....	....	....	....	380	....	....	398
Portugal	....	....	....	....	....	....	37	....	....	....
United Kingdom	....	....	....	....	....	....	1,770	1,861	89	3,192
Sweden	....	....	....	....	....	....	321	....	286	1,281
Uruguay	....	....	....	....	....	....	5	81	22	1
Japan	....	....	....	....	....	....	....	50	75	97
Norway	....	....	....	....	....	....	....	411	751	1,953
Switzerland	....	....	....	....	....	....	....	616	....	....
Other countries	....	....	....	....	....	....	....	....	....	2,406
Total	....	....	....	....	....	....	8,603	17,834	27,585	30,138

[1] From Annuario de la Direction General de Estadistica.
[2] Not separately stated prior to 1916.

TABLE 96.—*Sheep and wool: Estimated number of sheep on farms, by States, Jan. 1.*

[In thousands; i. e., 000 omitted.]

State.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
Maine	206	198	186	186	177	165	160	157	163	173	165	140
New Hampshire	44	45	43	42	39	38	35	35	37	38	37	31
Vermont	119	119	117	117	111	105	100	100	104	107	100	91
Massachusetts	33	35	35	34	31	30	26	25	26	28	28	28
Rhode Island	7	7	7	7	7	7	6	5	6	7	5	5
Connecticut	22	22	21	21	20	19	18	18	20	24	24	22
New York	930	930	911	875	875	849	849	800	800	800	810	745
New Jersey	31	31	30	31	31	31	29	29	28	29	30	29
Pennsylvania	883	901	883	865	839	831	835	830	913	930	930	856
Delaware	8	8	8	8	8	8	8	8	10	10	9	8
Maryland	237	237	230	225	223	223	223	223	234	246	245	220
Virginia	805	805	781	750	735	720	700	686	692	700	714	714
West Virginia	910	901	838	821	788	796	720	715	751	766	766	728
North Carolina	214	203	193	181	177	177	155	140	137	138	144	138
South Carolina	38	34	34	34	33	32	30	30	30	29	27	26
Georgia	188	179	174	169	166	163	161	150	144	135	125	119
Florida	114	119	120	119	118	119	119	119	120	105	95	89
Ohio	3,909	4,104	3,694	3,435	3,263	3,263	3,067	2,944	2,950	2,980	2,950	2,773
Indiana	1,337	1,444	1,372	1,317	1,238	1,114	1,005	950	998	1,078	1,067	960
Illinois	1,060	1,124	1,068	1,036	984	935	907	898	952	1,000	1,010	882

TABLE 96.—*Sheep and wool: Estimated number of sheep on farms, by States, Jan. 1*—Continued.

State.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
Michigan	2,306	2,421	2,276	2,139	2,118	2,033	1,931	1,834	1,926	2,119	2,224	2,135
Wisconsin	930	856	847	822	789	781	664	645	651	680	687	632
Minnesota	638	625	600	570	570	564	536	541	568	642	650	598
Iowa	1,146	1,226	1,201	1,249	1,249	1,249	1,240	1,200	1,224	1,270	1,019	948
Missouri	1,811	1,847	1,755	1,650	1,568	1,490	1,416	1,370	1,466	1,495	1,525	1,388
North Dakota	293	293	287	293	278	250	240	240	252	265	286	272
South Dakota	611	672	605	593	617	636	604	625	750	810	850	680
Nebraska	294	382	382	382	374	374	374	381	408	294	315	290
Kansas	272	326	326	316	316	316	341	348	418	460	506	405
Kentucky	1,363	1,404	1,320	1,320	1,267	1,229	1,155	1,155	1,213	1,274	1,236	1,137
Tennessee	795	811	762	724	688	674	650	600	550	556	560	526
Alabama	143	146	140	132	124	119	119	121	131	140	137	123
Mississippi	195	214	214	208	202	208	208	193	174	180	175	149
Louisiana	178	178	176	171	180	180	185	240	209	230	220	209
Texas	1,809	1,954	2,032	2,073	2,052	2,114	2,156	2,328	2,188	2,232	2,790	3,069
Oklahoma	62	71	72	71	75	76	95	104	114	125	110	110
Arkansas	144	141	134	130	124	130	124	124	134	161	201	191
Montana	5,381	5,220	5,011	5,111	4,293	4,379	3,941	3,500	3,045	2,984	2,330	2,450
Wyoming	5,397	5,019	4,969	4,472	4,472	4,427	4,338	4,100	4,100	4,000	3,200	3,040
Colorado	1,426	1,611	1,579	1,737	1,668	1,751	1,839	1,950	2,350	2,209	2,121	1,973
New Mexico	3,347	3,113	3,300	3,300	3,036	3,340	3,440	3,300	3,135	2,820	2,539	2,666
Arizona	1,227	1,411	1,510	1,570	1,601	1,761	1,700	1,632	1,550	1,400	1,200	1,200
Utah	1,827	2,010	1,990	1,990	1,970	2,068	2,089	2,089	2,340	2,223	2,245	2,245
Nevada	1,155	1,444	1,444	1,487	1,517	1,532	1,532	1,455	1,505	1,520	1,596	1,532
Idaho	3,010	2,951	2,951	2,951	2,981	3,041	3,102	3,170	3,202	3,234	2,914	2,623
Washington	476	486	486	501	506	546	568	585	661	780	725	645
Oregon	2,699	2,672	2,592	2,644	2,670	2,563	2,435	2,400	2,448	2,497	2,522	2,270
California	2,417	2,683	2,656	2,603	2,551	2,500	2,450	2,524	2,776	2,943	2,950	2,954
Total United States	52,447	53,633	52,362	51,482	49,719	49,956	48,625	47,616	48,603	48,866	47,114	45,067

PART III.—DAIRY PRODUCTS, POULTRY, AND OLEOMARGARINE.

TABLE 97.—*Butter: Monthly average wholesale price of 92-score butter at five markets, 1918 to 1920.*

[Cents per pound.]

Month.	New York.			Chicago.			Philadelphia.			Boston.			San Francisco.		
	1918	1919	1920	1918	1919	1920	1918	1919	1920	1918	1919	1920	1918	1919	1920
January	.....	62	65	.....	60	63	.....	62	65	.....	63	65	.....	56	62
February	50	52	66	.....	49	63	.....	52	67	.....	51	66	.....	49	62
March	44	62	67	41	60	66	.....	62	68	.....	62	68	.....	56	59
April	42	64	71	42	62	64	.....	65	71	.....	65	69	.....	56	56
May	42	58	61	42	57	57	46	59	62	46	69	61	.....	[1] 56	53
June	44	52	57	42	51	55	44	53	58	44	53	58	.....	54	54
July	45	53	57	43	51	55	45	54	58	45	53	58	.....	54	57
August	46	55	55	45	53	54	46	56	56	46	56	57	.....	55	59
September	56	59	59	55	57	57	56	59	60	55	58	59	.....	60	64
October	59	68	60	56	64	57	59	66	60	59	64	59	59	63	58
November	63	71	63	62	69	60	63	70	63	62	69	60	58	64	53
December	69	72	55	67	68	51	69	73	55	67	71	54	62	65	48

[1] Previous to May 3, 1919, San Francisco reported on 93 and 94 score butter.

TABLE 98.—*Butter: Monthly average wholesale price of 92-score creamery at New York, 1910 to 1920.*[1]

[Cents per pound.]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
January	33	26	39	35	33	34	33	40	52	62	65	41
February	30	26	32	36	29	32	34	44	50	52	66	39
March	33	24	31	37	28	30	37	42	44	62	67	40
April	31	21	33	35	25	31	36	44	42	64	71	39
May	28	22	30	29	26	29	31	40	42	58	61	36
June	28	23	27	28	27	28	30	39	44	52	57	35
July	28	25	27	27	28	27	29	39	45	53	57	35
August	29	26	27	28	30	26	31	41	46	55	55	36
September	30	27	30	32	31	27	34	44	56	59	59	39
October	30	30	31	31	32	29	35	45	59	68	60	41
November	31	34	34	34	35	31	39	46	63	71	63	44
December	30	37	37	36	34	35	40	50	69	72	55	45
Yearly average	30	27	32	32	30	30	34	43	51	61	61	39

[1] Prior to February, 1918, from Urner-Barry reports.

TABLE 99.—*Butter (packing stock): Stocks in cold storage first of month.*

[In thousands of pounds; i. e., 000 omitted.]

Month.	1916	1917	1918	1919	1920
January	....	1,785	2,046	1,384	1,410
February	....	1,663	1,566	1,196	1,520
March	....	868	865	1,340	1,472
April	....	364	1,328	859	1,149
May	....	173	1,941	825	764
June	....	343	3,458	888	712
July	....	1,319	4,779	1,908	1,916
August	....	3,447	5,276	3,074	2,970
September	3,695	3,320	5,421	3,314	3,548
October	3,333	3,380	4,660	3,441	3,786
November	2,645	3,408	3,394	2,671	3,528
December	2,284	3,403	2,328	2,098	3,139

TABLE 100.—*Creamery butter: Stocks in cold storage first of month.*

[In thousands of pounds; i. e., 000 omitted.]

Month.	1915	1916	1917	1918	1919	1920
January	....	48,977	46,134	50,726	43,910	53,737
February	....	31,139	30,474	26,618	36,777	38,359
March	....	15,033	16,952	18,808	24,191	22,568
April	....	3,346	6,805	14,629	11,909	12,555
May	....	1,082	3,607	9,536	9,659	7,554
June	....	7,017	9,953	12,698	29,435	12,872
July	....	53,863	49,982	49,140	90,158	52,526
August	68,578	102,537	88,992	88,305	123,546	101,455
September	101,662	105,836	108,179	99,334	131,388	115,558
October	99,450	100,522	109,154	87,883	121,816	113,385
November	92,719	85,260	109,115	80,874	100,474	101,778
December	71,849	67,292	79,928	65,111	73,654	79,750

TABLE 101.—*Butter: Weekly average wholesale price of 92-score butter at five markets, 1918 to 1920.*

[Cents per pound.]

Week ending—	New York.	Chicago.	Philadelphia.	Boston.	San Francisco.[1]
1918.					
Jan. 5	....	....	....	....	....
12	....	....	....	....	....
19	....	....	....	....	....
26	....	....	....	....	....
Feb. 2	....	....	....	....	....
9	52	....	....	....	....
16	52	....	....	....	....
23	51	....	....	....	....
Mar. 2	49	....	....	....	....
9	48	....	....	....	....
16	46	45	....	....	....
23	41	41	....	....	....
30	43	42	....	....	....
Apr. 6	42	41	....	....	....
13	43	41	....	....	....
20	45	42	45	45	....
27	44	43	45	45	....
May 4	46	43	47	46	....
11	47	43	49	47	....
18	46	43	46	47	....
25	44	42	45	45	....
June 1	43	42	44	44	....
8	43	41	44	44	....
15	45	42	44	44	....
22	44	43	45	45	....
29	45	43	45	45	....
July 6	44	43	45	45	....
13	45	43	45	45	....
20	45	44	45	45	....
27	45	44	45	45	....
Aug. 3	45	44	45	45	....
10	45	44	45	45	....
17	46	45	46	46	....
24	46	45	47	46	....
31	47	46	48	47	....
Sept. 7	50	48	50	49	....
14	53	52	53	52	....
21	58	58	58	57	....
28	62	59	61	60	....
Oct. 5	61	57	61	50	....
12	59	56	59	59	....
19	57	56	60	60	....
26	57	56	58	59	....
Nov. 2	59	58	58	59	....
9	60	59	60	60	....
16	63	61	63	61	....
23	64	64	65	62	....
30	67	66	67	65	....
Dec. 7	65	67	68	66	....
14	69	68	70	67	....
21	70	68	70	68	....
28	69	67	69	68	....
1919.					
Jan. 4	70	67	70	68	62
11	70	68	70	69	62
18	66	65	67	67	61
25	58	56	58	60	50
Feb. 1	48	46	48	50	45
8	49	45	49	48	45
15	52	48	52	49	45
22	54	44	56	52	49
Mar. 1	55	55	56	54	54
8	58	57	59	58	58
15	61	58	61	61	54
22	66	64	67	67	58
29	63	60	64	64	55
Apr. 5	67	63	68	68	58
12	66	62	67	67	56
19	65	62	65	65	53
26	64	61	64	64	54
May 3	60	58	61	62	53
10	58	56	58	59	54
17	59	57	60	60	56
24	59	58	60	60	59
31	56	55	57	57	58
June 7	54	52	54	54	54
14	53	51	53	53	54
21	52	50	53	53	55
28	52	51	53	53	53

Week ending—	New York.	Chicago.	Philadelphia.	Boston.	San Francisco.
1919.					
July 5	50	49	51	51	52
12	52	50	52	53	53
19	54	52	55	55	54
26	54	52	55	55	56
Aug. 2	55	53	56	56	56
9	55	53	55	55	54
16	54	53	55	55	53
23	56	54	57	56	53
30	57	54	57	57	57
Sept. 6	58	55	58	58	58
13	57	55	58	57	60
20	58	56	59	58	61
27	61	60	61	60	61
Oct. 4	64	63	65	62	64
11	65	63	65	63	63
18	68	64	68	64	63
25	70	65	70	66	62
Nov. 1	70	66	69	67	63
8	70	66	69	67	64
15	70	69	70	67	64
22	72	71	72	70	64
29	73	71	72	71	65
Dec. 6	74	72	73	72	65
13	73	69	73	73	65
20	73	67	73	72	66
27	71	66	72	70	65
1920.					
Jan. 3	70	66	70	69	64
10	68	64	68	67	65
17	63	61	63	64	59
24	64	64	65	64	60
31	63	61	63	64	64
Feb. 7	67	62	68	65	63
14	66	59	67	66	61
21	67	64	68	66	62
28	65	65	66	66	62
Mar. 6	64	64	65	66	57
13	67	68	68	68	60
20	68	67	69	69	60
27	68	66	69	69	59
Apr. 3	67	64	67	68	56
10	69	66	70	68	57
17	74	63	74	72	56
24	76	65	75	70	57
May 1	68	64	68	68	56
8	62	60	62	63	53
15	61	58	62	62	53
22	62	56	63	62	52
29	60	53	60	58	52
June 5	56	53	57	56	52
12	57	54	57	57	53
19	58	55	58	58	55
26	59	56	59	59	57
July 3	59	56	59	60	58
10	58	56	58	59	57
17	57	55	58	58	57
24	57	55	58	58	57
31	55	53	56	57	56
Aug. 7	54	52	55	56	57
14	55	54	56	56	58
21	56	55	57	57	58
28	57	56	58	58	62
Sept. 4	57	55	58	58	65
11	58	56	59	59	66
18	59	56	59	59	65
25	61	58	61	61	64
Oct. 2	61	59	61	61	63
9	63	60	62	62	64
16	60	55	58	59	59
23	58	55	58	57	56
30	60	59	60	58	54
Nov. 6	63	62	63	60	52
13	64	62	64	60	54
20	65	61	65	61	54
27	62	55	64	59	54
Dec. 4	56	51	56	56	50
11	53	48	53	52	48
18	55	51	55	53	47
25	56	53	56	54	48

[1] Did not report on 92-score butter in 1918.

TABLE 102.—*Butter: Comparative monthly receipts at five markets, 1918 to 1920.*

[In thousands of pounds; i. e., 000 omitted.]

Month.	New York.			Chicago.			Philadelphia.			Boston.			San Francisco.		
	1918	1919	1920	1918	1919	1920	1918	1919	1920	1918	1919	1920	1918	1919	1920
Jan.	......	16,439	11,794	......	12,324	10,065	......	3,824	3,264	......	4,014	3,216	2,278	1,266	1,488
Feb.	......	16,119	11,201	......	10,177	9,447	......	3,250	3,520	......	3,821	3,176	1,851	1,479	1,665
Mar.	15,750	16,232	12,972	24,051	11,458	11,398	2,620	3,748	3,398	4,323	3,140	5,368	2,564	2,014	2,178
Apr.	14,325	17,125	7,845	21,039	12,891	10,344	2,484	4,101	2,964	4,071	4,378	3,709	3,129	2,792	3,140
May.	17,550	22,904	13,383	20,780	23,168	17,118	3,591	5,064	3,980	6,159	9,554	6,323	2,771	2,979	2,767
June.	27,900	28,419	20,205	36,173	33,373	25,344	4,941	6,660	6,237	11,874	14,107	12,060	2,170	2,434	2,197
July.	25,875	23,372	21,534	34,554	24,627	27,633	4,721	5,026	5,850	12,237	13,699	14,406	1,762	2,202	1,744
Aug.	20,250	22,893	18,203	27,037	18,556	20,200	4,069	4,356	4,773	7,569	7,609	8,749	1,531	1,832	1,789
Sept.	15,600	19,650	14,914	21,134	13,156	15,455	3,419	4,141	4,698	5,377	5,241	6,762	1,178	1,094	1,722
Oct.	18,375	16,219	12,079	21,916	10,758	11,417	3,445	3,847	3,771	6,218	3,412	4,372	1,215	1,337	1,739
Nov.	13,125	15,285	10,436	16,122	7,722	9,528	2,693	4,181	3,010	5,079	2,210	2,378	1,258	1,333	1,565
Dec.	13,725	12,041	10,042	14,544	7,569	8,797	2,898	2,993	3,165	3,429	2,038	2,474	1,201	1,269	1,572

TABLE 103.—*Butter and cheese: Monthly production of creamery butter and American cheese, United States.*

[In thousands of pounds; i. e., 000 omitted.]

Month.	Creamery butter.					American cheese (whole milk).				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
January	....	43,997	44,357	52,189	47,131	....	8,519	8,143	10,956	9,910
February	....	38,459	42,389	44,343	44,611	....	9,415	7,860	11,855	11,181
March	....	47,371	49,086	54,822	54,224	....	11,918	11,992	19,009	14,513
April	....	53,809	57,332	67,487	58,936	....	17,577	17,931	21,642	18,074
May	....	75,108	85,564	103,941	84,460	....	28,932	31,285	34,849	28,417
June	....	98,898	104,385	119,357	111,345	....	38,796	40,184	44,599	39,392
July	....	94,151	97,440	104,156	105,113	....	35,296	34,332	35,465	31,658
August	....	83,936	85,148	84,458	86,069	....	32,248	29,996	30,940	24,664
September	76,028	76,744	72,397	68,815	73,144	29,984	37,613	25,424	26,257	21,136
October	54,308	56,176	63,886	58,723	64,968	18,162	22,303	18,862	23,114	19,872
November	43,469	42,705	45,741	45,041	53,398	11,772	14,262	12,172	13,107	13,179
December	40,203	48,157	45,560	46,662	52,205	7,607	8,070	9,097	10,044	10,198

TABLE 104.—*Butter and butter substitutes: Imports into the United States, 1910 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Imported from—	Fiscal years ending June 30—									Calendar years.		
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1918	1919	1920
Denmark	184	269	245	332	854	1,621	161	149	83	17	72	19,935
United Kingdom	5	4	......	156	2,690	6	......	......	......	......	1	4
Canada	980	416	629	351	722	1,278	372	311	620	1,152	9,438	9,236
Argentina	......	......	......	......	281	351	......	......	48	1	......	4,049
Australia	25	69	67	86	1,685	275	18	7	1,005	472	......	3
New Zealand	......	......	1	14	1,231	157	123	50	......	......	......	645
Other countries	166	250	84	223	379	140	39	6	50	13	8	3,582
Total	1,360	1,008	1,026	1,162	7,842	3,828	713	523	1,806	1,655	9,519	37,454

[1] Compiled from the Monthly Summary of Foreign Commerce.

TABLE 105.—*Butter: Exports from the United States, with countries of destination, 1910 to 1920.*[1]

[In thousands of pounds, i. e., 000 omitted.]

Exported to—	Fiscal years ending June 30—									Calendar years.		
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1918	1919	1920
Belgium	......	......	......	......	......	......	......	......	......	40	2,856	5,215
Denmark	......	18	......	......	5	......	233	......	......	......	1,033	3
France	......	......	......	......	......	......	......	89	123	80	778	701
Italy	......	......	......	......	......	......	......	3	2	58	1,075	221
Netherlands	......	......	......	......	......	......	......	......	......	......	482	320
Norway	......	......	......	......	......	......	62	21	5	5	1,368	......
Russia in Europe	......	......	......	......	......	......	893	......	128	128	1	......
Sweden	......	......	......	......	......	......	......	......	......	......	129	......
United Kingdom	2	830	1,452	......	721	3,336	5,433	20,839	13,982	22,250	21,817	3,899
Bermuda	28	75	84	47	54	88	262	326	183	145	53	48
Canada	202	560	1,348	158	230	2,643	2,013	1,324	45	13	275	855
Honduras	32	44	48	64	74	85	102	88	32	30	68	102
Panama	489	511	379	573	601	560	622	573	514	422	472	565
Mexico	493	427	413	358	156	138	167	558	223	313	429	799
Newfoundland and Labrador	......	4	7	3	......	20	80	125	1	12	9	......
Barbados	......	17	16	6	2	7	31	19	72	82	131	138
Jamaica[2]	271	98	91	71	76	58	91	126	58	47	60	49
Trinidad and Tobago	......	106	69	64	69	84	56	89	206	220	388	478
Cuba	300	329	224	193	206	254	311	339	268	230	554	859
Danish and West Indies	19	21	23	26	32	25	32	55	87	104	109	148
Dominican Republic	80	79	60	76	47	60	56	119	68	113	335	300
French West Indies	241	358	299	298	203	182	196	138	122	301	110	136
Haiti	254	372	519	524	397	294	426	443	224	423	364	553
British Guiana	3	9	7	1	14	16	68	144	299	420	198	506
Peru	1	5	2	6	10	5	51	287	384	15	280	574
Venezuela	458	654	700	779	408	256	39	80	6	3	36	25
China	1	1	1	......	3	17	51	232	36	38	91	70
Australia	......	......	......	......	......	1,223	1,641	34	......	......	......	......
Philippine Islands	......	16	17	9	54	33	154	114	161	132	255	329
Belgian Kongo	......	......	......	......	......	121	3	2	23	40	18	2
British West Africa	......	......	......	......	......	2	1	28	112	99	131	32
Other countries	267	344	333	329	332	344	412	640	372	431	651	561
Total	3,141	4,878	6,092	3,585	3,694	9,851	13,486	26,835	17,736	26,194	34,556	17,488

[1] Compiled from the Monthly Summary of Foreign Commerce.
[2] Includes other British West Indies.

TABLE 106.—*Butter: Exports from principal exporting countries, 1910 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported from—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Australia	87,895	101,722	66,679	75,796	(2)	[3] 54,022	[3] 16,722	[3] 74,879	[3] 72,278	[3] 41,115	....
New Zealand	39,932	33,867	42,349	41,693	48,616	47,056	40,167	28,492	48,275	38,732	....
Canada	3,674	9,712	884	1,220	2,500	3,593	7,787	4,345	10,919	16,509	142,768
Denmark	195,052	197,482	187,755	200,670	210,084	223,964	211,090	135,502	32,306	80,863	165,345
Russia	124,366	168,704	160,771	172,003	118,997	119,359	22	3	....	....	....
Argentina	6,342	3,077	8,106	8,343	7,676	10,192	12,502	21,672	41,821	44,881	....
Austria-Hungary	4,379	4,513	3,853	3,039	....	....	....	....	....	....	....
Belgium	3,509	3,345	2,625	2,147	....	....	....	....	....	11	127
Finland	24,471	27,230	26,474	27,867	24,567	20,015	8,960	....	....	....	....
France	48,428	28,221	37,572	38,360	39,616	44,566	18,937	6,728	2,620	1,119	....
Germany	399	555	482	602	....	....	....	....	....	....	....
Italy	8,295	8,147	8,843	6,034	9,310	7,488	792	170	109	51	....
Netherlands	72,456	66,513	86,307	81,702	84,407	93,352	78,997	54,215	5,415	30,242	45,576
Norway	2,739	3,679	3,475	2,346	1,575	3,607	1,027	(4)	(4)	[5] 2	[5] 5
Sweden	47,950	48,889	46,818	43,330	41,941	41,532	28,704	3	3	76	....
United States	3,104	6,375	5,105	3,111	3,688	17,943	26,561	7,193	26,194	34,556	17,488

[1] Compiled from the official publications of the respective countries.
[2] Data unavailable due to change from calendar to fiscal year.
[3] Year ending June 30.
[4] Less than 500 pounds.
[5] Norway, hitherto an exporting country, in 1919 and 1920, imported, respectively, 8,200,854 and 8,100,304 pounds of butter.

TABLE 107.—*Butter: Imports into the principal importing countries, 1910 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Imported by—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Austria-Hungary	......	6,524	10,265	14,616	......	......	......	......	......	......	......
Belgium	12,496	15,161	15,225	14,522	......	......	......	......	......	11,176	18,468
Brazil	4,589	4,321	4,208	4,336	2,364	732	140	14	4	42	......
British South Africa	3,645	4,156	4,946	3,910	3,990	1,876	290	50	2,446	385	......
Denmark	6,241	6,027	5,966	6,242	3,054	687	191	1	(2)	693	......
Dutch East Indies	3,889	4,279	4,486	4,550	4,965	4,381	5,121	4,547	4,385	......	......
Egypt	2,936	2,181	2,197	1,958	1,945	1,194	705	533	302	602	......
Finland	1,416	1,315	3,388	3,333	2,959	4,916	3	......	......	......	......
France	10,665	19,939	14,179	13,034	13,655	1,711	625	742	984	12,752	......
Germany	92,816	123,619	122,472	119,576	......	......	......	......	......	......	......
Netherlands	4,492	6,039	4,636	5,529	3,880	905	992	52	43	615	131
Russia	1,975	1,808	2,754	3,382	2,969	2,615	5,922	......	......	......	......
Sweden	205	343	273	432	189	30	60	15,756	11,426	13,846	......
Switzerland	11,063	12,098	11,930	11,155	8,900	5,700	946	369	54	13,250	......
United Kingdom	476,806	466,720	435,247	451,736	436,019	426,393	240,270	201,605	176,692	174,340	......
Canada	......	1,876	7,177	7,886	7,250	5,661	2,092	466	864	1,464	......
United States	1,209	1,005	876	3,726	7,201	1,544	676	1,308	1,655	9,519	37,454

[1] Compiled from the official publications of the respective countries.
[2] Less than 500 pounds.

TABLE 108.—*Cheese: Monthly and yearly average price per pound, New York, 1910 to 1920.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. Av.
January	$0.17	$0.15	$0.16	$0.17	$0.17	$0.15	$0.17	$0.24	$0.24	$0.35	$0.32	$0.21
February	.17	.15	.17	.17	.16	.16	.18	.25	.26	.30	.30	.21
March	.17	.14	.18	.16	.18	.16	.18	.26	.24	.32	.29	.21
April	.17	.14	.19	.15	.16	.16	.18	.26	.23	.31	.30	.20
May	.14	.11	.15	13	.14	.17	.18	.26	.24	.32	.30	.19
June	.14	.11	.14	.14	.15	.15	.15	.23	.23	.32	.28	.19
July	.15	.12	.15	.14	.15	.15	.15	.24	.25	.33	.27	.19
August	.15	.12	.16	.15	.16	13	.17	.23	.26	.31	.27	.19
September	.15	.14	.16	.16	.16	.14	.19	.25	.28	.31	.28	.20
October	.15	.14	.18	.16	.15	.15	.21	.25	.33	.31	.28	.21
November	.15	.15	.17	.16	.15	.16	.23	.23	.32	.32	.28	.21
December	.16	.16	17	.16	.15	.17	24	.24	.35	.32	.28	.22
Yearly average	.16	.14	.17	.15	.16	.15	.19	.25	.27	.32	.29	.20

[1] Prior to February, 1919, figures were compiled from Urner-Barry reports

TABLE 109.—*Cheese: Cold-storage holdings, first of month.*

[In thousands of pounds; i. e., 000 omitted.]

Month.	American cheese.					Cream and Neufchatel cheese.			Cottage, pot, and bakers' cheese		
	1916	1917	1918	1919	1920	1918	1919	1920	1918	1919	1920
January	28,558	31,855	66,784	19,823	53,168	55	136	168	892	2,718	2,765
February	18,908	22,113	56,298	15,486	43,631	27	89	161	632	2,280	2,433
March	13,373	15,560	37,743	9,837	34,039	53	92	158	521	1,964	2,041
April	8,443	9,842	27,965	6,750	23,431	29	86	180	458	2,786	1,954
May	6,546	7,928	17,736	6,027	16,963	31	95	181	539	4,060	2,511
June	7,301	11,626	20,395	12,478	13,502	31	114	177	903	5,294	3,253
July	16,357	34,159	30,054	37,501	29,654	219	228	207	2,117	6,601	5,135
August	31,569	67,595	48,804	62,645	51,512	220	334	226	2,402	6,957	5,765
September	46,776	91,545	55,742	76,661	60,372	135	242	276	3,194	6,639	5,689
October	49,579	90,671	42,065	81,359	55,007	255	259	275	3,012	5,760	5,780
November	45,713	78,087	33,402	72,889	48,566	369	223	187	2,564	5,073	5,493
December	37,080	75,166	25,625	62,508	39,921	181	194	199	3,080	4,028	4,825

TABLE 109.—*Cheese: Cold-storage holdings, first of month*—Continued.

Month.	Limburger cheese.			Brick and Munster cheese.			Swiss cheese.			All other cheese.		
	1918	1919	1920	1918	1919	1920	1918	1919	1920	1918	1919	1920
January	534	1,314	712	532	1,074	1,114	651	3,205	2,822	171	1,956	3,943
February	311	932	680	423	1,323	1,018	518	2,848	2,982	285	2,791	3,510
March	300	922	592	377	983	802	591	2,604	2,629	251	2,206	3,395
April	157	739	546	612	503	560	420	1,768	2,261	337	2,471	3,212
May	250	568	415	658	336	486	328	1,065	1,944	396	2,687	3,105
June	197	417	503	451	418	715	303	867	1,777	807	3,702	3,415
July	233	690	595	416	880	1,850	205	1,003	2,088	1,981	4,504	4,974
August	439	834	1,097	531	845	2,065	439	2,017	3,055	3,957	4,762	6,315
September	1,441	1,135	1,401	987	828	2,254	2,130	2,789	3,995	5,340	4,294	6,272
October	1,552	920	1,333	615	810	1,869	2,649	3,124	4,743	4,652	4,361	5,975
November	1,465	782	1,276	781	824	1,742	2,889	3,277	5,248	2,896	4,912	6,580
December	1,341	744	1,059	1,157	952	1,592	2,820	3,187	4,883	3,269	4,801	6,321

TABLE 110.—*Cheese: Weekly average wholesale prices at five markets, at Plymouth and other Wisconsin primary markets, 1919 and 1920.*

[Cents per pound; No. 1 Twins, American cheese.]

Week ending.	New York.	Chicago.	Philadelphia.	Boston.	San Francisco.	Plymouth, Wis.	Wisconsin primary markets.
1919.							
Jan. 4	....	....	....	....	....	....	....
11	....	....	....	....	....	37	....
18	....	....	....	....	....	....	....
25	....	....	....	....	....	29	....
Feb. 1	....	....	....	....	....	29	....
8	31	28	32	33	....	22	29
15	30	25	29	31	25	....	24
22	30	25	28	31	27	26	24
Mar. 1	30	27	29	32	29	27	26
8	31	29	30	33	30	29	28
15	32	30	31	33	28	....	30
22	32	32	33	35	28	30	32
29	32	31	33	34	28	28	31
Apr. 5	31	29	32	34	29	29	29
12	31	29	33	34	29	28	29
19	31	30	32	33	28	28	29
26	31	30	32	33	28	....	29
May 3	32	31	32	33	28	30	30
10	32	31	32	33	28	30	31
17	32	31	32	33	29	30	31
24	32	31	32	33	29	29	30
31	32	31	32	33	29	31	30
June 7	32	31	33	33	26	30	31
14	31	31	32	32	27	28	31
21	31	30	32	32	28	....	29
28	32	31	32	32	29	31	31
July 5	32	31	32	33	29	30	32
12	32	31	32	33	29	....	32
19	33	31	32	33	30	31	32
26	33	32	33	33	30	32	32
Aug. 2	33	32	33	34	32	29	32
9	33	31	33	33	33	....	31
16	32	31	33	33	32	28	30
23	31	30	32	32	32	29	29
30	31	30	32	32	32	29	29
Sept. 6	31	30	32	32	31	28	30
13	31	29	32	32	32	27	29
20	30	28	31	32	34	27	28
27	30	28	31	31	34	27	28
Oct. 4	30	28	31	32	33	27	27
11	30	28	31	31	32	28	28
18	30	29	31	32	30	29	29
25	31	30	31	32	29	30	30
Nov. 1	32	31	32	33	31	30	31
8	32	32	33	33	31	29	31
15	32	31	33	33	32	30	30
22	32	30	33	33	32	31	31
29	32	31	33	33	30	30	31
Dec. 6	32	31	32	33	30	30	31
13	32	31	32	33	30	29	31
20	32	31	32	32	30	30	30
27	32	31	32	32	28	30	31

TABLE 110.—*Cheese: Weekly average wholesale prices at five markets, at Plymouth and other Wisconsin primary markets, 1919 and 1920*—Continued.

[Cents per pound; No. 1 Twins, American cheese.]

Week ending.	New York.	Chicago.	Philadelphia.	Boston.	San Francisco.	Plymouth, Wis.	Wisconsin primary markets.
1920.							
Jan. 3	32	31	32	33	26	30	31
10	32	31	32	33	26	30	31
17	32	31	32	33	29	28	31
24	32	30	32	33	31	28	30
31	32	30	32	33	28	28	31
Feb. 7	31	30	32	32	27	27	30
14	31	29	32	32	28	27	29
21	29	28	31	32	27	25	28
28	30	27	26	31	28	25	27
Mar. 6	29	27	31	31	30	28	27
13	30	28	31	32	31	28	29
20	30	29	30	31	28	28	28
27	29	29	30	31	28	29	29
Apr. 3	30	29	30	31	29	....	30
10	30	30	30	31	28	....	30
17	30	29	31	31	25	27	29
24	30	28	31	31	24	27	28
May 1	30	29	31	31	24	27	28
8	30	28	31	31	23	25	28
15	30	28	31	31	25	27	27
22	31	28	31	31	25	26	28
29	31	27	31	31	25	23	27
June 5	29	26	31	31	25	23	25
12	29	26	30	31	27	23	25
19	29	25	28	28	28	24	25
26	28	26	28	28	30	23	25
July 3	27	26	28	28	30	23	25
10	27	26	28	28	30	23	25
17	27	25	28	28	30	22	25
24	27	25	27	28	31	23	24
31	27	25	28	28	30	22	24
Aug. 7	27	24	28	28	29	....	24
14	27	24	28	27	29	....	24
21	27	25	27	28	29	25	25
28	27	26	27	28	29	25	26
Sept. 4	28	26	28	28	29	25	26
11	28	26	28	29	31	25	26
18	28	26	28	29	31	26	26
25	28	26	28	30	33	25	27
Oct. 2	28	27	28	30	33	25	26
9	28	26	28	30	31	24	26
16	28	25	28	29	28	22	26
23	28	24	28	28	25	22	24
30	28	23	27	26	24	....	23
Nov. 6	28	24	24	26	26	....	23
13	27	25	24	26	29	24	24
20	28	25	25	26	30	24	25
27	28	26	25	26	30	24	25
Dec. 4	28	26	25	26	29	19	25
11	28	24	24	25	28	19	21
18	28	23	24	25	25	19	21
25	28	23	24	25	26	20	21

TABLE 111.—*Cheese and cheese substitutes: Imports into the United States, 1910 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Imported from—	Fiscal year ending June 30.									Calendar year.		
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1918	1919	1920
France	3,673	3,756	3,883	3,982	5,419	3,554	2,322	1,937	1,026	542	681	1,583
Greece	1,778	2,599	2,704	2,089	3,213	3,004	1,132	84	......	......	1	81
Italy	17,122	18,648	20,625	21,326	26,453	25,663	16,084	8,482	16	5	374	985
Netherlands	3,001	3,637	3,109	3,421	3,657	2,211	578	249	......	......	5	863
Switzerland	14,106	15,508	15,147	17,372	22,490	14,767	9,514	1,641	......	......	12	802
Canada	163	114	83	86	1,008	157	121	92	73	100	4,732	813
Argentina	......	......	......	......	......	......	......	1,841	8,252	6,589	5,043	9,872
Other countries	975	1,307	991	1,112	1,544	783	337	155	472	326	484	995
Total	40,818	45,569	46,542	49,388	63,784	50,139	30,088	14,481	9,839	7,562	11,332	15,994

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 112.—*Cheese: Exports from the United States, with countries of destination, 1910 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported to—	Fiscal year ending June 30.									Calendar year.		
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1918	1919	1920
Belgium	......	......	......	......	......	29	......	......	......	203	1,197	571
Denmark	......	......	......	......	......	......	......	......	......	......	1,207	150
France	......	1	......	......	......	......	......	4	1,547	1,848	639	19
Italy	72	......	1	......	......	......	......	......	571	604	45	341
Norway	......	......	......	2	......	8	60	46	1	15	3,292	536
Sweden	......	......	......	......	......	......	......	15	......	1	1,406	1,428
Spain	......	......	1	......	......	7	10	104	79	95	71	40
United Kingdom	990	7,550	3,823	638	551	50,532	38,077	55,399	35,817	38,968	586	5,233
Bermuda	13	34	67	9	9	14	52	113	14	19	14	15
Canada	86	997	624	185	141	2,809	2,567	6,248	350	247	283	842
Panama	334	429	387	389	477	489	445	351	262	290	173	316
Mexico	362	298	322	262	167	77	168	803	819	858	918	1,182
Jamaica [2]	361	149	158	160	133	120	157	129	105	75	101	203
Trinidad and Tabago	......	166	174	158	134	140	173	127	80	71	66	75
Cuba	167	168	139	146	200	458	1,603	1,407	2,759	3,121	2,349	2,875
Dominican Republic	27	35	46	32	22	64	88	153	145	154	270	429
China	70	54	79	89	72	57	89	123	232	331	146	173
British India	......	......	......	......	......	2	1	64	413	229	87	273
Hongkong	94	78	97	80	53	51	67	85	160	223	113	120
Japan	13	8	9	8	6	17	21	38	78	110	69	59
Other countries	258	399	411	441	463	489	816	841	871	942	1,128	1,411
Total	2,847	10,366	6,338	2,599	2,428	55,363	44,394	66,050	44,303	48,404	14,160	16,291

[1] Compiled from Monthly Summary of Foreign Commerce.
[2] Includes other British West Indies.

TABLE 113.—*Cheese: Exports from principal exporting countries, 1910 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Exported by—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Denmark	565	369	782	661	1,067	9,486	9,833	13,081	7,025	......	......
Bulgaria	7,091	7,549	4,030	......	......	......	......	......	......	......	......
Canada	186,666	169,179	154,345	148,849	138,265	160,660	170,248	176,380	164,163	107,633	142,768
France	25,161	24,641	27,690	37,386	22,324	16,242	11,704	7,403	5,213	7,336	......
Germany	1,858	2,179	1,812	1,603	......	......	......	......	......	......	......
Italy	57,516	61,403	67,505	72,321	66,004	65,762	39,323	2,333	938	1,821	......
Netherlands	122,771	113,607	131,107	145,337	149,574	190,334	199,108	123,634	32,893	27,372	99,738
New Zealand	50,614	49,187	64,632	68,506	96,743	91,533	106,335	99,203	98,944	176,099	......
Russia	[2] 5,464	[2] 8,945	[2] 7,455	[2] 8,373	[2] 3,836	995	[3] 105	5	......	......	......
Switzerland	69,392	66,593	66,435	78,739	77,573	74,775	47,215	12,861	2,680	1,369	......
Australia	912	1,149	136	1,603	([4])	[5] 2	[5] 128	[5] 10,569	[5] 8,427	[5] 2,303	......
United States	2,769	13,781	3,006	2,654	3,797	62,953	54,093	53,372	48,405	14,160	16,291

[1] Compiled from official publications of the respective countries.
[2] Includes cheese curds.
[3] European frontier only.
[4] Data unavailable due to change from calendar to fiscal year.
[5] Years ending June 30.

TABLE 114.—*Cheese: Imports into the principal importing countries, 1910 to 1920.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Imported by—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Algeria	6,421	6,205	6,747	7,084	6,738	4,658	4,275	2,802	2,475	2,693	5,124
Argentina	9,536	10,845	11,849	11,122	8,453	7,306	3,133	689	82	......	......
Australia	303	319	444	365	230	1,532	86	46	14	......	......
Austria-Hungary	12,537	12,473	12,797	13,200	......	......	......	......	......	......	......
Belgium	31,495	29,642	31,352	35,845	......	......	......	......	......	16,548	28,092
Brazil	3,241	3,931	6,280	4,196	3,288	2,300	1,423	337	159	210	......
British South Africa	4,727	5,039	5,242	5,694	5,044	3,955	2,109	530	252	36	......
Cuba	4,808	4,252	4,232	5,200	4,229	2,839	2,715	1,835	3,318	......	......
Denmark	1,358	1,203	1,295	1,475	1,048	847	318	39	(2)	564	......
Egypt	9,230	8,928	7,425	6,378	5,953	5,785	1,865	148	2,794	179	......
France	49,011	49,423	47,558	51,865	45,521	46,744	24,139	12,047	11,206	15,232	......
Germany	46,011	45,954	47,277	57,903	......	......	......	......	......	......	......
Italy	14,761	11,915	10,069	12,355	9,838	3,472	252	9	746	11,151	......
Russia	3,671	4,009	3,853	4,545	4,190	3,738	[3] 2,066	......	......	......	......
Spain	4,882	4,929	5,180	5,749	5,150	3,202	1,465	410	238	557	......
Switzerland	6,309	7,644	7,995	7,763	4,717	3,410	427	214	87	996	......
United Kingdom	267,878	257,134	250,823	249,972	266,591	299,920	287,115	327,981	263,132	237,086	......
United States	43,967	45,447	48,929	55,590	55,477	38,919	28,516	6,333	7,562	11,332	15,994

[1] Compiled from official publications of the respective countries.
[2] Less than 500 pounds.
[3] European frontier only.

TABLE 115.—*Milk: Monthly wholesale prices of condensed whole milk, by sections, 1919 and 1920.*

BULK PER HUNDRED POUNDS.

Month.	New England.	Middle Atlantic.	South Atlantic.	East North Central.	West North Central.	South Central.	Western North.	Western South.
1919.								
January	$14.37	$14.87	$12.00	$13.07	$13.25	....	$13.30	$12.50
February	14.75	13.92	12.00	12.33	11.70	....	13.59	12.23
March	12.00	11.95	....	11.30	12.00	....	12.00	11.70
April	11.69	11.72	....	12.13	12.00	....	12.01	9.00
May	14.75	13.94	....	11.94	11.00	....	12.01	12.00
June	13.17	13.58	....	12.36	12.25	....	12.50	11.50
July	13.57	14.24	....	13.25	12.50	....	12.50	14.00
August	13.50	14.70	....	13.81	12.40	....	11.75	10.50
September	13.62	14.50	....	14.39	....	....	13.82	11.21
October	17.00	14.97	....	14.67	11.29	....	15.14	....
November	15.28	15.80	....	15.25	13.00	....	15.25	....
December	16.18	16.77	....	16.40	14.00	$15.00	17.50	....
1920.								
January	18.04	17.68	....	17.11	14.00	....	17.50	19.00
February	16.19	18.75	18.00	18.08	16.83	18.00	18.25	17.67
March	14.85	16.42	16.00	16.00	14.00	14.50	16.16	15.67
April	15.03	16.45	16.27	16.91	16.50	....	16.32	....
May	22.00	21.75	20.78	21.13	19.75	23.00	20.17	21.00
June	22.23	22.00	23.00	21.83	21.17	23.00	21.67	23.00
July	22.03	20.58	19.45	19.73	20.05	19.85	20.23	19.70
August	20.25	20.00	18.21	19.80	20.33	20.00	20.13	20.00
September	18.32	19.50	18.03	17.77	18.27	19.70	17.65	19.70
October	16.71	17.60	16.71	15.50	16.71	16.71	16.71	16.71
November	15.00	16.96	15.83	14.63	15.83	15.83	15.10	15.75
December	11.99	12.94	13.48	12.92	13.48	13.48	13.74	13.48

PER CASE OF FORTY-EIGHT 14-OUNCE CANS.

Month.	New England.	Middle Atlantic.	South Atlantic.	East North Central.	West North Central.	South Central.	Western North.	Western South.
1919.								
January	$7.89	$7.83	....	$7.78	$7.90	....	$7.90	$7.90
February	7.83	7.81	....	7.71	7.90	....	7.80	7.90
March	7.68	7.49	....	7.02	....	....	....	....
April	7.50	7.45	....	7.32	7.55	....	....	7.55
May	7.45	7.54	....	7.31	7.30	....	7.30	7.30
June	7.62	7.59	....	7.57	7.55	....	7.55	7.55
July	7.87	7.77	$5.70	7.67	7.80	....	7.80	7.80
August	8.12	8.08	....	7.99	8.05	....	8.05	8.05
September	8.13	8.08	....	7.99	8.05	....	8.05	8.05
October	8.12	8.09	....	7.98	8.05	....	8.05	8.05
November	8.13	8.17	....	7.93	8.05	....	8.05	8.05
December	8.12	8.32	....	8.10	8.05	....	8.05	8.05

TABLE 115.—*Milk: Monthly wholesale prices of condensed whole milk, by sections, 1919 and 1920*—Continued.

PER CASE OF FORTY-EIGHT 14-OUNCE CANS—Continued.

Month.	New England.	Middle Atlantic.	South Atlantic.	East North Central.	West North Central.	South Central.	Western North.	Western South.
1920.								
January	$8.53	$8.59	....	$8.53	$8.55	....	$8.55	$8.55
February	8.71	8.68	$8.83	8.73	8.86	$8.83	8.86	8.86
March	8.76	8.60	8.81	8.54	8.77	8.81	8.77	8.77
April	8.68	8.35	9.03	9.02	9.15	8.89	9.15	9.05
May	9.24	8.87	9.03	9.37	9.37	9.33	9.45	9.45
June	10.09	9.87	10.22	10.21	10.14	10.21	10.14	10.14
July	10.29	9.99	10.25	10.25	10.25	10.30	10.17	10.25
August	10.13	9.93	10.31	10.33	10.30	10.29	10.30	10.38
September	10.29	9.46	10.54	10.30	10.13	10.17	10.33	10.33
October	9.64	9.04	9.87	9.79	9.67	9.69	9.67	9.60
November	9.59	8.92	9.92	9.83	9.70	9.83	9.70	9.63
December	9.71	8.58	9.78	9.80	9.63	9.67	9.63	9.42

TABLE 116.—*Milk: Monthly wholesale prices of evaporated whole milk, by sections, 1919 and 1920.*

PER CASE OF FORTY-EIGHT 16-OUNCE CANS.

Month.	New England.	Middle Atlantic.	South Atlantic.	East North Central.	West North Central.	South Central.	Western North.	Western South.
1919.								
January	$6.36	$6.41	$6.30	$6.29	$6.15	....	$6.27	$6.36
February	6.37	6.46	6.18	6.05	6.22	....	5.90	5.89
March	6.09	5.95	5.30	5.38	4.89	....	5.20	4.96
April	5.62	5.57	5.20	5.43	5.49	....	5.10	5.12
May	5.58	5.82	5.20	5.59	5.67	....	5.26	5.23
June	5.58	5.98	5 20	5.75	5.78	....	5.36	5.46
July	6.17	6.35	....	6.03	6.05	....	5.89	5.75
August	6.45	6.45	6.20	6.25	6.33	....	6.08	6.06
September	6.53	6.50	5.90	6.27	6.39	....	6.11	6.02
October	6.40	6.48	5.98	6.32	6.38	....	6.10	6.04
November	6.76	6.61	6.15	6.39	6.48	....	6.14	6.21
December	6.17	6.50	6.15	6.38	6.48	....	6.07	6.11
1920.								
January	6.28	6.55	5.90	6.31	6.42	....	5.91	6.24
February	5.68	5.71	5.68	5.48	5.82	$5.56	5.72	5.60
March	5.17	5.26	5.21	4.99	5.08	5.16	5.04	5.21
April	5.20	5.22	5.25	5.03	5.21	5.30	5.01	5.07
May	5.59	5.57	5.69	5.38	5.47	5.66	5.40	5.34
June	6.12	5.99	6.29	5.87	5.88	6.18	5.84	5.85
July	6.39	6.22	6.63	6.19	6.28	6.43	6.28	6.15
August	6.52	6.43	6.12	6.15	6.22	6.50	6.20	6.18
September	6.26	6.28	6.39	6.22	6.24	6.37	6.14	6.21
October	5.76	5.82	5.85	5.53	5.78	5.89	5.76	5.65
November	5.32	5.57	5.79	5.51	5.66	5.84	5.68	5.71
December	5.52	5.57	5.75	5.01	5.63	5.78	5.56	5.57

TABLE 117.—*Milk: Monthly average price per 100 pounds paid by condenseries, by sections, 1919 and 1920.*

[Price of 3.5 per cent milk delivered at condensery.]

Month.	New England.	Middle Atlantic.	South Atlantic.	East North Central.	West North Central.	South Central.	Western North.	Western South.
1919.								
January	$3.77	$4.05	$3.54	$3.58	$3.18	$4.00	$3.38	$3.04
February	3.69	3.57	3.55	3.28	3.04	3.62	3.16	2.70
March	3.34	3.34	2.86	2.94	2.84	3.29	2.65	2.62
April	3.21	2.92	2.78	2.62	2.66	2.97	2.50	2.62
May	3.05	3.10	2.78	2.65	2.45	3.29	2.47	2.50

TABLE 117.—*Milk: Monthly average price per 100 pounds paid by condenseries, by sections, 1919 and 1920*—Continued.

Month.	New England.	Middle Atlantic.	South Atlantic.	East North Central.	West North Central.	South Central.	Western North.	Western South.
1919.								
June	$2.89	$2.95	$3.10	$2.60	$2.39	$2.28	$2.55	$2.53
July	3.07	3.07	2.62	2.90	2.62	2.97	2.65	2.67
August	3.27	3.24	2.89	3.29	2.87	3.62	2.98	2.91
September	3.37	3.32	2.90	3.39	3.01	3.80	3.09	2.91
October	3.55	3.25	3.02	3.48	3.26	3.80	3.10	3.01
November	3.73	3.44	3.21	3.56	3.39	3.80	3.13	3.07
December	3.85	3.74	3.21	3.61	3.36	3.80	3.25	3.18
1920.								
January	3.86	3.76	3.20	3.57	3.35	....	3.38	3.11
February	3.79	3.59	3.02	3.35	3.10	....	3.31	3.22
March	3.62	3.48	3.02	3.02	2.98	....	2.91	2.76
April	3.36	2.79	2.96	2.86	2.81	....	2.68	2.59
May	3.34	2.79	2.90	2.81	2.72	....	2.55	2.54
June	3.22	2.98	3.05	2.69	2.77	....	2.52	2.45
July	3.53	3.08	3.08	2.98	2.73	....	2.69	2.87
August	3.80	3.43	3.09	3.21	2.86	....	2.74	2.71
September	3.89	3.64	3.20	3.14	2.69	....	2.84	2.83
October	3.96	3.49	3.06	2.70	2.70	....	2.55	2.56
November	3.42	3.56	3.02	2.70	2.67	....	2.51	2.85
December	3.34	3.20	2.73	2.60	2.50	....	2.44	2.27

TABLE 118.—*Milk: Monthly retail price in cents per quart delivered to family trade in cities.*

(Standard or Grade B milk.)

Month.	Boston.		New York.		Philadelphia.		Pittsburgh.		Washington.		Atlanta.		Jacksonville.		New Orleans.	
	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920
January	17	17	16	18	14	14	14	16	17	18	20	23	18	20	16	19
February	17	17	16	17	13	14	15	16	17	18	20	23	18	20	16	19
March	17	17	16	17	13	14	14	16	17	18	20	.....	18	20	16	19
April	16	17	15	15	13	14	14	15	14	18	20	.....	18	20	16	19
May	15	16	15	15	13	14	14	15	14	16	.....	25	18	20	16	17
June	15	16	15	15	13	14	13	15	14	16	.....	25	18	20	16	17
July	15	17	16	16	13	14	14	15	14	16	.....	25	18	25	16	17
August	16	18	16	17	14	15	15	16	15	16	20	25	18	25	16	17
September	16	18	16	18	14	15	15	16	15	17	25	25	18	25	17	19
October	17	18	16	18	14	15	16	16	18	18	23	25	20	24	19	19
November	17	18	18	18	14	15	16	16	18	18	25	.....	20	23	19	19
December	17	18	18	17	14	13	16	16	18	18	23	.....	20	23	19	18

Month.	St. Louis.		Kansas City.		Chicago.		Detroit.		Cleveland.		Milwaukee.		Minneapolis.	
	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920
January	14	16	16	16	14	15	15	16	15	16	13	13	14	13
February	14	16	16	16	14	15	15	16	14	16	13	13	13	13
March	14	16	16	16	13	14	15	16	13	16	12	12	13	13
April	13	15	16	16	13	14	15	16	13	15	12	12	13	13
May	13	15	15	16	14	14	15	16	13	15	12	12	12	13
June	13	15	15	16	14	14	15	16	14	15	12	12	12	13
July	14	15	15	16	14	15	15	16	15	15	12	13	12	13
August	15	16	15	16	15	16	16	16	15	16	13	13	13	14
September	16	16	15	16	15	16	16	16	15	16	13	13	13	14
October	16	17	15	16	15	16	16	16	16	16	13	13	13	14
November	16	17	16	16	15	15	16	16	16	15	13	11	13	14
December	16	16	16	15	15	14	16	14	16	15	13	11	13	14

TABLE 118.—*Milk: Monthly retail price in cents per quart delivered to family trade in cities*—Continued.

Month.	St. Paul.		Denver.		Dallas.		Los Angeles.		San Francisco.		Portland, Oreg.		Seattle.	
	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920
January	14	13	13	13	......	......	14	16	14	16	15	15	16	15
February	13	13	13	13	......	23	14	16	14	16	15	15	16	15
March	13	13	13	13	......	23	14	16	14	16	14	15	14	14
April	......	13	13	13	......	21	14	16	14	16	14	13	13	12
May	12	13	13	13	......	21	14	16	14	16	14	13	12	......
June	12	13	13	13	......	21	14	16	14	16	14	13	13	13
July	12	13	13	13	......	21	14	18	14	16	15	14	13	14
August	13	14	13	13	......	21	14	18	14	17	15	14	14	14
September	13	14	13	13	......	21	14	18	14	17	15	14	15	14
October	13	14	13	13	......	21	14	18	15	17	16	14	15	14
November	13	14	13	13	......	21	16	18	15	17	16	15	15	......
December	13	14	13	13	......	21	16	18	16	17	15	15	15	13

TABLE 119.—*Dressed poultry: Stocks in storage at first of month.*

[In thousands of pounds; i. e., 000 omitted.]

Month.	Broilers.					Roasters.					Fowls.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
January	.....	3,927	9,206	15,156	9,187	.....	6,505	16,659	29,466	28,687	......	5,939	13,899	26,030	20,636
February	.....	4,638	8,211	15,023	8,405	.....	7,581	18,340	33,204	32,051	......	8,293	15,283	30,698	23,110
March	.....	4,418	7,256	14,230	6,868	.....	5,612	14,588	30,455	27,683	......	5,105	12,484	28,068	18,384
April	.....	3,645	4,731	12,196	5,576	.....	6,036	11,724	27,244	21,690	......	4,698	9,419	23,581	13,177
May	523	7,422	3,126	10,954	4,081	1,064	10,695	7,025	18,821	13,665	1,615	6,396	4,107	15,549	7,251
June	257	4,999	1,710	8,709	3,448	558	7,694	3,923	14,183	8,573	384	4,751	2,749	11,121	4,654
July	175	4,360	1,318	7,409	3,052	342	6,635	2,328	10,294	5,019	378	3,787	4,360	9,572	3,985
August	317	4,274	1,605	6,156	2,691	242	6,110	1,469	7,260	2,604	391	3,482	5,841	7,349	5,239
September	658	3,249	5,118	6,081	4,135	406	4,798	1,237	5,046	1,724	926	2,770	7,349	4,897	5,002
October	1,312	3,683	8,660	5,994	7,152	1,084	3,873	2,749	4,069	1,935	1,341	2,660	7,453	4,364	3,769
November	2,359	4,197	12,685	6,996	9,756	2,040	5,191	7,685	5,580	5,231	1,881	3,301	9,456	4,331	4,264
December	4,147	8,717	14,586	8,046	10,970	5,817	12,578	16,201	14,833	11,242	4,613	8,497	15,068	9,691	7,212

Month.	Turkeys.					Miscellaneous poultry.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
January	....	2,708	4,744	9,039	5,178	....	13,105	20,050	29,032	23,824
February	....	3,521	10,509	10,606	6,030	....	11,568	15,895	30,144	22,656
March	....	3,220	9,688	10,117	5,691	....	9,441	12,935	26,757	19,795
April	....	2,892	8,506	8,669	4,545	....	8,718	9,734	21,206	16,449
May	169	3,054	7,324	7,072	3,497	14,477	39,675	4,941	18,765	12,031
June	180	3,238	5,935	6,358	2,832	5,180	43,604	4,612	15,245	11,028
July	253	4,382	4,236	5,378	2,432	5,067	41,031	5,410	16,559	10,303
August	149	4,078	3,086	4,390	1,800	5,932	36,188	6,754	15,418	10,031
September	151	3,547	2,100	3,200	1,183	6,741	41,729	7,229	13,693	9,287
October	296	3,020	1,770	1,849	872	16,009	33,501	9,166	14,215	9,225
November	401	6,485	1,579	1,327	870	24,494	32,569	13,029	14,905	10,951
December	2,842	3,152	6,337	3,212	4,351	9,720	16,616	19,046	18,967	15,270

TABLE 120.—*Oleomargarine: Monthly and yearly production, United States, 1918 to 1920.*

[In thousands of pounds; i. e., 000 omitted.]

UNCOLORED.

Month.	Animal and vegetable oil.			Exclusively vegetable oil.			Exclusively animal oil.		
	1918	1919	1920	1918	1919	1920	1918	1919	1920
January	24,823	27,520	17,559	7,924	12,559	18,092	71	123	254
February	22,859	12,461	15,284	12,123	6,524	16,720	1,242	1,148	378
March	21,674	18,620	15,880	9,329	8,886	19,647	46	115	450
April	16,203	20,673	14,515	6,911	11,072	17,157	46	227	457
May	18,506	19,223	16,208	5,381	10,527	19,424	199	248	360
June	15,449	11,527	11,650	3,397	6,822	12,200	130	198	205
July	17,017	15,659	10,994	3,126	7,252	11,429	179	183	869
August	15,791	16,708	11,921	2,706	8,378	13,158	205	196	354
September	21,428	16,154	14,058	5,927	9,832	15,311	450	485	461
October	30,248	19,902	13,183	12,957	14,619	16,642	342	192	251
November	23,172	17,541	12,603	8,328	16,869	13,608	153	129	242
December	28,027	18,771	11,322	10,753	19,566	13,179	244	147	162
Total	255,197	214,759	165,177	88,862	132,906	186,567	3,307	3,391	4,443

COLORED.

Month.	Animal and vegetable oil.			Exclusively vegetable oil.			Exclusively animal oil.		
	1918	1919	1920	1918	1919	1920	1918	1919	1920
January	495	813	815		230	339			
February	564	566	675		1,001	298	8		69
March	1,127	1,277	1,115		1,567	404			3
April	505	711	971	58	1,948	338			5
May	608	820	816	1	1,097	347	15	28	6
June	474	628	782	31	325	294	13	31	6
July	418	600	720	14	876	283	14	25	7
August	428	712	694		1,156	312	13	32	7
September	504	575	743		87	729	17	47	7
October	629	730	725		377	641			8
November	541	818	712	1	733	597			9
December	763	1,053	655	7	396	388	923	1,002	12
Total	7,056	9,303	9,423	112	9,793	4,970	1,003	1,165	139

PART IV.—GRAIN, HAY, FEED, AND SEEDS.

TABLE 121.—*Wheat: Monthly and yearly average price per bushel of reported sales, 1910–11 to 1920–21.*

NO. 2 RED WINTER, CHICAGO.[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$1.07	$0.86	$1.05	$0.87	$0.82	$1.13	$1.23	$2.50	$2.22	$2.23	$2.59	$1.55
August	1.02	.90	1.03	.88	.92	1.11	1.43	2.30	2.21	2.24	2.50	1.55
September	.99	.93	1.03	.93	1.11	1.08	1.53	2.17	2.23	2.24	2.53	1.58
October	.96	1.00	1.06	.92	1.12	1.12	1.66	2.17	2.25	2.24	2.20	1.57
November	.93	.96	.99	.92	1.15	1.12	1.85	2.17	2.24	2.29	2.01	1.57
December	.94	.96	.86	.94	1.20	1.23	1.76	2.17	2.29	2.44	2.02	1.59
January	.98	.97	1.09	.97	1.39	1.30	1.89	2.17	2.34	2.64		1.57
February	.91	1.01	.99	.97	1.57	1.23	1.74	2.17	2.28	2.42		1.53
March	.90	1.03	.95	.95	1.52	1.13	1.99	2.17	[2] 2.36	2.55		1.56
April	.90	1.09	1.02	.95	1.59	1.22	2.43	2.17	2.52	2.63		1.54
May	.96	1.16	1.03	.99	1.55	1.15	2.94	2.16	2.76	3.10		1.78
June	.91	1.10	1.00	.82	1.24	1.05	2.76	2.17	2.32	2.89		1.63
Weighted average	1.02	.90	1.03	.88	1.08	1.13	1.68	2.25	2.22	2.24		1.44

[1] Compiled from the Chicago Daily Trade Bulletin.
[2] Based on small number of sales.

TABLE 121.—*Wheat: Monthly and yearly average price per bushel of reported sales, 1910–11 to 1920–21*—Continued.

NO. 1 NORTHERN SPRING, MINNEAPOLIS.[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$1.21	$0.99	$1.09	$0.91	$0.92	$1.44	$1.21	$2.66	$2.17	$2.66	$2.89	$1.69
August	1.13	1.05	.98	.88	1.10	1.18	1.64	2.47	2.23	2.59	2.56	1.67
September	1.09	1.09	.89	.87	1.12	.97	1.64	2.17	2.23	2.56	2.54	1.61
October	1.08	1.10	.90	.84	1.11	1.02	1.79	2.17	2.19	2.67	2.16	1.60
November	1.04	1.05	.84	.85	1.18	1.02	1.95	2.17	2.22	2.85	1.80	1.59
December	1.03	1.02	.82	.86	1.20	1.14	1.79	2.17	2.22	3.07	1.68	1.60
January	1.06	1.06	.89	.87	1.38	1.29	1.93	2.17	2.21	3.01	......	1.59
February	1.02	1.06	.87	.93	1.52	1.26	1.86	2.17	2.24	2.67	......	1.56
March	.98	1.08	.85	.92	1.49	1.14	2.03	2.17	2.36	2.84	......	1.59
April	.96	1.10	.88	.91	1.58	1.22	2.38	2.17	2.56	3.06	......	1.68
May	.99	1.16	.91	.94	1.58	1.22	2.96	2.17	2.59	3.09	......	1.76
June	.97	1.13	.92	.92	1.35	1.11	2.73	2.17	2.48	2.93	......	1.67
Weighted average	1.05	1.07	.87	.88	1.20	1.09	1.76	2.20	2.25	2.72	......	1.51

NO. 1 DARK NORTHERN SPRING, MINNEAPOLIS.[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	......	......	......	......	......	......	......	......	$2.21	$2.72	$2.94	......
August	......	......	......	......	......	......	......	$2.50	2.29	2.71	2.59	......
September	......	......	......	......	......	......	......	2.21	2.24	2.77	2.65	......
October	......	......	......	......	......	......	......	2.21	2.23	2.84	2.21	......
November	......	......	......	......	......	......	......	2.21	2.25	3.00	1.82	......
December	......	......	......	......	......	......	......	2.21	2.25	3.25	1.72	......
January	......	......	......	......	......	......	......	2.21	2.25	3.34	......	......
February	......	......	......	......	......	......	......	2.21	2.29	2.90	......	......
March	......	......	......	......	......	......	......	2.21	2.41	2.97	......	......
April	......	......	......	......	......	......	......	2.21	2.63	3.23	......	......
May	......	......	......	......	......	......	......	2.21	2.68	3.26	......	......
June	......	......	......	......	......	......	......	2.21	2.56	3.01	......	......
Weighted average	......	......	......	......	......	......	......	2.23	2.36	3.00	......	......

NO. 2 HARD WINTER, KANSAS CITY.[2]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$1.04	$0.87	$0.92	$0.82	$0.78	$1.36	$1.14	$2.68	$2.20	$2.25	$2.67	$1.57
August	1.00	.93	.89	.83	.91	1.26	1.41	2.61	2.16	2.18	2.44	1.56
September	.99	.95	.88	.87	1.04	1.07	1.57	2.12	2.16	2.24	2.43	1.53
October	.95	1.04	.88	.84	1.02	1.07	1.67	2.12	2.16	2.30	2.06	1.52
November	.91	1.00	.83	.83	1.08	1.03	1.85	2.12	2.15	2.46	1.78	1.51
December	.93	1.00	.84	.84	1.13	1.12	1.72	2.12	2.24	2.63	1.71	1.54
January	.95	1.05	.87	.85	1.34	1.20	1.89	2.12	2.31	2.82	......	1.54
February	.90	1.03	.86	.86	1.54	1.20	1.82	2.12	2.26	2.42	......	1.50
March	.88	1.05	.86	.88	1.49	1.05	1.97	2.12	2.39	2.49	......	1.52
April	.88	1.09	.88	.87	1.54	1.12	2.43	2.12	2.62	2.75	......	1.63
May	.90	1.11	.87	.90	1.50	1.10	3.01	2.12	2.60	2.93	......	1.70
June	.88	1.09	.88	.85	1.21	1.00	2.74	(3)	2.47	2.76	......	1.55
Weighted average	.98	.97	.88	.84	.93	1.19	1.71	2.52	2.19	2.42	......	1.46

NO. 2 RED WINTER, ST. LOUIS.[4]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$1.07	$0.84	$1.03	$0.85	$0.87	$1.17	$1.25	$2.36	$2.21	$2.22	$2.70	$1.55
August	1.02	.88	1.04	.88	.93	1.14	1.45	2.32	2.21	2.20	2.47	1.55
September	1.02	.94	1.63	.94	1.10	1.14	1.60	2.15	2.19	2.21	2.56	1.59
October	1.00	1.00	1.09	.93	1.10	1.21	1.73	2.15	2.22	2.24	2.25	1.59
November	.96	.96	1.04	.94	1.11	1.16	1.87	2.15	2.22	2.29	2.03	1.58
December	.98	.97	1.07	.95	1.18	1.23	1.83	2.15	2.32	2.48	1.99	1.62
January	1.03	1.02	1.11	.96	1.40	1.34	1.96	2.15	2.41	2.70	......	1.61
February	.96	1.01	1.09	.95	1.57	1.30	1.88	2.15	2.38	2.55	......	1.58
March	.93	1.04	1.08	.95	1.50	1.17	2.05	2.15	2.55	2.58	......	1.60
April	.90	1.13	1.09	.94	1.54	1.22	2.66	2.15	2.71	2.76	......	1.71
May	.94	1.21	1.04	.96	1.50	1.20	3.04	2.15	2.60	2.99	......	1.76
June	.88	1.11	.99	.84	1.19	1.10	2.65	2.15	2.41	2.89	......	1.62
Weighted average	.99	.94	1.05	.89	1.10	1.20	1.63	2.23	2.23	2.30	......	1.46

[1] Compiled from Minneapolis Market Record.
[2] Compiled from Kansas City Price Current.
[3] No sales.
[4] Compiled from St. Louis Daily Market Report.

TABLE 122.—*Wheat: Monthly and yearly average farm price per bushel, United States, 1910–11 to 1920–21.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr av.
July	$0.97	$0.84	$0.94	$0.79	$0.77	$1.05	$1.00	$2.25	$2.04	$2.20	$2.43	$1.43
August	.97	.84	.88	.77	.85	1.01	1.19	2.19	2.05	2.11	2.25	1.41
September	.95	.87	.85	.78	.93	.93	1.34	2.05	2.06	2.08	2.17	1.41
October	.92	.90	.84	.77	.95	.92	1.47	2.00	2.06	2.11	2.01	1.40
November	.89	.89	.80	.78	.98	.93	1.59	2.00	2.05	2.14	1.66	1.38
December	.88	.88	.76	.80	1.03	.97	1.55	2.01	2.05	2.23	1.47	1.38
January	.89	.89	.78	.81	1.19	1.08	1.58	2.02	2.06	2.34	....	1.36
February	.88	.91	.80	.82	1.32	1.08	1.65	2.02	2.08	2.31	....	1.39
March	.85	.92	.80	.84	1.33	1.01	1.72	2.03	2.11	2.30	....	1.39
April	.84	.96	.80	.84	1.36	1.01	2.13	2.03	2.23	2.43	....	1.46
May	.85	1.01	.82	.84	1.36	1.01	2.47	2.03	2.30	2.55	....	1.52
June	.85	1.01	.82	.81	1.17	.97	2.34	2.03	2.25	2.56	....	1.48
Yearly average	.90	.91	.82	.80	1.10	1.00	1.67	2.06	2.11	2.28	....	1.40

TABLE 123.—*Wheat: Monthly and yearly average price per bushel of No. 1 Northern and Manitoba No. 1 Northern, Liverpool, 1910 to 1916.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916
January	$1.23	$1.12	$1.24	$1.13	$1.05	$1.73	$2.02
February	1.21	1.13	1.27	1.14	1.07	2.00	2.14
March	1.21	1.11	1.24	1.10	1.07	2.00	2.07
April	1.21	1.09	....	1.15	1.07	1.99	1.94
May	1.00	1.09	....	1.17	1.10	2.14	1.86
June	1.05	1.09	1.21	1.14	1.08	1.84	1.61
July	1.14	1.11	1.19	1.14	1.07	1.73	1.64
August	1.23	1.15	1.20	1.13	1.27	1.78	2,08
September	1.22	1.19	1.25	1.12	1.40	1.77	2.17
October	1.09	1.22	1.21	.97	1.36	1.77	2.29
November	1.09	1.15	1.10	.97	1.37	1.79	2.50
December	1.08	1.16	1.10	1.03	1.54	1.81	2.65
Yearly average	1.15	1.13	1.20	1.10	1.20	1.86	2.08

[1] From Agricultural Staples and Tariff, Series No. 20.

TABLE 124.—*Wheat: Monthly and yearly average price per bushel of reported sales of No. 2 Red Winter, Chicago, 1910–11 to 1920–21.*[1]

[Reduced to 1913 basis.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$1.08	$0.91	$1.05	$0.86	$0.83	$1.12	$1.03	$1.35	$1.12	$1.02	$0.99	$1.03
August	1.03	.96	1.03	.87	.90	1.11	1.16	1.25	1.09	.99	1.00	1.04
September	1.00	.99	1.03	.91	1.08	1.10	1.20	1.19	1.08	1.02	1.05	1.07
October	.97	1.06	1.06	.91	1.13	1.11	1.25	1.21	1.10	1.00	.98	1.08
November	.94	1.02	.99	.91	1.17	1.10	1.28	1.19	1.09	1.00	.97	1.07
December	.95	1.02	.86	.95	1.24	1.17	1.21	1.20	1.11	1.03	1.07	1.09
January	1.04	.97	1.10	.97	1.42	1.18	1.26	1.17	1.15	1.06	....	1.13
February	.97	1.01	.99	.98	1.57	1.11	1.12	1.17	1.16	.97	....	1.11
March	.96	1.03	.96	.96	1.54	.99	1.24	1.16	1.17	1.01	....	1.10
April	.96	1.09	1.04	.97	1.61	1.05	1.42	1.14	1.24	.99	....	1.15
May	1.02	1.16	1.05	1.01	1.55	.97	1.62	1.14	1.33	1.14	....	1.20
June	.97	1.10	1.00	.84	1.25	.89	1.50	1.12	1.12	1.07	....	1.09
Weighted average	1.03	.95	1.01	.87	1.09	1.10	1.22	1.23	1.10	1.01	....	1.06

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 125.—*Wheat: Monthly and yearly receipts at primary markets, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	18,464	33,320	20,630	37,513	51,217	19,634	33,204	10,568	38,085	43,659	27,640	31,547
August	40,358	26,399	39,127	39,884	49,630	33,866	54,162	24,793	84,395	73,897	39,967	46,612
September	32,461	30,465	56,676	44,721	69,928	62,928	45,463	24,970	72,851	67,838	42,809	51,865
October	29,108	33,460	55,718	35,935	55,058	68,108	47,944	30,55[illegible]	64,696	48,069	42,762	48,330
November	19,678	24,520	54,761	35,230	60,257	81,776	41,582	30,588	37,868	33,980	35,27[illegible]	43,584
December	18,368	18,514	38,923	28,315	39,299	73,080	29,577	17,725	54,844	29,114	30,862	36,025
January	14,278	12,750	29,536	18,930	23,794	38,933	22,621	10,484	25,405	21,57[illegible]	....	22,047
February	9,214	14,274	20,980	17,166	19,524	37,115	17,052	5,960	12,831	16,419	....	16,828
March	10,239	11,175	18,947	16,967	16,683	34,184	22,085	5,758	13,176	16,420	....	16,563
April	8,102	8,671	15,095	11,609	13,766	25,795	23,190	6,307	14,500	13,943	....	13,752
May	12,250	10,804	15,141	13,424	17,568	24,187	23,902	6,756	11,417	19,086	....	15,454
June	10,264	6,970	15,874	10,589	15,331	20,105	13,556	6,534	8,339	19,807	....	12,869
Crop year total	222,784	231,322	382,408	310,283	432,055	519,711	374,338	180,396	438,407	393,835	....	348,636

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 126.—*Wheat: Visible supply in United States, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	12,034	23,863	23,350	30,163	14,999	7,948	42,628	14,209	785	8,681	17,777	18,643
August	12,375	41,316	18,841	37,677	29,744	6,582	40,889	5,819	17,155	20,902	17,487	23,614
September	26,45[illegible]	48,057	19,586	44,530	31,534	7,111	54,660	5,058	48,821	56,828	19,554	33,554
October	34,967	52,709	31,658	49,026	51,586	15,900	57,418	7,789	96,886	84,909	27,391	47,527
November	40,120	65,199	41,712	55,105	65,922	22,639	60,470	14,908	122,604	95,352	35,500	58,041
December	42,989	69,948	55,400	58,868	74,086	48,797	62,026	21,031	121,561	89,742	43,149	64,461
January	44,282	70,489	65,342	63,743	72,861	67,311	59,534	17,552	119,711	75,363	....	65,619
February	43,251	60,425	64,913	60,806	60,252	68,458	48,721	13,869	130,613	60,359	....	61,167
March	39,868	57,080	63,786	57,021	49,682	63,553	44,916	9,739	118,219	50,875	....	55,475
April	34,152	51,042	58,996	51,862	39,323	57,387	39,317	5,381	92,546	45,896	....	47,590
May	27,605	41,722	47,157	43,378	26,439	48,864	25,756	2,194	49,502	42,784	....	35,540
June	26,838	30,847	37,940	29,775	19,082	44,463	28,896	1,146	23,702	37,101	....	27,979

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 127.—*Wheat: Monthly and yearly shipments from primary markets, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr av.
July	9,238	10,791	12,767	19,561	30,575	10,079	17,474	6,493	10,874	8,730	17,810	14,515
August	16,854	18,125	26,397	22,931	35,036	24,276	33,832	12,391	37,712	34,290	24,540	26,953
September	14,926	14,453	33,036	25,995	38,022	39,034	28,769	9,085	28,482	35,974	23,958	27,681
October	18,512	13,726	32,666	20,693	31,670	40,529	27,200	12,785	25,919	25,107	25,024	25,532
November	13,769	13,296	31,582	20,982	43,065	47,840	27,589	12,620	40,263	19,060	22,220	27,852
December	7,027	9,133	19,949	20,596	28,318	40,458	23,255	8,810	36,402	17,835	21,512	22,627
January	5,408	5,583	13,992	10,304	22,261	20,586	17,175	3,503	10,405	16,165	....	12,538
February	4,672	5,979	10,031	8,576	18,043	22,487	12,257	3,360	8,172	13,671	....	10,650
March	5,790	6,522	11,221	10,139	14,899	24,505	15,041	3,782	13,832	10,160	....	11,589
April	6,359	9,025	16,172	9,047	15,651	20,406	18,965	3,417	29,037	9,730	....	13,781
May	10,700	13,460	17,396	19,163	16,521	16,667	28,359	1,769	32,881	21,228	....	17,556
June	6,799	8,001	12,815	17,951	14,051	13,865	16,584	1,320	9,508	18,363	....	11,926
Crop year total	120,054	128,094	238,024	205,938	308,112	320,732	266,500	79,335	283,487	230,313	....	217,740

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 128.—*Wheat: Yearly movements and local consumption at primary markets, 1910 to 1920, and 5-year average for 10 designated markets.*

[In thousands of bushels; i. e., 000 omitted.]

ALL PRIMARY MARKETS.[1]

Year.	Supply at beginning of year.	Receipts.	Shipments.	Supply at end of year.	Local consumption.	Year.	Supply at beginning of year.	Receipts.	Shipments.	Supply at end of year.	Local consumption.
1910...	12,034	222,783	124,478	23,863	86,476	1916...	42,628	374,754	266,500	14,209	136,673
1911...	23,863	231,322	130,055	23,350	101,780	1917...	14,209	177,551	80,717	785	110,258
1912...	23,350	382,409	238,024	30,163	137,572	1918...	785	439,088	285,874	8,681	145,318
1913...	30,163	310,283	205,938	13,248	121,260	1919...	8,681	402,643	227,729	19,799	163,796
1914...	13,248	432,055	304,201	7,948	133,154	1920...	19,799	401,076	222,806	11,621	186,448
1915...	7,948	513,476	313,886	42,628	164,910						

[1] Compiled from Chicago Daily Trade Bulletin.

AVERAGE YEARLY RECEIPTS, SHIPMENTS, AND CONSUMPTION AT 10 PRIMARY MARKETS.[1]

Market.	Averages for calendar years 1913–1917.				Market.	Averages for calendar years 1913–1917.			
	Receipts.	Shipments.	Local consumption.	Per cent of local receipts consumed.		Receipts.	Shipments.	Local consumption.	Per cent of local receipts consumed.
Minneapolis.	120,151	38,521	81,630	67.9	Duluth......	56,884	54,090	2,794	4.9
Kansas City	55,612	43,986	11,626	20.9	Cincinnati..	5,955	4,356	1,599	26.9
Chicago.....	65,412	58,127	7,285	11.1	Indianapolis	[2] 3,390	1,255	2,135	63.0
St. Louis....	34,209	27,090	7,119	20.8	Peoria........	3,079	2,974	105	3.4
Omaha......	21,275	17,889	3,386	15.9					
Milwaukee..	8,062	4,933	3,129	38.8	Total..	374,029	253,221	120,808	32.3

[1] From Report of Federal Trade Commission.
[2] Average of calendar years 1916–1917 only.

TABLE 129.—*Wheat: Monthly and yearly receipts at Chicago, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July..........	2,662	12,070	3,435	10,023	21,094	4,885	3,125	999	6,596	9,375	2,562	7,716
August........	11,784	8,850	6,295	14,445	17,721	12,505	10,843	3,091	2,725	21,411	8,585	10,647
September....	2,990	2,978	7,364	4,367	13,496	9,858	6,276	2,010	14,872	20,215	3,920	8,536
October.......	1,354	2,068	5,161	2,290	8,677	5,204	6,623	2,505	6,279	9,191	1,534	4,953
November....	1,202	1,593	5,071	2,154	14,102	7,616	6,336	2,276	5,629	3,322	1,262	4,936
December.....	766	1,086	1,657	1,968	8,563	7,570	3,641	1,006	1,137	2,072	2,478	3,118
January.......	773	563	3,356	2,080	5,330	7,038	3,477	332	3,552	1,740	....	2,824
February.....	640	1,359	2,652	3,314	5,066	7,427	2,785	363	2,812	2,231	....	2,855
March.........	640	1,421	2,418	1,930	3,624	9,790	3,460	539	1,231	977	....	2,599
April..........	631	970	2,924	1,484	2,818	7,744	3,859	298	1,117	769	....	2,261
May...........	2,682	2,099	1,668	4,716	4,495	5,738	3,939	190	1,727	1,356	....	2,661
June..........	1,312	506	2,167	2,113	2,732	2,444	2,344	126	856	1,508	....	1,611
Crop year total....	27,400	35,563	44,168	50,884	107,718	85,819	56,708	13,735	54,533	74,167	....	55,070

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 130.—*Wheat: Visible supply at Chicago, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	1,145	8,268	9,282	1,769	782	140	6,330	203	21	199	1,060	2,805
August	2,390	15,909	7,906	3,930	4,274	1,237	6,229	50	4,585	5,110	406	4,964
September	5,915	18,690	4,286	11,070	5,749	779	7,726	174	14,269	10,006	1,006	7,376
October	6,483	17,680	5,574	9,668	4,744	1,059	6,556	167	17,770	13,479	786	7,748
November	6,170	17,013	6,529	9,167	5,418	1,343	6,187	513	20,160	18,616	745	8,569
December	5,907	16,184	9,332	8,691	6,946	4,545	5,293	1,058	15,560	17,205	699	8,551
January	5,512	14,878	3,104	6,664	3,622	6,728	4,877	1,057	13,079	15,169	....	8,521
February	5,139	13,838	7,537	5,701	1,391	6,028	3,990	1,061	14,794	11,834	....	7,409
March	5,095	13,773	7,402	5,987	984	3,759	3,558	1,020	15,948	9,730	....	7,178
April	4,962	13,689	6,311	5,484	911	4,338	2,696	942	14,343	8,624	....	6,542
May	4,856	12,909	5,448	4,100	1,774	4,319	931	715	7,331	7,604	....	5,262
June	6,883	10,909	3,869	6,077	2,711	6,201	291	256	718	4,155	....	4,565

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 131.—*Wheat: Monthly and yearly shipments from Chicago, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	1,507	2,542	2,659	5,669	14,175	2,654	2,609	915	1,405	1,292	2,202	3,612
August	4,015	7,252	9,230	9,242	16,295	11,454	7,630	1,984	17,429	14,828	6,141	10,149
September	2,286	3,225	6,044	5,866	10,693	7,413	6,884	1,277	10,238	15,398	5,240	7,228
October	2,029	2,333	3,606	2,246	7,164	5,350	5,605	1,375	3,484	5,507	1,404	3,607
November	1,419	1,790	1,890	2,301	9,730	2,158	4,714	840	8,498	3,939	940	3,680
December	1,125	1,320	1,965	2,744	7,858	3,499	2,677	523	7,736	2,466	1,308	3,210
January	943	1,090	2,650	2,660	7,861	5,249	2,380	121	2,435	3,490	....	2,888
February	587	710	1,903	1,780	5,042	6,655	2,502	111	627	3,141	....	2,306
March	518	1,143	3,068	2,894	2,754	7,979	3,049	206	1,760	1,375	....	2,475
April	742	1,767	3,285	2,067	1,902	6,728	4,245	199	4,710	950	....	2,660
May	1,572	3,704	2,970	2,960	3,197	2,890	2,879	356	7,760	2,016	....	3,030
June	516	2,127	4,055	7,476	4,441	1,502	2,168	211	1,040	2,813	....	2,635
Crop year total	17,259	30,003	43,325	47,905	91,112	61,531	47,342	8,118	67,122	57,215	....	47,093

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 132.—*Wheat: Monthly and yearly receipts at Minneapolis, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	4,545	5,219	2,861	4,181	4,394	4,987	8,537	2,629	2,647	4,143	7,049	4,665
August	9,380	6,662	8,761	6,778	8,892	5,565	9,021	6,326	14,908	13,658	7,681	8,825
September	13,106	13,810	13,829	16,284	21,035	19,826	15,019	11,569	18,713	15,661	12,786	15,853
October	11,727	13,727	18,085	13,452	17,984	23,439	15,520	14,676	21,306	18,481	16,469	17,314
November	8,186	12,724	17,808	12,331	12,042	24,492	15,482	12,377	9,420	12,125	13,501	14,230
December	10,005	11,176	18,719	12,143	12,533	28,524	10,457	7,780	18,020	13,882	11,115	14,435
January	8,089	8,102	10,232	8,682	9,657	8,887	7,457	5,822	4,182	8,732	....	7,984
February	4,577	7,522	8,347	8,754	6,852	11,685	6,007	3,506	5,715	7,061	....	7,003
March	6,305	6,894	10,014	8,684	4,333	12,428	10,449	3,252	8,405	7,684	....	7,845
April	4,680	3,995	6,397	5,623	3,513	7,624	9,300	3,938	5,535	5,690	....	5,630
May	4,995	3,686	5,070	3,539	5,883	7,539	7,490	5,074	5,004	5,848	....	5,413
June	5,179	3,372	6,038	3,228	5,598	8,206	4,962	5,280	3,932	6,454	....	5,22[illegible]
Crop year total	90,774	96,889	126,161	103,679	112,716	163,202	119,701	82,229	117,787	119,419	....	113,252

[1] Compiled from Minneapolis Chamber of Commerce Reports and Daily Market Record.

TABLE 133.—*Wheat: Visible supply at Minneapolis, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	5,125	8,179	6,959	14,844	8,291	2,755	8,368	2,312	95	1,620	3,150	5,657
August	2,838	5,317	2,371	10,628	3,694	1,273	7,344	382	41	746	1,599	3,340
September	3,106	3,517	651	7,015	869	187	6,625	55	120	1,371	769	2,118
October	7,253	4,783	3,794	10,834	8,002	726	6,059	218	8,019	4,842	1,716	4,899
November	10,915	10,849	7,694	14,457	14,655	1,482	8,185	641	21,164	6,433	4,905	9,047
December	11,808	14,297	11,818	16,152	16,779	4,825	10,656	590	22,181	7,851	7,856	11,301
January	14,285	18,244	19,340	19,050	18,309	11,846	12,791	500	22,688	8,520	....	14,557
February	15,366	18,196	20,157	19,987	17,132	13,781	12,386	642	23,632	8,691	....	15,017
March	14,781	18,662	20,820	19,178	13,784	12,868	11,582	774	23,889	8,874	....	14,521
April	14,009	17,720	21,726	19,837	9,397	12,372	10,166	469	20,478	8,278	....	13,253
May	11,104	13,756	20,060	17,694	6,263	10,096	7,534	78	10,968	7,094	....	10,465
June	9,330	10,579	16,588	13,081	4,023	9,134	4,720	59	4,125	5,534	....	7,706

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 134.—*Wheat: Monthly and yearly receipts at Kansas City, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	7,570	6,604	7,590	9,253	11,258	3,665	8,610	3,848	14,535	13,842	6,770	8,598
August	8,729	3,833	10,438	7,045	13,080	5,785	13,543	4,772	16,188	18,916	8,532	10,213
September	6,235	3,197	7,933	2,311	13,280	7,274	8,798	2,349	6,897	10,180	7,598	6,982
October	5,335	2,714	5,699	2,128	8,408	6,699	8,485	3,194	4,297	6,056	6,668	5,435
November	2,598	1,216	4,250	1,975	10,777	10,981	6,890	3,360	2,492	8,714	7,509	5,816
December	2,753	820	2,567	1,260	5,775	9,125	4,547	1,586	2,921	7,653	6,668	4,292
January	2,022	1,069	2,653	1,777	3,092	6,637	4,685	975	1,692	6,584	....	3,119
February	1,170	1,661	1,950	1,848	1,986	5,688	3,044	622	1,292	4,213	....	2,347
March	964	358	892	1,553	1,283	3,173	2,876	648	995	5,219	....	1,796
April	697	836	1,268	1,004	2,399	3,696	2,792	410	1,199	2,249	....	1,655
May	1,274	882	1,586	872	3,371	4,969	3,132	292	969	4,158	....	2,150
June	1,190	437	1,548	1,126	3,036	275	1,318	170	629	4,431	....	1,664
Crop year total	40,537	23,627	48,374	32,152	77,745	70,442	68,720	22,226	54,106	92,215	....	53,014

[1] Compiled from Kansas City Board of Trade Reports and Kansas City Daily Price Current.

TABLE 135.—*Wheat: Visible supply at Kansas City, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	710	738	298	618	57	104	5,903	265	41	270	3,161	1,146
August	1,491	4,785	1,761	4,504	2,807	86	6,520	554	2,709	4,332	1,992	3,005
September	4,120	5,342	4,557	8,881	4,884	274	10,896	555	8,159	12,023	1,752	6,732
October	4,351	5,515	5,618	8,517	7,385	633	11,701	570	13,603	15,416	1,307	7,047
November	4,545	5,673	5,660	8,273	8,791	881	12,064	520	14,930	14,484	1,848	7,309
December	4,122	5,221	5,408	8,274	9,594	4,946	11,617	1,274	15,244	14,349	2,864	7,879
January	4,688	4,936	4,942	7,736	9,719	7,752	10,759	1,328	13,677	13,532	....	7,909
February	4,669	4,145	4,720	7,247	6,829	8,957	8,392	1,130	13,477	12,051	....	7,162
March	4,230	3,947	4,520	6,960	3,682	7,997	7,156	962	9,627	1,592	....	5,967
April	3,476	2,853	3,188	5,966	1,786	6,322	4,921	284	4,961	9,603	....	4,336
May	2,292	1,598	2,222	3,886	917	5,423	2,077	50	1,735	9,148	....	2,935
June	872	921	1,495	699	484	6,228	635	55	447	6,521	....	1,836

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 136.—*Wheat: Monthly and yearly exports from United States, 1910–11 to 1920–21.*

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	862	3,260	545	9,404	26,357	7,956	6,355	5,059	225	5,834	23,838	8,883
August	2,131	6,253	5,800	24,346	24,341	16,838	11,060	5,170	15,120	12,941	27,694	14,956
September	2,226	5,088	13,153	11,971	25,867	21,526	13,108	2,613	26,848	17,090	30,771	16,804
October	3,261	3,350	15,255	7,434	19,578	18,040	11,985	5,415	21,319	13,687	35,803	15,187
November	2,505	2,299	10,584	3,851	19,182	13,500	14,279	4,878	16,087	15,116	26,035	12,581
December	3,409	3,084	9,490	5,727	28,876	12,624	14,473	4,491	25,084	9,520	25,896	13,927
January	2,802	2,043	8,441	4,985	24,088	13,461	18,906	1,914	9,943	8,480	....	9,506
February	1,349	1,244	4,357	3,947	24,432	15,054	10,384	1,048	5,992	4,938	....	7,274
March	1,883	1,352	4,569	3,457	20,541	17,294	7,885	1,688	10,208	6,939	....	7,582
April	1,315	1,386	6,590	3,066	22,758	16,506	14,233	1,024	17,338	4,176	....	8,839
May	1,371	603	7,159	6,810	14,227	14,571	11,359	353	14,028	10,864	....	8,135
June	617	199	5,661	7,395	9,396	5,905	15,804	467	16,390	12,846	....	7,468
Crop year total	23,731	30,161	91,604	92,393	259,643	173,275	149,831	34,120	178,582	122,431	....	115,577

TABLE 137.—*Wheat: Monthly and yearly exports of wheat flour from United States, 1910–11 to 1920–21.*

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	504	670	547	792	848	800	940	747	2,429	1,731	2,404	1,191
August	626	872	691	889	728	1,061	858	1,015	972	1,638	1,107	983
September	880	1,247	852	1,231	1,237	823	1,123	1,015	333	1,764	939	1,056
October	931	1,216	1,220	1,262	1,352	1,273	921	1,357	714	1,620	1,607	1,254
November	944	950	1,238	1,281	1,492	1,281	1,050	1,275	1,312	1,840	1,101	1,282
December	1,030	1,088	1,111	1,088	1,833	1,732	937	2,402	1,879	1,313	952	1,434
January	933	838	1,112	1,049	1,764	1,652	1,133	2,341	2,702	843	....	1,437
February	840	842	1,075	802	1,555	1,336	706	2,099	2,189	1,254	....	1,270
March	830	1,000	940	777	1,690	1,506	1,012	2,338	2,246	2,209	....	1,455
April	873	786	940	883	1,437	1,315	949	2,520	3,065	2,121	....	1,489
May	996	841	893	912	1,347	1,338	1,080	2,347	2,728	3,339	....	1,582
June	743	655	775	856	900	1,404	1,234	2,424	3,614	1,979	....	1,458
Crop year total	10,130	11,005	11,394	11,822	16,183	15,521	11,943	21,880	24,183	21,651	....	15,571

TABLE 138.—*Wheat: Monthly and yearly exports, including flour, from United States, 1910–11 to 1920–21.*

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	3,100	6,300	3,000	13,000	30,200	11,600	10,600	8,400	11,200	13,600	34,900	14,280
August	4,900	10,200	8,900	28,300	27,600	20,400	14,900	9,700	19,500	20,300	32,600	19,240
September	6,200	10,700	17,000	17,500	31,400	26,300	18,700	7,200	28,300	24,800	52,100	23,400
October	7,500	8,800	20,600	13,100	25,700	23,800	16,100	11,400	24,500	21,000	43,000	20,800
November	6,800	6,600	16,100	9,600	25,900	19,300	19,000	10,600	22,000	23,400	31,000	18,350
December	8,000	8,000	14,500	10,600	37,100	20,400	18,200	15,300	33,500	15,400	30,200	20,320
January	7,000	5,800	13,400	9,700	32,000	20,900	24,900	12,500	22,100	12,309	....	15,970
February	5,100	5,000	9,200	7,600	31,400	20,100	13,600	10,500	15,800	10,600	....	12,890
March	5,600	5,900	8,800	7.000	28,100	24,100	12,400	12,200	20,300	16,900	....	14,130
April	5,200	4,900	10,500	7,000	29,200	22,400	18,500	12,400	31,100	13,700	....	15,490
May	5,900	4,400	11,200	10,900	20,300	20,600	16,200	10,900	26,300	25,900	....	15,260
June	4,000	3,100	9,100	11,200	13,400	12,200	21,400	11,400	32,700	21,800	....	14,030
Crop year total	69,300	79,700	142,300	145,500	332,300	242,100	203,600	132,500	287,300	219,700	....	185,430

TABLE 139.—*Wheat: Monthly and yearly exports, including flour, from Canada, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	1,663	6,358	6,602	8,412	5,486	3,150	23,128	18,698	3,790	9,562	6,066	9,125
September	3,127	4,288	4,018	6,788	5,072	7,629	12,803	6,154	3,541	4,247	5,321	5,986
October	8,722	6,814	7,762	25,235	12,268	35,144	16,618	17,174	8,325	6,454	19,117	15,491
November	11,119	16,224	18,199	24,580	13,782	47,045	18,263	29,191	7,023	12,138	....	19,756
December	7,952	13,230	16,737	24,533	8,675	42,524	22,384	33,756	13,426	13,205	....	19,642
January	3,302	3,656	4,410	5,747	4,945	8,246	10,001	8,492	10,164	12,299	....	7,126
February	2,641	4,954	5,177	3,570	4,974	8,310	4,231	9,574	4,149	7,615	....	5,530
March	4,150	6,361	14,381	4,848	7,122	10,073	8,594	13,500	7,239	5,915	....	8,218
April	2,560	4,392	9,640	4,801	4,809	16,217	4,545	11,074	6,613	2,493	....	6,714
May	8,170	15,372	10,619	9,569	7,131	34,101	23,648	7,767	14,577	2,755	....	13,371
June	5,627	8,425	10,423	6,724	8,428	28,049	19,946	8,614	11,612	7,940	....	11,579
July	3,365	7,842	7,778	10,782	4,048	28,670	10,404	5,247	13,626	9,828	....	10,159
Crop year total	62,398	97,916	115,746	135,589	86,740	269,158	174,565	169,241	104,085	104,013	....	132,045

[1] From International Institute of Agriculture.

TABLE 140.—*Wheat: Yearly exports from United States, by countries of destination, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Belgium	5,976	2,471	4,054	10,601	12,873	5,321	2,683	2,698	12,628	24,477	17,343
Denmark	840	198	483	416	870	2,755	1,655	1,157	....	....	....
France	856	3,649	36	4,932	5,537	49,879	21,803	16,253	6,386	27,591	26,445
Germany	5,367	721	1,589	12,112	10,983	2,652	....	....	....	....	8,246
Greece	12	(2)	....	299	....	8,768	11,687	4,811	....	96	1,415
Italy	1,960	286	533	7,217	1,840	47,123	31,442	13,747	16,337	38,265	32,110
Netherlands	2,695	890	3,386	14,832	19,950	31,352	21,070	19,128	2,236	1,962	11,906
Norway	147	....	....	....	72	2,504	1,838	3,156	383	1	798
Portugal	8	100	185	710	1,754	859	1,863	601	460	988	1,287
Spain	....	....	....	....	128	7,156	7,042	852	111	138	7,099
Sweden	....	....	....	....	272	4,093	4,786	5,385	....	....	1,013
Switzerland	....	....	....	....	....	521	183	6,046	1,500	6,134	367
United Kingdom	22,393	11,298	15,766	31,549	28,025	65,911	53,550	67,976	43,147	44,819	77,369
All other Europe	39	(2)	755	515	248	2,766	1,278	2,671	1,475	2,029	7,755
Total Europe	40,293	19,613	26,787	83,183	82,552	231,860	160,880	144,481	84,663	146,500	193,153
Canada	2,112	1,257	537	851	4,125	19,665	6,245	4,715	26,493	1,422	14,812
Mexico	3,179	273	1,491	645	306	296	18	55	2	134	299
Cuba	10	12	23	46	52	54	250	50	1	23	29
All other in North America	7	36	59	133	226	406	714	99	1	1	976
Total North America	5,308	1,578	2,110	1,675	4,709	20,421	7,227	4,919	26,497	1,580	16,116
South America	450	323	517	580	254	3,078	3,243	411	17	7	3,442
Asia	127	2,104	741	4,179	4,628	759	15	14	....	(2)	209
Oceania	1	1	1	1	1	1,089	1,509	1	(2)	(2)	....
Africa	501	110	4	1,985	250	2,436	400	5	(2)	(2)	5,356
Total	46,680	23,729	30,160	91,603	92,394	259,643	173,274	149,831	111,177	148,087	218,276

[1] Compiled from Monthly Summary of Foreign Commerce.
[2] Less than 500 bushels.

TABLE 141.—*Wheat: Summary of carloads graded by licensed inspectors, for half-yearly periods, all inspection points, July, 1917, to December, 1920.*

[Totals of all classes and subclasses under each grade.]

Period.	Inspected receipts, by grade.						
	No. 1	No. 2	No. 3	No. 4	No. 5	Sample	Total.
July-December, 1917	45,942	66,443	42,607	16,198	11,574	10,822	193,586
January-June, 1918	14,841	24,163	16,110	7,114	3,979	4,349	70,556
Total, crop year, 1917-18	60,783	90,606	58,717	23,312	15,553	15,171	264,142
July-December, 1918	241,153	161,136	47,630	19,328	7,431	10,960	487,638
January-June, 1919	59,111	42,829	16,197	7,332	2,586	7,287	135,342
Total, crop year, 1918-19	300,264	203,965	63,827	26,660	10,017	18,247	622,980
July-December, 1919	34,884	141,736	135,801	71,367	32,541	18,840	435,169
January-June, 1920	10,741	50,360	51,732	29,906	16,884	9,961	169,584
Total, crop year, 1919-20	45,625	192,096	187,533	101,273	49,425	28,801	604,753
July-December, 1920	102,374	138,445	71,211	29,614	20,077	25,832	387,553

	Inspected shipments, by grade.						
	No. 1	No. 2.	No. 3	No. 4	No. 5	Sample.	Total.
July-December, 1917	13,155	19,072	12,350	4,869	3,222	2,562	55,230
January-June, 1918	4,741	6,899	5,340	1,614	1,046	1,039	20,679
Total, crop year, 1917-18	17,896	25,971	17,690	6,483	4,268	3,601	75,909
July-December, 1918	147,458	42,825	5,602	1,953	601	845	199,284
January-June, 1919	99,111	44,338	8,494	2,534	917	2,322	157,716
Total, crop year, 1918-19	246,569	87,163	14,096	4,487	1,518	3,167	357,000
July-December, 1919	10,036	87,979	53,561	9,709	3,498	2,871	167,654
January-June, 1920	6,266	56,889	35,237	9,395	2,899	1,776	112,462
Total, crop year, 1919-20	16,302	144,868	88,798	19,104	6,397	4,647	280,116
July-December, 1920	31,784	161,483	28,278	5,111	3,912	3,711	234,279

TABLE 142.—*Wheat: Graded by licensed inspectors, for yearly periods, July, 1917–June, 1920.*

JULY, 1917–June, 1918.

[All inspection points; in carloads.]

Classes and subclasses	Inspected receipts, by grade.						
	No. 1	No. 2.	No. 3	No. 4	No. 5	Sample.	Total.
Hard red spring:							
Dark northern spring	18,855	9,180	2,844	1,312	244	768	33,213
Northern spring	20,366	16,434	6,505	4,919	2,046	3,339	53,609
Red spring	898	925	577	429	155	341	3,325
Red spring humpback	68	203	138	131	45	50	635
Total	40,187	26,742	10,064	6,791	2,490	4,508	90,782
Common and red durum:							
Amber durum	429	4,186	2,560	1,288	317	304	9,084
Durum	316	1,878	1,428	973	259	602	5,456
Red durum	102	318	265	231	28	54	998
Total	847	6,382	4,253	2,492	604	960	15,538

TABLE 142—*Wheat: Graded by licensed inspectors, for yearly periods, July, 1917–June, 1920*—Continued.

JULY, 1917-JUNE, 1918—Continued.

Classes and subclasses.	Inspected receipts, by grade.						
	No. 1	No. 2	No. 3	No. 4	No. 5	Sample.	Total.
Hard red winter:							
Dark hard winter	1,171	6,182	4,113	1,627	534	341	13,968
Hard winter	5,292	11,987	7,281	2,296	1,522	1,928	30,306
Yellow hard winter	221	485	543	204	207	255	1,915
Total	6,684	18,654	11,937	4,127	2,263	2,524	46,289
Soft red winter:							
Red winter	4,462	19,640	17,387	3,461	4,485	2,654	52,089
Red walla	147	472	459	96	19	20	1,213
Soft red	153	1,995	2,970	896	2,876	1,803	10,693
Total	4,762	22,107	20,816	4,453	7,380	4,477	63,995
Common white:							
Hard white	1,485	1,890	2,214	1,641	990	568	8,788
Soft white	1,311	2,714	1,721	511	235	687	7,179
Total	2,796	4,604	3,935	2,152	1,225	1,225	15,967
White club	1,880	2,303	1,345	573	146	79	6,326
Mixed wheat	3,627	9,814	6,367	2,724	1,445	1,368	25,345
Total, all classes	60,783	90,606	58,717	23,312	15,553	15,171	264,142

Classes and subclasses.	Inspected shipments, by grade.						
	No. 1	No. 2	No. 3	No. 4	No. 5	Sample.	Total.
Hard red spring:							
Dark northern spring	10,680	1,771	433	252	78	91	13,205
Northern spring	4,541	3,524	1,517	1,165	497	1,313	12,557
Red spring	64	119	105	41	14	59	402
Red spring humpback	3	9	4	4	1	5	26
Total	15,288	5,423	2,059	1,462	590	1,468	26,190
Common and red durum:							
Amber durum	149	2,666	1,369	476	100	64	4,824
Durum	241	1,526	1,407	217	127	243	3,761
Red durum	23	130	70	20	8	3	254
Total	413	4,332	2,846	713	235	310	8,839
Hard red winter:							
Dark hard winter	193	1,375	396	142	18	23	2,147
Hard winter	712	3,877	2,437	453	149	447	8,075
Yellow hard winter	11	70	108	27	23	61	300
Total	916	5,322	2,941	622	190	531	10,522
Soft red winter:							
Red winter	671	8,030	5,846	849	849	417	16,662
Red walla	12	27	49	14	4	1	107
Soft red	27	676	2,238	642	1,558	190	5,331
Total	710	8,733	8,133	1,505	2,411	608	22,100
Common white:							
Hard white	123	355	414	285	96	65	1,318
Soft white	52	193	215	61	6	16	543
Total	175	528	629	346	102	81	1,861
White club	20	59	50	17	8	19	173
Mixed wheat	474	1,584	1,032	1,818	732	584	6,224
Total, all classes	17,896	25,971	17,690	6,483	4,268	3,601	75,909

TABLE 142.—*Wheat: Graded by licensed inspectors, for yearly periods, July, 1917–June, 1920*—Continued.

JULY, 1918–JUNE, 1919

Classes and subclasses.	Inspected receipts, by grade.						
	No. 1	No. 2.	No. 3	No. 4	No. 5	Sample.	Total.
Hard red spring:							
Dark northern spring	38,438	5,451	2,198	1,238	265	854	48,544
Northern spring	93,382	24,737	12,738	4,689	1,477	3,944	140,967
Red spring	3,355	1,424	1,177	574	207	301	7,038
Red spring humpback	....	1	....	....	....	....	1
Total	135,175	31,613	16,113	6,601	1,949	5,099	196,550
Common and red durum:							
Amber durum	5,997	14,842	963	328	134	137	22,401
Durum	1,640	5,350	707	264	100	192	8,253
Red durum	527	348	52	32	8	10	977
Total	8,164	20,540	1,722	624	242	339	31,631
Hard red winter:							
Dark hard winter	11,033	9,185	5,610	4,992	2,225	262	33,307
Hard winter	38,752	36,190	14,282	6,847	2,467	2,466	101,004
Yellow hard winter	765	963	488	164	57	93	2,530
Total	50,550	46,338	20,380	12,003	4,749	2,821	136,841
Soft red winter:							
Red winter	69,970	69,950	12,669	2,473	1,558	3,024	159,644
Red walla	439	652	209	29	10	10	1,349
Soft red	14	89	112	28	21	16	280
Total	70,423	70,691	12,990	2,530	1,589	3,050	161,273
Common white:							
Hard white	19,03	3,204	2,687	1,571	364	898	10,627
Soft white	4,525	6,859	1,502	523	121	4,038	17,568
Total	6,428	10,063	4,189	2,094	485	4,936	28,195
White club	2,574	2,604	1,463	352	56	166	7,215
Mixed wheat	26,950	22,116	6,970	2,456	947	1,836	61,275
Total, all classes	300,264	203,965	63,827	26,660	10,017	18,247	622,980

Classes and subclasses.	Inspected shipments, by grade.						
	No. 1	No. 2	No. 3	No. 4	No. 5	Sample.	Total.
Hard red spring:							
Dark northern spring	22,888	582	147	129	347	289	24,382
Northern spring	68,922	11,287	2,786	1,618	384	1,432	86,429
Red spring	150	100	107	77	50	97	581
Red spring humpback	....	....	....	....	....	....	....
Total	91,960	11,969	3,040	1,824	781	1,818	111,392
Common and red durum:							
Amber durum	6,458	10,863	66	37	10	10	17,444
Durum	1,174	3,080	276	29	14	13	4,586
Red durum	112	60	11	9	0	0	192
Total	7,744	14,003	3,553	75	24	23	22,222
Hard red winter:							
Dark hard winter	4,020	3,529	1,719	647	113	17	10,045
Hard winter	28,118	18,766	4,469	1,028	225	279	52,885
Yellow hard winter	46	47	49	19	6	5	172
Total	32,184	22,342	6,237	1,694	344	301	63,102
Soft red winter:							
Red winter	84,735	22,104	1,436	243	81	261	108,860
Red walla	249	162	4	1	....	....	416
Soft red	10	14	7	14	....	3	48
Total	84,994	22,280	1,447	258	81	264	109,324

TABLE 142.—*Wheat: Graded by licensed inspectors, for yearly periods, July, 1917–June, 1920*—Continued.

JULY, 1918–JUNE, 1919—Continued.

Classes and subclasses.	Inspected shipments, by grade.						
	No. 1	No. 2	No. 3	No. 4	No. 5	Sample.	Total.
Common white:							
Hard white	1,070	1,420	509	62	1	12	3,074
Soft white	3,922	4,061	375	137	83	71	8,649
Total	4,992	5,481	884	199	84	83	11,723
White club	412	946	70	8	2	7	1,445
Mixed wheat	24,283	10,142	2,065	429	202	671	37,792
Total, all classes	246,569	87,163	14,096	4,487	1,518	3,167	357,000

JULY, 1919–JUNE, 1920.

Classes and subclasses.	Inspected receipts, by grade.						
	No. 1	No. 2	No. 3	No. 4	No. 5	Sample.	Total.
Hard red spring:							
Dark northern spring	4,993	3,856	10,669	13,092	10,380	2,546	45,536
Northern spring	4,331	3,226	7,405	6,847	5,371	2,541	29,721
Red spring	137	100	118	77	43	42	517
Total	9,461	7,182	18,192	20,016	15,794	5,129	75,774
Common and red durum:							
Amber durum	740	5,865	3,070	1,375	466	83	11,599
Durum	153	1,356	609	348	199	98	2,763
Red durum	492	421	131	82	31	24	1,181
Total	1,385	7,642	3,810	1,805	696	205	15,543
Hard red winter:							
Dark hard winter	2,136	4,719	4,656	2,045	555	137	14,248
Hard winter	9,966	57,494	69,653	41,864	19,109	7,538	205,624
Yellow hard winter	651	3,441	4,364	2,615	1,079	469	12,619
Total	12,753	65,654	78,673	46,524	20,743	8,144	232,491
Soft red winter:							
Red winter	8,107	76,744	61,583	22,677	8,476	11,987	189,574
Red walla	1,264	973	132	33	10	37	2,449
Total	9,371	77,717	61,715	22,710	8,486	12,024	192,023
Common white:							
Hard white	1,946	2,388	1,488	942	327	212	7,303
Soft white	1,235	5,771	1,896	193	31	418	9,544
Total	3,181	8,159	3,384	1,135	358	630	16,847
White club	4,152	5,210	2,720	206	33	171	12,492
Mixed wheat	5,322	20,532	19,039	8,877	3,315	2,498	59,583
Total, all classes	45,625	192,096	187,533	101,273	49,425	28,801	604,753

Classes and subclasses.	Inspected shipments, by grade.						
	No. 1	No. 2	No. 3	No. 4	No. 5	Sample.	Total.
Hard red spring:							
Dark northern spring	1,544	1,663	4,840	2,277	1,633	333	12,290
Northern spring	1,702	1,961	4,300	2,228	1,272	656	22,119
Red spring	5	7	22	9	11	26	80
Total	3,251	3,631	9,162	4,514	2,916	1,015	24,489

TABLE 142.—*Wheat: Graded by licensed inspectors, for yearly periods, July, 1917-June, 1920*—Continued.

JULY, 1919-JUNE, 1920.—Continued.

Classes and subclasses.	Inspected shipments, by grade.						
	No. 1	No. 2	No. 3	No. 4	No. 5	Sample.	Total.
Common and red durum:							
Amber durum	440	6,213	1,482	172	31	16	8,354
Durum	25	1,021	170	58	27	18	1,319
Red durum	154	154	70	28	5	9	420
Total	619	7,388	1,722	258	63	43	10,093
Hard red winter:							
Dark hard winter	301	1,477	1,097	230	36	11	3,152
Hard winter	4,439	41,578	33,169	8,050	1,647	796	89,679
Yellow hard winter	25	272	470	196	74	30	1,067
Total	4,765	43,327	34,736	8,476	1,757	837	93,898
Soft red winter:							
Red winter	5,185	75,189	34,033	2,830	893	1,735	119,865
Red walla	366	148	6	1	....	20	541
Total	5,551	75,337	34,039	2,831	893	1,755	120,406
Common white:							
Hard white	51	300	128	37	3	1	520
Soft white	81	852	122	8	....	10	1,073
Total	132	1,152	250	45	3	11	1,593
White club	285	927	47	4	....	2	1,265
Mixed wheat	1,699	13,106	8,842	2,976	765	984	28,372
Total, all classes	16,302	144,868	88,798	19,104	6,397	4,647	280,116

TABLE 143.—*Wheat: Yearly production in United States and in principal producing States, 1901 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

State.	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
United States	789,538	724,528	664,543	596,375	726,384	757,195	637,981	644,656	700,434	635,121
California	34,743	22,374	20,926	17,475	17,542	26,884	20,520	11,680	6,203	9,900
Illinois	30,052	32,602	16,572	21,542	29,952	38,536	40,104	30,212	37,831	36,660
Indiana	31,933	35,484	23,994	12,526	35,351	48,081	34,013	45,169	33,936	35,194
Kansas	99,079	45,827	87,250	65,019	77,001	81,831	65,609	79,282	77,566	63,236
Minnesota	80,103	79,752	70,653	68,344	72,434	55,802	67,600	68,557	57,094	64,000
Missouri	31,137	56,266	22,195	27,163	28,022	31,735	29,212	22,260	29,837	25,958
Nebraska	42,007	52,726	42,158	31,454	48,003	52,289	45,911	44,295	47,686	38,760
North Dakota	59,311	62,872	55,241	53,892	75,623	77,896	55,130	68,428	116,782	38,500
Ohio	33,533	36,333	28,304	17,563	32,198	43,202	30,677	33,328	30,664	34,425
Oklahoma	20,559	12,074	24,483	15,041	11,764	18,664	8,631	15,625	14,008	25,542
South Dakota	51,662	43,973	47,253	31,557	44,133	41,955	32,480	37,862	47,060	46,720
Texas	6,062	8,633	19,880	12,484	11,118	14,126	2,812	10,164	2,561	10,500
Washington	34,519	23,672	19,986	32,141	32,517	25,075	35,045	27,162	40,920	35,571

State.	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
United States	621,338	730,267	763,380	891,017	1,025,801	636,318	636,655	921,438	934,265	787,128
California	8,640	6,290	4,200	6,800	7,040	5,600	7,425	7,590	16,335	9,100
Illinois	42,000	9,819	41,888	46,250	53,200	16,775	30,850	63,970	64,562	40,670
Indiana	34,354	10,080	39,775	43,239	45,580	19,440	33,432	49,427	42,332	23,540
Kansas	51,387	92,290	86,983	177,200	106,538	97,980	45,443	102,008	152,079	137,056
Minnesota	43,935	67,038	68,040	42,975	70,870	26,410	51,611	75,792	36,315	29,116
Missouri	36,110	23,750	39,586	43,333	34,108	16,575	28,971	53,154	59,833	32,721
Nebraska	41,574	55,052	62,325	68,116	71,018	68,550	13,764	41,213	60,675	60,480
North Dakota	73,200	143,820	78,855	81,592	151,970	39,325	56,000	105,672	55,200	68,400
Ohio	36,240	9,760	35,100	36,538	40,194	21,600	41,140	43,547	53,932	28,698
Oklahoma	8,976	20,096	17,500	47,975	38,860	29,585	35,650	32,899	54,040	46,240
South Dakota	14,800	52,185	33,975	31,566	63,762	24,825	44,800	62,160	30,175	26,282
Texas	6,580	11,025	13,650	14,066	25,575	13,200	16,200	9,000	33,742	15,925
Washington	50,661	53,728	53,300	41,840	51,420	37,635	29,218	29,187	39,305	37,982

TABLE 144.—*Wheat: Production and disposition of crop, United States, 1910 to 1920.*

In millions of bushels; i. e., 000,000 omitted.]

Year.	Production.			Quality.	On hand July 1.	Total supply.	Seeding.	Carryover.	Exports.	Remaining for consumption.	Canadian.	
	Winter wheat.	Spring wheat.	Total.								Crop.	Export.
				Per ct.								
1910	434	201	635	0.93	88	723	77	92	69	482	132	61
1911	430	191	621	.88	92	713	72	78	80	483	231	77
1912	400	330	730	.90	78	808	71	90	143	504	224	104
1913	523	240	763	.93	90	853	82	76	146	549	232	152
1914	685	206	891	.90	76	967	86	55	332	494	161	91
1915	674	352	1,026	.88	55	1,081	84	163	243	591	394	177
1916	480	156	636	.87	163	[1] 824	80	48	204	492	263	227
1917	413	224	637	.92	48	[1] 708	95	17	133	463	234	186
1918	565	356	921	.93	17	938	100	54	287	497	189	100
1919	732	209	941	.82	54	995	100	108	220	567	193	114
1920	578	209	787	.86	151	938	......	......	......	......	270	......
10-year average	859	247	795	......	82	883	86	80	186	513	239	129

[1] Includes imports.

TABLE 145.—*Wheat: Yearly farm movement and supplies in the United States, 1910 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

Year.	Production.	Supplies Mar. 1 following.			Supplies July 1 following.	
		On farms.	In country mills and elevators.	[1] At points of large accumulations.	On farms.	[1] At points of large accumulations.
1910	635,121	162,705	98,597	39,868	34,071	23,863
1911	621,338	122,041	95,710	57,080	23,876	23,350
1912	730,267	156,471	118,400	63,786	35,515	30,163
1913	763,380	151,795	98,505	57,021	32,236	14,999
1914	891,017	152,903	85,955	49,688	28,972	7,948
1915	1,025,801	244,448	155,027	63,553	74,731	42,628
1916	636,318	100,650	89,173	44,916	15,611	14,209
1917	636,655	107,745	66,138	9,739	8,063	785
1918	921,438	128,703	107,037	118,219	19,261	8,681
1919	940,987	165,539	118,626	50,875	47,756	19,799
1920	787,128	207,591	81,946	28,159	....	....

[1] From Chicago Daily Trade Bulletin.

TABLE 146.—*Wheat: Monthly and yearly sales by farmers, United States, 1910–11 to 1920–21.*

[Estimated by per cent.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20
July	11.8	15.8	8.4	16.3	17.5	7.1	13.3	7.4	17.6	17.1
August	16.5	14.8	13.9	13.4	13.2	11.0	17.9	12.4	19.9	23.2
September	14.1	16.4	16.4	14.3	15.5	14.4	16.8	19.3	18.0	15.6
October	11.4	12.9	16.2	12.8	12.5	14.5	14.1	18.0	13.8	11.1
November	8.4	8.4	10.9	9.7	10.3	12.4	9.7	13.7	8.7	7.5
December	8.0	6.4	8.7	7.6	7.5	11.0	5.6	7.6	7.3	5.7
January	6.1	5.7	6.0	6.7	5.1	6.8	7.2	4.7	4.6	4.2
February	4.5	5.4	4.9	4.8	5.7	6.8	3.3	3.9	3.1	3.0
March	4.8	3.7	3.4	4.2	3.3	3.8	3.9	3.7	2.0	2.9
April	3.7	3.4	3.4	2.9	4.6	3.9	3.1	4.1	1.6	3.1
May	5.1	3.8	3.9	3.5	2.7	4.7	3.0	3.1	1.9	3.4
June	5.6	3.3	3.9	3.8	2.1	3.6	2.1	2.1	1.5	3.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 147.—*Wheat: Production in foreign countries, 1901 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

Country.	1901	1902	1903	1904	1905
Canada	91,424	100,051	85,271	75,213	109,097
Mexico	12,021	8,477	10,493	9,393	9,710
Argentina	74,753	56,380	103,759	129,672	150,745
Chile	9,000	10,641	10,114	17,948	12,089
Uruguay	3,664	7,604	5,240	7,565	7,565
Austria	180,900	235,022	226,721	204,406	228,138
Hungary proper					
Belgium	14,143	14,521	12,350	13,817	12,401
Bulgaria	24,000	35,000	33,551	42,242	34,949
Czechoslovakia					
Denmark	942	4,528	4,461	4,302	4,067
Finland	140	79	130	133	129
France	310,938	327,841	364,320	298,826	335,453
Alsace-Lorraine					
Germany	91,817	143,315	130,626	139,803	135,947
Greece	6,400	7,000	8,000	8,000	8,000
Italy	164,587	136,210	184,451	167,635	160,504
Jugo-Slavia					
Luxemburg					
Netherlands	4,231	5,105	4,258	4,423	5,078
Norway	300	265	307	212	329
Portugal	10,000	10,400	8,000	9,000	5,000
Roumania	72,383	76,220	73,700	53,738	103,328
Russia proper	401,632	560,676	551,728	622,255	568,274
Poland					
Serbia	8,102	11,409	10,885	11,676	11,262
Spain	136,905	133,523	128,979	95,377	92,504
Sweden	4,193	4,757	5,538	5,135	5,529
Switzerland	4,400	4,200	4,000	4,000	4,000
United Kingdom	55,581	60,065	50,321	39,082	62,234
Montenegro	200	200	200	200	200
Turkey in Europe	22,000	25,000	26,000	23,000	20,000
British India	264,825	227,380	297,601	359,936	283,063
Cyprus	1,943	1,181	2,477	2,176	2,441
Japanese Empire	22,457	20,243	9,779	19,944	18,637
Persia	15,200	13,600	16,000	16,000	16,000
Russia in Asia	61,149	84,718	69,659	44,494	68,011
Turkey in Asia	30,000	35,000	35,000	35,000	35,000
Africa	50,672	52,023	55,611	50,496	58,795
Australasia	56,610	43,927	20,461	84,628	65,626

Country.	1906	1907	1908	1909	1910
Canada	127,772	92,691	112,434	166,744	149,900
Mexico	8,000	10,000	10,000	10,000	11,976
Argentina	134,931	155,991	192,487	156,162	131,010
Chile	12,157	15,776	18,967	17,743	19,682
Uruguay	4,606	6,867	7,430	8,595	7,750
Austria	268,708	185,217	230,577	186,076	242,018
Hungary proper					
Belgium	12,964	15,835	13,393	14,603	12,449
Bulgaria	39,109	23,545	36,496	32,071	42,247
Czechoslovakia					
Denmark	4,161	4,343	4,318	3,829	4,547
Finland	150	140	111	134	125
France	324,919	376,999	317,735	356,193	257,667
Alsace-Lorraine					
Germany	144,754	127,843	138,442	138,000	141,884
Greece	8,000	8,000	8,000	7,000	7,000
Italy	176,464	177,543	152,236	189,959	153,403
Jugo-Slavia					
Luxemburg					
Netherlands	4,942	5,325	5,121	4,158	4,441
Norway	303	290	333	313	294
Portugal	9,000	7,000	8,000	8,000	9,120
Roumania	113,867	42,257	54,813	56,751	110,761
Russia proper	450,963	437,773	489,162	711,478	699,413
Poland					
Serbia	13,211	8,375	11,495	13,962	15,561
Spain	140,656	100,331	119,970	144,105	137,448
Sweden	6,650	6,279	6,756	6,978	7,450
Switzerland	4,000	4,000	3,527	3,568	2,756
United Kingdom	62,529	58,313	55,629	65,188	58,322
Montenegro	200	200	200	200	200
Turkey in Europe	25,000	18,000	20,000	20,000	20,000
British India	319,952	317,023	227,983	284,361	359,654
Cyprus	2,410	2,636	2,556	1,912	2,169
Japanese Empire	20,460	22,995	22,787	23,166	24,687
Persia	16,000	16,000	16,000	16,000	16,000
Russia in Asia	57,427	72,919	77,237	71,792	76,282
Turkey in Asia	35,000	35,000	35,000	35,000	35,000
Africa	66,779	70,075	65,913	73,699	76,357
Australasia	77,693	74,297	51,806	73,612	102,271

Table 147.—*Wheat: Production in foreign countries, 1901 to 1920*—Continued.

Country.	1911	1912	1913	1914	1915
Canada	230,924	224,159	231,717	161,280	393,543
Mexico	12,000	12,000	4,000	4,389	4,000
Argentina	145,981	166,190	187,391	113,904	169,166
Chile	18,184	22,468	23,575	16,403	19,000
Uruguay	6,009	8,757	5,461	5,887	3,596
Austria	251,883	257,347	232,193	38,024	28,286
Hungary proper	...	...	...	105,237	152,934
Belgium	15,745	15,348	14,769	13,973	8,000
Bulgaria	48,295	44,756	51,256	23,200	36,940
Czechoslovakia	...	...	...	...	...
Denmark	4,466	5,045	6,692	5,785	7,978
Finland	125	130	130	196	260
France	315,126	336,284	321,000	282,689	222,776
Alsace-Lorraine	...	...	...	6,700	5,508
Germany	149,411	160,224	171,075	145,944	141,676
Greece	8,000	7,000	7,000	7,000	6,000
Italy	192,395	165,720	214,405	169,581	170,541
Jugoslavia	...	...	...	...	...
Luxemburg	...	...	...	530	387
Netherlands	5,511	5,604	5,164	5,779	7,090
Norway	271	332	325	269	285
Portugal	11,850	6,761	9,186	10,000	6,571
Roumania	93,724	88,924	83,236	49,270	89,241
Russia proper	447,038	623,762	837,977	833,629	826,784
Poland	...	...	...	...	...
Serbia	15,312	16,351	10,524	9,000	10,000
Spain	148,495	109,783	112,401	116,089	139,298
Sweden	7,945	7,832	9,330	8,472	9,170
Switzerland	3,524	3,178	3,546	3,277	3,957
United Kingdom	66,289	59,162	58,441	64,356	76,250
Montenegro	200	200	200	...	...
Turkey in Europe	20,000	18,000	18,000	...	...
British India	375,629	370,515	362,693	312,032	376,731
Cyprus	2,394	2,176	2,779	2,500	1,924
Japanese Empire	25,783	26,678	26,921	29,018	33,085
Persia	16,000	16,000	16,000	14,000	16,000
Russia in Asia	61,715	96,280	114,628	172,568	94,566
Turkey in Asia	35,000	35,000	35,000	35,000	35,000
Africa	88,589	68,334	86,819	71,070	91,897
Australasia	106,644	81,384	100,223	112,159	32,531
Country.	**1916**	**1917**	**1918**	**1919**	**1920**
Canada	262,781	233,743	189,075	193,260	263,189
Mexico	...	...	10,470	14,239	14,951
Argentina	172,620	80,115	184,000	171,591	214,140
Chile	20,184	22,498	23,120	21,591	21,845
Uruguay	9,867	5,390	13,060	6,890	5,416
Austria	27,811	5,993	5,159	5,114	...
Hungary proper	...	115,530	...	...	29,139
Belgium	...	8,252	6,189	9,895	7,948
Bulgaria	27,764	33,294	25,341	34,028	41,189
Czechoslovakia	...	...	...	14,942	24,453
Denmark	6,044	4,296	6,331	5,923	6,944
Finland	246	...	...	306	272
France	204,908	134,575	225,736	182,444	230,404
Alsace-Lorraine	...	...	2,952	4,589	...
Germany	110,207	81,791	85,865	79,701	78,924
Greece	8,106	11,505	...	9,693	13,287
Italy	176,530	139,999	183,294	169,769	141,337
Jugoslavia	...	...	...	50,956	64,712
Luxemburg	377	388	512	...	...
Netherlands	4,035	3,452	5,431	6,015	6,677
Norway	317	432	1,087	1,071	1,035
Portugal	7,343	5,560	8,252	...	...
Roumania	78,520	...	18,447	66,060	41,815
Russia proper	...	...	...	...	...
Poland	...	...	...	20,760	25,610
Serbia	...	...	4,126	...	...
Spain	152,329	142,674	135,709	129,250	138,606
Sweden	8,979	6,864	9,003	9,509	11,123
Switzerland	4,053	4,556	7,905	3,524	3,586
United Kingdom	61,659	66,350	96,079	69,324	56,898
British India	323,008	282,069	370,421	280,485	376,884
Cyprus	...	...	...	1,861	3,000
Japanese Empire	36,572	41,404	39,578	36,944	...
Persia	...	...	...	...	...
Russia in Asia	...	...	...	...	...
Turkey in Asia	145,519	...	...	...	...
Africa	77,716	64,738	99,613	72,028	52,544
Australasia	192,041	157,516	121,622	82,206	50,901

Note.—Old boundaries from 1901–1913.

TABLE 148.—*Wheat: Yearly exports, by principal exporting countries, 1901 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

Country.	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Argentina	33,227	23,696	61,778	84,684	105,391	82,599	98,502	133,610	92,378	69,209
Australia	20,260	9,283	1,210	34,114	25,425	30,262	28,784	15,027	31,549	47,762
Austria-Hungary	782	519	603	117	49	1,119	683	15	11	28
Belgium	13,168	12,467	11,751	14,804	14,639	16,052	17,852	24,178	22,845	22,898
British India	13,774	19,543	43,017	75,256	47,680	26,488	37,516	4,289	34,712	40,481
Bulgaria	4,902	8,625	12,235	19,241	16,543	9,857	8,845	7,818	5,913	8,688
Canada	26,118	34,025	28,031	16,618	28,670	38,135	37,503	52,503	49,428	46,426
Chile	57	919	1,979	2,718	295	8	1,298	4,947	4,015	2,247
Germany [1]	3,411	3,020	6,626	5,864	6,050	7,365	3,521	9,594	7,708	10,339
Netherlands	37,427	36,980	39,741	40,682	53,052	33,127	44,717	29,914	47,470	58,300
Roumania	20,890	33,751	30,612	26,107	63,066	63,485	42,307	26,247	31,515	67,659
Russia	83,409	111,977	153,449	169,058	176,853	132,411	85,271	54,050	189,272	225,458
Serbia	2,187	1,856	1,842	3,057	3,423	3,366	1,992	3,319	5,296	2,669
United States	154,856	114,181	73,373	13,015	20,739	62,851	91,384	92,780	48,490	24,257
Other countries	9,594	9,055	4,548	5,294	5,707	6,039	10,600	6,043	11,267	15,942
Total	424,060	419,896	470,794	510,630	567.582	513,164	510,775	464,335	581,869	642,363

Country.	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Argentina	83,993	96,600	103,328	36,028	92,281	84,321	34,385	110,098	126,543	183,717
Australia	55,148	32,604	42,923	52,878	5,617	55,279	22,982	66,760	....	62,949
Austria-Hungary	15	56	71	....	....	....	....	....	....	....
Belgium	22,723	16,576	12,991	....	....	....	....	....	847	331
British India	52,557	65,598	50,558	26,130	26,505	23,986	53,872	24,144	2,524	5,007
Bulgaria	11,122	9,238	[2] 9,238	....	....	....	....	....	....	....
Canada	60,474	84,958	129,950	70,302	151,900	191,218	146,874	55,054	115,586	104,034
Chile	509	2,411	1,922	149	12	....	529	....	....	....
Germany [1]	11,390	11,853	19,781	....	....	....	....	....	....	....
Netherlands	46,171	51,444	63,598	37,063	1,807	1	....	21	264	1,095
Roumania	53,586	50,406	42,362	19,744	....	....	....	....	....	....
Russia	144,779	96,915	122,336	88,609	7,018	8,656	....	....	....	....
Serbia	3,366	....	....	....	....	....	....	....	....	....
United States	32,669	61,655	99,509	173,862	205,830	154,050	106,196	111,177	148,087	218,276
Other countries	18,815	12,839	7,499	13,358	12,466	....	....	....	....	....
Total	597,317	593,153	706,066	518,123	503,436	....	....	....	....	....

[1] Not including free ports until Mar. 1, 1906.

[2] Data for previous year

TABLE 149.—*Wheat: Yearly imports, by principal importing countries, 1901 to 1919.*

[In thousands of bushels; i. e., 000 omitted.]

Country.	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Austria-Hungary	....	3,475	825	8,058	3,974	1,217	88	290	26,976	....
Belgium	54,935	57,062	59,498	63,979	64,790	67,928	67,469	67,032	70,922	75,219
Brazil	4,209	5,501	6,200	7,112	7,874	8,511	9,070	9,551	9,528	[2] 9,528
British South Africa	....	....	....	....	....	....	4,803	3,820	3,445	3,517
Denmark	5,071	4,329	3,686	3,862	3,447	4,168	2,820	3,594	3,497	2,824
France	5,817	9,030	17,365	7,581	6,713	11,288	13,131	2,752	5,249	23,327
Germany [1]	78,418	76,226	70,883	74,264	84,054	73,784	90,199	76,814	89,400	86,117
Greece	6,389	6,275	6,110	5,133	5,734	7,426	7,454	6,639	6,490	7,660
Italy	38,445	43,274	43,116	29,618	43,048	50,474	27,391	24,215	43,024	45,260
Japan	191	192	2,813	889	2,281	790	2,009	1,320	779	1,818
Netherlands	48,145	47,294	49,669	50,510	61,993	44,507	53,704	40,159	59,724	71,027
Portugal	3,392	337	2,748	3,282	4,673	3,853	962	4,604	3,898	3,024
Spain	5,273	2,557	3,336	8,192	32,518	19,313	4,291	2,902	3,530	5,933
Sweden	6,321	7,511	8,238	8,083	7,255	7,839	5,657	7.600	7,071	6,810
Switzerland	14,254	15,227	16,325	17.220	16,159	16,196	17,211	12,140	14,699	14,661
United Kingdom	129,557	150,894	164,206	181,984	181,580	172,809	180,443	168,629	182,220	195,965
Other countries	13,693	12,278	24,955	11,476	14,032	20,374	12,723	9,901	11,555	25,929
Total	424,060	441,460	479,972	481,242	540,124	510,477	499,426	441,961	542,006	578,619

[1] Not including free ports until Mar.1, 1906.

[2] Data for previous year.

TABLE 149.—*Wheat: Yearly imports, by principal importing countries, 1901 to 1919*—Continued.

Country.	1911	1912	1913	1914	1915	1916	1917	1918	1919
Austria-Hungary	....	....	....	....	....	....	....	....	....
Belgium	82,192	71,167	69,628	....	....	....	....	....	4,256
Brazil	12,241	14,010	16,109	20,808	20,142	21,553	12,618	18,499	22,404
British South Africa	2,919	1,886	5,359	6,767	5,168	5,822	3,898	1,824	2,030
Denmark	3,060	5,885	5,176	5,424	4,226	3,648	1,649	353	....
France	78,995	26,131	57,160	65,598	76,776	106,446	87,517	72,627	86,630
Germany	91,430	84,415	93,547	....	....	....	....	....	....
Greece	7,934	5,901	6,882	6,704	6,772	8,323	3,165	....	....
Italy	43,300	65,760	66,532	37,399	83,159	71,088	77,249	78,671	95,503
Japan	2,019	2,276	6,255	4,976	910	687	301	2,874	....
Netherlands	58,570	65,788	79,369	57,951	28,766	30,242	12,575	2,245	18,259
Portugal	439	2,382	6,399	5,439	4,827	6,789	2,321	....	....
Spain	4,927	1,543	6,405	15,575	13,691	11,648	1,861	4,664	13,426
Sweden	6,333	6,285	7,355	5,346	9,934	9,862	3,673	2,402	4,073
Switzerland	16,142	17,843	19,446	17,272	18,109	22,177	9,957	7,406	13,148
United Kingdom	182,352	203,322	196,809	218,025	191,064	211,830	206,255	175,460	178,543
Other countries	20,305	11,109	13,073	61,717	46,978	30,786	29,112	133,149	....
Total	613,158	585,703	655,504	529,001	510,522	543,901	452,151	500,174	438,272

TABLE 150.—*Wheat: Estimated percentage sold monthly from farms of Minnesota, North Dakota, and South Dakota, combined, 1910–11 to 1920–21.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20
July	3.4	3.4	1.5	2.9	2.3	1.4	7.7	1.3	0.8	2.3
August	12.8	7.3	8.6	7.6	9.3	3.9	10.0	7.3	10.1	12.5
September	17.2	16.3	16.7	18.9	23.4	17.2	18.2	22.4	28.5	19.9
October	14.7	16.8	19.8	18.1	21.2	18.7	16.4	20.5	19.7	17.3
November	11.5	13.2	14.4	14.3	14.4	16.2	13.6	16.6	12.1	11.9
December	8.9	9.8	11.2	11.5	8.9	15.0	7.0	9.6	11.0	10.1
January	6.6	7.5	6.8	6.8	5.6	6.7	5.7	5.3	6.5	6.2
February	4.7	6.2	5.7	5.3	4.1	6.3	3.9	3.4	3.5	3.7
March	5.3	5.8	3.7	4.5	3.5	3.9	5.0	3.5	2.4	3.3
April	3.2	3.9	2.7	2.5	2.5	2.8	3.7	3.6	1.2	4.1
May	5.6	5.1	3.9	3.7	2.6	3.7	5.3	4.3	2.3	4.6
June	6.1	4.7	5.0	3.9	2.2	4.2	3.5	2.2	1.9	4.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 151.—*Wheat: Estimated percentage sold monthly from farms of Kansas, 1910–11 to 1919–20.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20
July	17.1	18.6	13.1	25.7	18.8	6.3	19.4	14.0	28.8	16.3
August	16.4	18.4	15.0	13.9	14.8	9.5	17.4	9.8	26.6	20.6
September	11.6	11.4	12.2	7.6	14.1	10.3	12.7	13.2	11.9	11.3
October	9.7	14.6	11.5	8.5	10.6	11.0	13.2	19.6	10.9	9.2
November	7.8	6.2	8.5	7.2	9.8	13.7	9.1	15.9	7.8	7.7
December	7.0	4.9	8.0	5.3	8.4	12.1	6.0	7.4	4.4	5.3
January	6.0	5.0	7.0	9.6	5.6	8.6	8.5	4.3	1.8	6.6
February	4.2	7.4	6.1	5.9	5.7	8.8	3.2	4.5	2.2	3.6
March	4.8	2.5	3.9	4.9	2.6	4.8	3.9	3.3	1.3	3.9
April	4.4	4.9	5.9	3.6	4.9	5.9	2.9	4.5	1.7	5.1
May	5.2	4.2	4.9	4.0	2.6	5.6	2.5	2.3	1.8	5.8
June	5.8	1.9	3.9	3.8	2.1	3.4	1.2	1.2	0.8	4.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 152.—*Corn: Monthly and yearly average price per bushel of reported sales No. 3 yellow, 1900–1 to 1920–21.*

CHICAGO.[1]

Month.	1900–1	1901–2	1902–3	1903–4	1904–5	1905–6	1906–7	1907–8	1908–9	1909–10	10-yr. av.
November	$0.37	$0.60	$0.53	$0.44	$0.48	$0.45	$0.43	$0.59	$0.63	$0.59	$0.511
December	.35	.64	.46	.44	.43	.42	.42	.58	.59	.59	.492
January	.36	.62	.43	.43	.42	.42	.41	.53	.64	.64	.490
February	.37	.59	.43	.46	.44	.42	.43	.54	.65	.63	.496
March	.39	.59	.41	.46	.47	.40	.43	.63	.66	.61	.505
April	.42	.62	.41	.49	.48	.42	.44	.65	.69	.57	.519
May	.43	.62	.46	.49	.50	.47	.52	.73	.73	.60	.555
June	.42	.63	.49	.50	.55	.49	.53	.72	.75	.59	.567
July	.48	.65	.51	.49	.57	.52	.54	.76	.72	.62	.586
August	.56	.60	.53	.52	.54	.54	.57	.81	.70	.64	.601
September	.56	.59	.51	.53	.53	.47	.64	.80	.69	.58	.590
October	.56	.60	.45	.55	.53	.46	.65	.77	.59	.50	.566
Weighted average	.426	.617	.472	.487	.480	.443	.502	.678	.651	.593	.534

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	$0.49	$0.68	$0.52	$0.72	$0.67	$0.63	$0.98	$2.21	$1.33	$1.46	$0.77	$0.97
December	.45	.61	.46	.66	.64	.69	.92	1.77	1.45	1.47	.74	.91
January	.45	.62	.46	.62	.71	.74	.98	1.77	1.43	1.51	....	.93
February	.45	.64	.48	.62	.74	.74	1.00	1.81	1.27	1.46	....	.92
March	.45	.68	.49	.64	.72	.73	1.09	1.70	1.53	1.58	....	.96
April	.50	.78	.55	.67	.75	.76	1.40	1.65	1.62	1.69	....	1.04
May	.54	.79	.57	.70	.77	.75	1.59	1.60	1.74	2.02	....	1.11
June	.55	.75	.60	.72	.74	.74	1.70	1.62	1.78	1.89	....	1.11
July	.63	.68	.62	.71	.78	.81	1.99	1.70	1.92	1.58	....	1.14
August	.65	.79	.74	.82	.81	.85	2.06	1.72	1.95	1.58	....	1.20
September	.67	.74	.75	.79	.74	.86	2.10	1.58	1.55	1.31	....	1.11
October	.73	.65	.70	.73	.65	.96	2.03	1.41	1.41	.91	....	1.02
Weighted average	.53	.71	.53	.70	.70	.79	1.11	1.63	1.62	1.59	....	.99

[1] Compiled from Chicago Daily Trade Bulletin.

KANSAS CITY.[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	$0.47	$0.67	$0.45	$0.72	$0.64	$0.62	$0.95	$2.02	$1.47	$1.51	$0.67	$0.96
December	.43	.62	.45	.66	.65	.67	.89	1.66	1.52	1.51	.69	.91
January	.44	.66	.47	.65	.73	.70	.95	1.65	1.42	1.49	....	.92
February	.42	.65	.47	.63	.73	.71	.99	1.74	1.34	1.45	....	.91
March	.44	.71	.50	.66	.71	.68	1.16	1.66	1.48	1.56	....	.96
April	.47	.81	.56	.69	.75	.72	1.41	1.59	1.66	1.71	....	1.04
May	.52	.80	.58	.73	.75	.72	1.58	1.61	1.74	1.91	....	1.09
June	.55	.75	.59	.71	.74	.72	1.68	1.54	1.79	1.82	....	1.09
July	.67	.75	.62	.70	.76	.78	2.01	1.63	1.92	1.58	....	1.14
August	.62	.76	.75	.81	.76	.82	1.78	1.76	1.93	1.57	....	1.16
September	.66	.71	.75	.78	.70	.84	1.96	1.66	1.64	1.28	....	1.10
October	.71	.64	.72	.70	.59	.91	1.91	1.45	1.42	.88	....	.99
Weighted average	.49	.69	.55	.67	.72	.69	1.06	1.63	1.56	1.60	....	.97

[1] Compiled from Kansas City Daily Price Current and Grain Market Review.

TABLE 153.—*Corn: Monthly and yearly average farm price per bushel, United States, 1910–11 to 1920–21.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	$0.50	$0.63	$0.54	$0.70	$0.68	$0.60	$0.87	$1.37	$1.38	$1.34	$0.78	$0.86
December	.48	.62	.49	.69	.65	.59	.89	1.31	1.41	1.38	.67	.86
January	.49	.63	.50	.69	.70	.64	.93	1.37	1.41	1.44	....	.88
February	.49	.66	.51	.69	.74	.67	.98	1.47	1.38	1.48	....	.92
March	.49	.69	.53	.70	.75	.70	1.07	1.54	1.43	1.54	....	.94
April	.51	.75	.55	.71	.76	.71	1.32	1.55	1.56	1.64	....	1.01
May	.53	.81	.59	.74	.78	.73	1.55	1.54	1.67	1.77	....	1.07
June	.58	.81	.62	.75	.78	.75	1.62	1.53	1.74	1.85	....	1.10
July	.63	.80	.64	.76	.78	.77	1.81	1.57	1.84	1.75	....	1.14
August	.66	.78	.70	.79	.78	.82	1.86	1.63	1.88	1.60	....	1.15
September	.66	.74	.75	.80	.74	.83	1.75	1.63	1.70	1.39	....	1.10
October	.65	.64	.73	.74	.66	.84	1.61	1.50	1.44	1.04	....	.99
Yearly average	.56	.71	.60	.73	.73	.72	1.36	1.50	1.57	1.52	....	1.00

TABLE 154.—*Corn: Monthly and yearly average price per bushel of reported sales of No. 3 yellow, Chicago, 1910–11 to 1920–21.*[1]

[Reduced to 1913 basis.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	$0.49	$0.72	$0.52	$0.71	$0.68	$0.62	$0.69	$1.21	$0.65	$0.63	$0.37	$0.68
December	.45	.65	.46	.67	.66	.66	.63	.98	.70	.62	.39	.64
January	.48	.62	.46	.62	.72	.67	.65	.96	.70	.61	....	.65
February	.48	.64	.48	.63	.74	.67	.65	.97	.64	.59	....	.65
March	.48	.68	.49	.65	.73	.64	.68	.91	.76	.62	....	.66
April	.53	.78	.56	.68	.76	.66	.82	.87	.80	.64	....	.71
May	.57	.79	.58	.71	.77	.64	.88	.84	.84	.74	....	.74
June	.59	.75	.60	.73	.75	.63	.92	.84	.86	.70	....	.74
July	.67	.68	.61	.72	.77	.68	1.08	.86	.88	.60	....	.76
August	.69	.79	.73	.80	.81	.69	1.12	.85	.86	.63	....	.80
September	.71	.74	.74	.77	.76	.68	1.15	.76	.70	.54	....	.76
October	.78	.65	.69	.74	.64	.72	1.13	.69	.63	.40	....	.71
Weighted average	.56	.72	.53	.70	.71	.67	.71	.84	.64	.63	....	.67

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 155.—*Corn: Yearly receipts at 10 primary markets, 1911–12 to 1920–21, for crop year beginning Nov. 1.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Market.	1910–11[2]	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	9-yr. av.
Chicago	....	108,431	131,792	84,838	116,348	101,325	78,723	98,786	61,366	87,641	96,583
Milwaukee	....	9,410	11,613	15,804	19,609	9,887	12,755	12,374	6,784	14,652	12,543
Minneapolis	....	5,423	6,258	10,710	14,699	5,661	9,550	16,715	6,621	9,192	9,425
St. Louis	....	25,176	22,762	16,961	18,626	17,974	21,312	25,354	19,219	27,595	21,064
Toledo	....	4,121	2,996	4,560	4,582	4,656	2,882	2,609	1,127	2,122	3,406
Detroit	....	2,857	2,757	2,835	4,058	4,726	3,192	4,361	1,633	1,671	3,121
Kansas City	....	19,646	16,992	27,494	16,396	25,837	12,743	31,366	16,146	11,218	19,759
Peoria	....	19,041	17,923	14,723	16,736	35,948	31,533	36,176	18,511	22,449	23,671
Omaha	....	20,817	22,618	37,108	24,599	21,496	29,820	46,159	21,805	23,227	27,516
Indianapolis	....	13,687	15,974	14,118	15,087	22,790	24,421	20,583	15,905	19,991	18,061
Crop year total	....	228,609	252,685	229,151	250,740	250,300	226,931	294,483	169,117	219,758	210,753

[1] Compiled from Chicago Daily Trade Bulletin.
[2] No record.

TABLE 156.—*Corn: Monthly and yearly receipts at primary markets, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	12,618	14,427	13,863	12,485	23,165	17,614	21,645	13,412	16,113	13,232	9,786	15,524
December	23,853	20,828	27,511	38,552	43,230	26,414	27,515	18,357	17,381	22,205	17,955	25,995
January	22,251	27,534	38,976	27,763	47,599	30,362	32,398	24,551	12,405	21,239	....	28,508
February	17,930	33,576	37,396	23,500	25,877	36,413	21,129	39,150	12,792	24,169	....	27,093
March	17,833	19,586	19,070	24,988	13,016	24,173	22,466	49,591	17,843	22,969	....	23,154
April	9,879	10,726	10,108	9,948	13,749	16,665	15,992	28,294	9,178	10,669	....	13,521
May	16,171	15,412	12,376	10,784	12,554	17,768	16,332	19,010	19,560	10,894	....	15,086
June	23,238	23,740	29,102	24,322	14,918	13,919	23,029	19,163	12,275	25,763	....	20,947
July	10,863	12,557	13,032	12,313	14,367	21,275	17,155	22,292	27,125	20,102	....	17,108
August	14,716	13,232	12,403	20,032	13,767	15,427	14,145	16,622	8,229	9,264	....	13,784
September	16,089	20,212	25,257	15,031	17,191	18,359	8,361	22,746	14,809	19,852	....	17,791
October	13,178	12,268	14,373	10,899	15,245	12,149	8,209	23,740	11,849	18,707	....	14,062
Crop year total	198,619	224,098	253,467	230,617	254,678	250,538	228,376	296,928	179,559	223,065	....	233,995

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 157.—*Corn: Visible supply in United States, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	3,510	1,703	2,689	6,206	3,114	3,288	2,361	1,277	4,733	1,484	10,085	3,694
December	1,545	2,054	1,525	2,026	3,382	4,387	2,677	1,932	2,216	1,477	4,597	2,627
January	5,099	5,140	5,879	12,126	19,703	8,919	5,838	3,155	2,415	2,921	....	7,120
February	9,145	6,900	9,717	16,505	34,156	14,773	10,671	4,623	5,549	3,575	....	11,561
March	11,794	14,257	17,918	18,374	41,238	24,605	12,931	8,939	4,483	4,951	....	15,949
April	11,166	15,914	21,494	18,812	32,877	27,697	11,974	19,016	2,514	5,669	....	16,713
May	7,047	7,490	7,270	9,380	20,203	21,004	7,173	16,111	4,245	5,035	....	10,596
June	4,685	5,699	2,549	4,409	12,795	14,505	2,629	13,038	2,600	2,740	....	6,565
July	7,482	8,204	11,479	7,589	5,225	6,870	3,277	11,487	4,038	4,364	....	7,002
August	7,100	2,451	6,389	3,203	2,306	5,167	2,841	9,466	2,461	6,152	....	4,754
September	6,724	1,823	2,612	3,923	2,382	3,330	2,371	5,232	956	2,564	....	3,202
October	6,339	3,101	7,308	5,461	3,444	5,093	1,163	5,503	2,163	7,587	....	4,716

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 158.—*Corn: Monthly and yearly shipments from primary markets, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	9,060	7,475	6,419	9,382	11,321	7,462	7,430	4,324	11,596	6,739	7,734	7,988
December	13,747	12,937	11,715	15,961	20,360	11,485	13,628	8,005	10,300	11,563	8,505	12,446
January	15,043	13,906	24,681	18,101	24,925	13,190	15,020	11,084	13,688	12,126	....	16,176
February	12,247	17,873	28,985	12,762	19,543	16,207	12,105	16,943	9,394	12,192	....	15,825
March	11,246	13,345	15,058	15,818	14,819	14,522	13,819	27,659	7,800	11,943	....	14,603
April	12,179	12,648	14,846	15,968	20,302	15,046	14,301	18,065	9,338	5,931	....	13,862
May	14,997	13,019	9,667	10,900	14,463	15,182	11,593	14,113	8,217	6,075	....	11,821
June	15,678	15,196	13,257	15,672	14,177	13,178	13,238	9,785	9,166	10,273	....	12,962
July	12,178	11,187	14,146	10,523	10,328	14,972	11,854	10,041	8,631	9,599	....	11,346
August	10,775	8,480	9,542	12,542	9,584	11,527	8,849	9,883	5,469	6,700	....	9,335
September	15,055	13,105	13,471	10,943	9,092	9,197	5,237	9,763	6,914	6,569	....	9,935
October	12,041	9,292	10,296	7,329	9,212	10,404	4,836	11,796	7,322	10,137	....	9,267
Crop year total	154,246	148,463	172,083	155,901	178,126	152,372	131,910	151,461	107,835	109,847	....	146,224

[1] Compiled from Chicago Daily Trade Bulletin.

Table 159.—*Corn: Average yearly receipts, shipments, and local consumption at 10 primary markets, for five calendar years, 1913–1917.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Market.	Receipts.	Shipments.	Local consumption.	Per cent of local receipts consumed.
Chicago	100,592	70,474	30,118	29.9
Peoria	23,843	10,080	13,763	58.1
Indianapolis[2]	23,144	12,702	10,442	45.1
St. Louis	19,774	11,023	8,751	44.2
Cincinnati	8,504	4,450	4,054	47.7
Kansas City	20,422	14,728	5,694	27.9
Milwaukee	13,666	10,167	3,499	25.6
Minneapolis	9,366	4,782	1,884	20.1
Omaha	27,352	25,559	1,793	6.6
Duluth	862	779	83	9.6
Total	247,525	167,444	80,081	32.4

[1] From Report of Federal Trade Commission.
[2] 2-year average, 1916–17.

Table 160.—*Corn: Monthly and yearly receipts at Chicago, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	8,163	7,838	7,016	2,805	12,458	7,627	8,604	4,851	6,139	4,851	3,765	6,595
December	13,857	8,925	13,267	13,842	25,735	9,675	10,308	6,228	5,489	7,487	6,223	10,718
January	12,745	12,904	21,937	8,774	20,877	11,952	11,054	5,797	7,958	8,124	....	12,212
February	10,061	15,204	21,454	8,401	9,411	15,673	7,245	10,555	3,714	7,759	....	10,948
March	9,872	10,113	11,016	7,644	4,928	8,222	7,976	14,045	3,824	8,549	....	8,619
April	4,696	3,016	3,622	2,139	3,877	4,650	4,486	8,493	6,140	2,264	....	4,348
May	9,054	5,867	5,135	2,492	4,267	7,210	5,060	5,894	3,334	3,139	....	5,145
June	15,439	12,880	16,302	9,741	4,873	3,883	8,380	7,656	8,077	8,864	....	9,609
July	5,092	5,945	6,379	5,131	6,537	10,622	5,310	10,007	4,887	9,067	....	6,898
August	6,708	6,409	4,291	9,925	6,213	6,375	4,050	5,254	3,296	3,721	....	5,624
September	11,237	12,426	15,205	8,146	9,248	9,439	2,931	9,530	7,554	12,061	....	9,778
October	6,881	7,616	5,795	5,914	8,054	5,445	3,883	14,550	4,802	11,268	....	7,420
Crop year total	113,805	109,143	131,419	84,954	116,478	100,773	79,287	102,860	65,214	87,154	....	170,409

[1] Compiled from Chicago Daily Trade Bulletin.

Table 161.—*Corn: Visible supply at Chicago, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	211	255	1,186	3,487	834	1,782	249	35	2,173	593	6,238	1,683
December	91	527	576	536	2,621	1,937	847	419	760	466	1,837	1,053
January	1,108	1,293	1,893	6,785	9,609	2,691	1,757	681	290	845	....	2,996
February	1,110	2,236	2,492	8,436	13,826	3,893	3,589	1,079	1,185	836	....	4,690
March	1,794	5,276	6,107	9,381	13,990	8,178	4,322	2,627	0	1,346	....	6,570
April	2,762	8,341	8,749	9,995	11,450	10,206	3,488	4,761	416	1,260	....	7,694
May	2,587	3,113	2,379	4,803	8,083	8,340	1,157	4,722	1,442	1,020	....	4,040
June	1,262	2,582	829	1,827	5,549	7,615	195	3,729	519	500	....	2,681
July	2,139	3,849	6,048	2,514	1,224	3,147	248	4,217	1,543	1,223	....	3,045
August	3,565	812	3,033	1,367	515	1,802	85	4,287	940	2,467	....	1,924
September	1,611	139	522	1,006	448	951	252	1,933	168	333	....	818
October	3,078	1,105	4,328	1,550	1,759	2,021	121	2,475	1,192	4,173	....	2,225

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 162.—*Corn: Monthly and yearly shipments from Chicago, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	5,992	3,743	3,462	4,429	5,916	3,403	2,625	981	5,268	1,996	4,703	3,653
December	7,672	5,182	5,563	3,058	9,234	4,901	5,182	2,223	3,274	3,357	3,379	4,535
January	8,540	5,853	14,076	4,773	11,622	4,902	4,336	1,541	3,133	3,431	....	5,221
February	6,602	6,960	14,430	3,327	8,691	5,425	3,222	2,612	1,964	3,715	....	5,595
March	5,255	5,283	8,985	4,249	5,830	4,155	4,844	4,964	1,572	2,671	....	4,781
April	7,020	6,515	8,208	6,705	9,309	4,513	5,195	2,925	1,715	939	....	5,284
May	9,128	6,527	5,015	4,423	5,204	5,422	3,029	3,204	2,964	1,205	....	4,612
June	10,935	8,191	7,242	6,727	5,828	5,015	3,624	2,370	2,228	2,478	....	5,464
July	8,022	6,299	8,465	4,188	4,536	7,584	3,846	3,051	2,312	2,995	....	5,130
August	5,759	4,408	5,421	6,132	4,710	6,145	1,791	2,728	1,910	2,978	....	4,198
September	9,972	8,125	8,212	5,794	3,861	4,338	1,373	2,857	2,603	2,683	....	4,982
October	7,753	6,853	5,231	3,723	5,515	6,345	1,427	5,084	3,076	6,084	....	5,109
Crop year total	92,650	73,939	94,310	57,528	80,256	62,148	40,497	34,540	32,019	33,332	....	60,122

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 163.—*Corn: Monthly and yearly receipts at Minneapolis, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	854	673	496	697	1,905	314	1,330	472	325	710	939	786
December	1,863	581	1,156	2,867	3,062	685	1,599	978	953	2,380	1,758	1,602
January	1,156	581	1,172	1,412	2,706	743	1,723	2,593	1,430	1,229	....	1,474
February	962	1,064	690	1,006	1,561	1,206	1,285	3,294	837	924	....	1,283
March	880	258	411	1,161	1,432	647	1,536	3,212	852	621	....	1,101
April	357	375	174	396	877	241	463	1,445	257	548	....	513
May	596	385	256	373	612	238	441	631	430	314	....	428
June	734	361	602	969	942	278	494	877	440	921	....	662
July	265	295	302	512	527	331	243	669	524	439	....	411
August	663	345	408	581	373	299	176	634	318	325	....	412
September	249	229	331	450	380	343	173	1,099	278	448	....	398
October	382	229	279	433	369	278	81	794	337	458	....	366
Crop year total	8,961	5,376	6,277	10,857	14,746	5,606	9,544	16,698	6,981	9,317	....	9,443

[1] Compiled from Reports of Minneapolis Chamber of Commerce and Daily Market Record.

TABLE 164.—*Corn: Visible supply at Minneapolis, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels, i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	41	37	5	18	10	18	2	3	112	4	79	29
December	19	11	6	21	187	15	18	17	89	9	62	44
January	155	71	114	179	592	33	77	78	22	133	....	145
February	353	37	209	312	891	91	197	287	152	139	....	267
March	367	120	88	332	1,104	92	231	578	89	100	....	310
April	351	40	74	224	922	92	291	795	26	39	....	285
May	173	29	7	44	866	90	152	883	12	79	....	234
June	6	35	2	2	242	38	79	557	19	43	....	100
July	276	40	44	61	54	4	5	370	11	166	....	102
August	74	3	7	10	7	4	1	76	2	48	....	17
September	81	3	17	13	22	14	2	34	7	28	....	24
October	62	5	38	8	18	2	3	28	7	65	....	24

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 165.—*Corn: Monthly and yearly receipts at St. Louis, 1910–11 to 1920–21.*[1]

[In thousands of bushels, i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	947	1,195	1,280	982	1,037	1,148	1,164	2,204	1,957	1,335	843	1,315
December	2,059	2,312	2,525	1,711	1,584	1,579	1,896	1,547	1,508	2,441	1,416	1,852
January	2,631	4,753	2,526	2,057	2,393	1,381	3,187	1,754	3,346	3,350	....	2,738
February	1,815	3,408	3,306	1,699	2,329	1,779	2,381	3,216	1,756	3,621	....	2,534
March	1,971	1,996	1,307	1,856	1,352	1,820	2,273	5,102	1,666	3,517	....	2,323
April	1,434	1,919	2,173	1,010	2,127	2,455	2,079	2,800	2,215	1,835	....	1,983
May	2,573	1,936	2,376	1,502	1,339	2,616	1,907	1,716	910	1,755	....	1,797
June	2,452	2,347	2,307	1,638	1,707	1,783	1,555	1,480	2,370	3,548	....	2,141
July	2,034	1,529	1,041	1,046	1,378	1,400	1,711	1,488	1,079	2,300	....	1,465
August	2,063	1,335	1,520	1,560	944	1,080	1,620	1,132	719	1,135	....	1,337
September	1,075	1,651	1,353	910	1,283	760	698	1,484	1,162	1,490	....	1,180
October	1,666	900	1,188	1,008	1,138	727	885	1,869	1,435	1,097	....	1,200
Crop year total	22,720	25,281	22,902	16,979	18,611	17,928	21,356	25,792	20,123	27,429	....	21,929

[1] From Annual Statement of the St. Louis Merchants Exchange.

TABLE 166.—*Corn: Visible supply at St. Louis, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	225	42	34	257	28	160	11	7	204	22	356	112
December	15	65	59	105	39	182	63	95	114	72	79	87
January	221	244	192	345	286	315	244	78	121	133	....	218
February	344	397	159	411	433	327	295	156	416	171	....	310
March	313	503	498	441	644	393	421	293	279	280	....	407
April	297	637	267	407	139	326	342	809	287	333	....	383
May	40	307	115	156	196	238	117	596	382	419	....	257
June	147	336	137	106	87	109	103	403	23	251	....	168
July	496	288	499	347	67	164	55	374	438	286	....	302
August	114	63	131	61	59	155	28	242	141	395	....	137
September	346	8	157	58	73	85	36	30	20	52	....	89
October	77	28	221	58	135	147	....	120	69	230	....	100

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 167.—*Corn: Monthly and yearly receipts at Kansas City, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	800	1,030	735	2,224	699	1,676	978	1,598	875	615	546	1,098
December	1,523	2,202	1,539	4,841	1,124	4,428	1,585	2,188	1,926	1,435	931	2,220
January	1,650	3,056	1,981	4,716	4,394	3,570	1,233	3,168	4,491	1,275	....	2,949
February	1,218	4,634	1,761	2,626	3,453	3,400	1,221	5,618	1,423	1,724	....	2,708
March	1,372	1,411	984	4,495	494	3,299	1,370	6,634	1,284	1,504	....	2,283
April	1,471	1,609	1,105	2,160	1,458	2,673	1,665	2,936	1,850	550	....	1,747
May	1,386	1,948	1,044	1,755	1,183	1,841	1,486	2,038	1,121	878	....	1,468
June	1,823	1,633	1,693	2,859	858	1,161	788	1,676	1,554	1,423	....	1,547
July	1,836	1,109	1,054	825	781	1,166	591	1,379	795	794	....	1,033
August	1,477	895	1,486	961	845	1,226	658	1,434	381	345	....	971
September	608	616	1,756	528	691	715	545	1,425	358	494	....	773
October	862	339	2,000	425	545	573	676	1,195	495	352	....	747
Crop year total	16,626	20,482	17,138	28,415	16,525	25,728	12,796	31,289	16,553	11,389	....	19,628

[1] Compiled from Reports of Kansas City Board of Trade, and Kansas City Price Current.

TABLE 168.—*Corn: Visible supply at Kansas City, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	218	28	8	386	59	27	29	16	496	44	261	135
December	197	49	27	305	207	142	86	136	288	20	200	146
January	419	242	232	969	476	2,038	381	440	236	95	....	553
February	628	382	521	1,520	2,768	4,359	348	1,039	777	140	....	1,248
March	637	1,364	928	1,660	5,168	5,624	499	1,850	1,017	319	....	1,907
April	621	1,149	764	1,532	2,961	6,371	299	3,228	310	359	....	1,759
May	754	384	296	778	1,664	5,442	229	2,815	429	309	....	1,310
June	168	387	159	320	1,359	3,278	347	1,798	208	166	....	793
July	279	265	640	743	471	1,341	64	1,307	325	280	....	571
August	152	68	148	291	103	470	16	930	150	358	....	291
September	789	366	118	162	60	295	31	560	37	226	....	265
October	127	40	407	110	79	369	53	538	....	303	....	208

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 169.—*Corn: Monthly and yearly exports by United States, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	2,018	1,321	1,102	444	2,153	1,642	2,290	1,622	1,710	962	1,829	1,508
December	5,206	5,043	3,274	773	4,781	2,790	2,891	2,443	991	1,526	3,041	2,755
January	9,947	7,646	11,317	1,148	5,244	3,498	7,253	1,956	1,177	2,211	....	4,689
February	11,033	7,022	12,307	928	7,855	5,151	6,597	3,203	976	1,791	....	5,685
March	10,054	5,267	10,109	1,170	8,815	4,837	10,834	7,658	683	1,863	....	6,129
April	5,374	1,815	5,596	710	9,105	4,898	6,463	8,645	699	1,147	....	4,445
May	3,715	831	1,252	538	3,735	5,336	4,838	3,793	878	750	....	2,567
June	4,650	657	743	926	3,845	4,811	3,720	3,279	910	835	....	2,438
July	2,410	777	926	576	2,179	5,483	3,146	2,009	588	1,151	....	1,925
August	1,314	561	745	494	959	6,700	2,670	1,850	716	781	....	1,679
September	3,778	873	670	1,152	888	3,761	980	2,469	1,210	1,034	....	1,682
October	2,934	1,154	404	1,052	1,228	3,891	1,602	2,335	868	1,417	....	1,689
Crop year total	62,433	32,967	48,445	9,911	50,787	52,798	53,284	41,262	11,406	15,468	....	37,876

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 170.—*Corn: Monthly and yearly exports of corn meal and corn flour, from United States, 1910–11 to 1920–21.*[1]

[In thousands of barrels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	35	29	32	25	28	33	37	82	33	31	85	42
December	36	44	40	19	40	39	43	83	25	31	146	51
January	57	63	39	18	45	30	44	55	292	27	....	67
February	46	34	67	20	49	30	21	119	161	34	....	58
March	56	38	50	28	71	44	37	162	177	37	....	70
April	52	39	28	37	33	35	33	101	112	47	....	52
May	39	31	32	41	59	34	92	304	87	55	....	77
June	32	26	32	33	42	55	87	381	87	77	....	82
July	37	29	32	23	34	25	125	295	38	36	....	67
August	24	32	22	30	28	28	206	167	96	128	....	76
September	31	30	26	25	28	30	239	92	41	38	....	58
October	42	29	37	26	30	31	161	57	50	157	....	63
Crop year total	487	424	437	325	487	414	1,125	1,898	1,199	698	....	749

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 171.—*Corn: Yearly exports from the United States, by countries of destination, 1910 to 1920.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Belgium	1,144	2,681	1,406	1,648	60	104	5	581	3,467	1,010	72
Denmark	2,451	3,083	1,546	5,390	(2)	11,170	9,527	7,057	......	335	173
France	446	1,626	452	442	55	3,772	2,560	1,533	1,370	(2)	190
Germany	4,537	7,971	6,801	6,545	303	16	......	......	......	......	1,324
Italy	......	52	4	4	......	70	(2)	1,157	2,196	......	......
Netherlands	5,185	7,147	5,658	7,192	374	15,876	5,706	7,924	46	100	424
Norway	......	69	......	158	......	614	317	......	......	......	(2)
Portugal	......	1	......	762	......	......	(2)	......	......	......	......
Sweden	......	......	......	......	......	1,023	433	400	......	......	......
United Kingdom	10,668	17,724	10,616	14,983	541	2,850	5,627	24,494	15,659	948	2,707
All other in Europe	3	31	......	10	(2)	31	1	120	53	118	4
Total Europe	24,434	40,385	26,483	37,134	1,333	35,526	24,176	43,284	22,791	2,511	4,894
Canada	6,179	13,410	9,569	8,098	4,642	8,238	6,569	15,725	13,229	6,542	10,065
Mexico	3,258	7,067	1,168	543	467	1,588	3,679	2,531	2,736	134	771
Cuba	2,377	2,225	2,118	2,373	2,410	2,267	3,231	2,819	1,074	1,965	1,894
All other in North America	538	627	647	653	505	948	544	317	69	38	123
Total North America	12,352	23,329	13,502	11,667	8,024	13,041	14,023	21,392	17,108	8,679	12,853
South America	17	19	53	74	19	33	16	29	(2)	2	3
Asia	......	......	(2)	(2)	......	176	(2)	......	(2)	(2)	1
Oceania	(2)	(2)	(2)	1	1	(2)	1	3	(2)	(3)	1
Africa	......	29	1	189	4	10	1	13	(2)	(2)	9
Grand total	36,803	63,762	40,039	49,065	9,381	48,786	38,217	64,721.	39,899	11,192	17,761

[1] For year ending June 30, 1910–17 inclusive, calendar years 1918–20 inclusive.
[2] Less than 500 bushels.

TABLE 172.—*Corn: Graded by licensed inspectors for half yearly periods, all inspectio points, in carloads, July, 1917, to Dec., 1920.*

Period.	Inspected receipts by grade.							
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Sample grade.	Total.
July–December, 1917	10,113	30,147	11,562	7,080	5,804	5,881	15,030	85,617
January–June, 1918	966	11,311	42,850	40,712	31,476	27,528	52,650	207,493
Total, 1917–18	11,079	41,458	54,412	47,792	37,280	33,409	67,680	293,110
July–December, 1918	829	7,034	19,345	20,315	16,848	18,128	40,435	122,934
January–June, 1919	1,347	15,262	28,875	29,843	19,734	7,909	7,924	110,894
Total, 1918–19	2,176	22,296	48,220	50,158	36,582	26,037	48,359	233,828
July–December, 1919	12,622	21,295	11,302	18,718	10,753	4,747	5,626	85,063
January–June, 1920	4,555	19,510	27,829	38,380	16,957	5,041	6,906	119,178
Total, 1919–20	17,177	40,805	39,131	57,098	27,710	9,788	12,532	204,241
July–December, 1920	25,119	31,388	12,806	12,098	5,494	3,592	5,850	96,347

TABLE 172.—*Corn: Graded by liscensed inspectors for half yearly periods, all inspection points, in carloads. July, 1917, to Dec., 1920*—Continued.

Period.	Inspected shipments by grade.							
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Sample grade.	Total.
July-December, 1917	1,414	21,833	8,128	3,196	1,280	1,303	2,517	39,671
January-June, 1918	163	6,831	40,595	23,631	7,940	8,476	13,396	101,032
Total, 1917-18	1,577	28,664	48,723	26,827	9,220	9,779	15,913	140,703
July-December, 1918	285	4,646	16,935	8,990	5,706	8,873	20,112	65,547
January-June, 1919	196	12,175	27,795	11,606	3,552	1,947	2,494	59,765
Total, 1918-19	481	16,821	44,730	20,596	9,258	10,820	22,606	125,312
July-December, 1919	2,520	20,050	11,854	4,764	1,682	1,633	1,934	44,437
January-June, 1920	534	13,945	20,257	10,791	3,337	1,120	1,412	51,396
Total, 1919-20	3,054	33,995	32,111	15,555	5,019	2,753	3,346	95,833
July-December, 1920	6,921	31,628	8,608	2,477	468	1,107	1,999	53,298

TABLE 173.—*Corn: Graded by licensed inspectors for yearly periods, all inspection points, in carloads, July, 1917, to June, 1920.*

JULY, 1917-JUNE, 1918.

Color.	Inspected receipts by grades.							
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Sample grade.	Total.
White	2,644	11,465	18,927	15,745	8,932	7,599	....	65,312
Yellow	3,704	11,655	14,445	15,561	17,218	15,177	....	77,780
Mixed	4,731	18,338	21,040	16,466	11,130	10,633	67,680	150,018
Total	11,079	41,458	54,412	47,792	37,280	33,409	67,680	293,110
JULY, 1918-JUNE, 1919.								
White	817	7,980	15,657	13,179	9,692	7938	7,585	62,848
Yellow	956	10,113	23,546	27,313	19,360	12,670	12,602	106,560
Mixed	403	4,203	9,017	9,666	7,530	5,429	28,172	64,420
Total	2,176	22,296	48,220	50,158	36,582	26,037	48,359	233,828
JULY, 1919-JUNE, 1920.								
White	3,218	10,882	10,613	11,903	2,856	1,557	2,308	43,337
Yellow	11,267	20,257	17,955	30,772	15,323	4,219	4,478	104,271
Mixed	2,692	9,666	10,563	14,423	9,531	4,012	5,746	56,633
Total	17,177	40,805	39,131	57,098	27,710	9,788	12,532	204,241

JULY, 1917-JUNE, 1918.

Color.	Inspected shipments by grade.							
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Sample grade.	Total.
White	421	7,697	13,397	5,800	1,730	1,811	....	30,856
Yellow	573	7,374	12,765	8,171	3,866	3,589	....	36,338
Mixed	583	13,593	22,561	12,856	3,624	4,379	15,913	73,509
Total	1,577	28,664	48,723	26,827	9,220	9,779	15,913	140,703

TABLE 173.—*Corn: Graded by liscensed inspectors for yearly periods, all inspection points. in carloads July, 1917 to June 1920*—Continued.

JULY, 1918–JUNE, 1919.

Color.	Inspected shipments by grade.							
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Sample grade.	Total.
White	261	7,513	10,639	4,358	2,296	2,516	2,202	29,785
Yellow	137	6,397	21,843	10,601	3,906	4,259	5,053	52,196
Mixed	83	2,911	12,248	5,637	3,056	4,045	15,351	43,331
Total	481	16,821	44,730	20,596	9,258	10,820	22,606	125,312

JULY, 1919–JUNE, 1920.

Color.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Sample grade.	Total.
White	602	10,573	5,589	2,376	393	356	346	20,235
Yellow	2,124	17,211	16,987	8,008	2,293	877	656	48,156
Mixed	328	6,211	9,535	5,171	2,333	1,520	2,344	27,442
Total	3,054	33,995	32,111	15,555	5,019	2,753	3,346	95,833

TABLE 174.—*Corn: Yearly production in United States and principal producing States, 1901 to 1920.*

(Thousands of bushels; i. e., 000 omitted.)

State.	1901	1902	1903	1904	1905
United States	1,607,288	2,620,699	2,339,417	2,520,682	2,744,329
Alabama	27,903	23,224	41,736	41,877	42,972
Georgia	37,858	35,094	46,078	47,335	47,255
Illinois	198,026	372,436	264,087	344,134	382,752
Indiana	87,754	171,332	142,581	143,397	187,131
Iowa	230,265	297,686	229,218	303,039	305,112
Kansas	61,506	222,806	171,687	134,610	193,276
Kentucky	49,575	90,093	82,546	86,816	94,894
Minnesota	35,797	33,827	40,727	41,809	48,997
Mississippi	22,473	24,659	39,848	39,710	30,028
Missouri	66,436	264,233	202,840	151,523	203,295
Nebraska	109,142	252,520	172,380	260,943	263,552
North Carolina	30,642	37,623	38,595	40,705	37,596
Ohio	80,313	121,609	88,096	99,629	112,399
Oklahoma	10,324	40,502	34,748	48,612	48,145
Pennsylvania	51,003	53,658	45,448	48,536	56,086
South Dakota	29,843	29,813	41,618	43,855	51,615
Tennessee	45,130	73,081	75,284	80,890	77,208
Texas	60,051	44,867	140,751	136,703	139,146
Virginia	40,903	41,346	39,741	42,900	43,515
Wisconsin	40,021	42,425	43,639	45,120	55,408

State.	1906	1907	1908	1909	1910
United States	2,895,882	2,512,065	2,544,957	2,572,336	2,886,260
Alabama	47,849	45,896	44,835	30,696	51,300
Georgia	52,067	57,538	53,750	39,375	51,982
Illinois	347,170	342,756	298,620	390,219	400,775
Indiana	183,894	168,840	137,835	195,496	188,640
Iowa	373,275	270,220	287,456	341,750	343,761
Kansas	195,075	155,142	156,200	154,652	170,050
Kentucky	105,437	93,060	84,823	83,348	101,500
Minnesota	50,149	43,605	46,835	67,897	66,708
Mississippi	40,789	42,500	45,845	28,429	53,095
Missouri	228,523	241,025	203,634	191,427	247,500
Nebraska	249,783	179,328	205,767	180,133	191,565
North Carolina	41,797	45,078	50,166	34,063	49,290
Ohio	141,645	117,640	136,675	157,513	144,540
Oklahoma	65,737	113,265	122,239	94,283	91,760
Pennsylvania	57,960	45,922	57,275	41,494	58,630
South Dakota	62,813	47,175	57,677	55,559	52,500
Tennessee	86,429	78,364	83,080	67,682	88,060
Texas	155,805	155,589	201,848	75,499	140,080
Virginia	45,189	46,025	50,050	38,295	49,980
Wisconsin	60,106	46,688	49,674	49,163	49,400

TABLE 174.—*Corn: Yearly production in United States and principal producing States, 1901 to 1920*—Continued.

State.	1911	1912	1913	1914	1915
United States	2, 531, 488	3, 124, 746	2, 446, 988	2, 672, 804	2, 994, 793
Alabama	54, 000	54, 180	55, 360	55, 488	66, 300
Georgia	59, 072	53, 958	63, 023	56, 000	64, 950
Illinois	334, 950	426, 320	282, 150	300, 034	374, 400
Indiana	174, 600	199, 364	176, 400	163, 317	190, 950
Iowa	305, 350	432, 021	338, 300	389, 424	298, 500
Kansas	126, 150	174, 225	23, 424	108, 225	172, 050
Kentucky	93, 600	109, 440	74, 825	91, 250	105, 000
Minnesota	74, 140	78, 177	96, 000	91, 000	64, 400
Mississippi	54, 150	56, 840	63, 000	58, 275	67, 450
Missouri	192, 400	243, 904	129, 062	158, 400	191, 750
Nebraska	155, 925	182, 616	114, 150	173, 950	213, 000
North Carolina	49, 680	51, 106	55, 282	57, 550	60, 900
Ohio	150, 540	174, 410	146, 250	142, 715	153, 550
Oklahoma	36, 888	101, 878	52, 250	50, 000	112, 100
Pennsylvania	63, 858	61, 582	57, 057	62, 178	58, 520
South Dakota	50, 820	76, 347	67, 320	78, 000	94, 250
Tennessee	91, 120	88, 298	68, 675	80, 400	93, 150
Texas	69, 350	153, 300	163, 200	124, 800	166, 850
Virginia	47, 520	47, 520	51, 480	39, 380	60, 562
Wisconsin	58, 080	58, 262	66, 825	69, 862	40, 825

State.	1916	1917	1918	1919	1920
United States	2, 566, 927	3, 065, 233	2, 502, 665	2, 858, 509	3, 232, 367
Alabama	47, 812	77, 200	63, 919	62, 843	67, 149
Georgia	62, 000	72, 000	68, 850	69, 890	76, 500
Illinois	300, 900	418, 000	344, 350	294, 000	294, 168
Indiana	174, 658	196, 776	165, 000	166, 500	184, 072
Iowa	366, 825	410, 700	352, 800	416, 000	473, 800
Kansas	69, 500	119, 028	43, 523	62, 320	137, 535
Kentucky	95, 200	114, 975	91, 000	82, 500	100, 650
Minnesota	87, 100	91, 800	111, 200	116, 000	118, 125
Mississippi	47, 600	77, 613	66, 300	59, 700	63, 680
Missouri	132, 112	241, 500	133, 860	152, 550	198, 880
Nebraska	192, 400	249, 480	123, 086	184, 186	255, 528
North Carolina	48, 100	58, 400	63, 630	53, 200	64, 032
Ohio	113, 400	150, 100	129, 600	161, 392	162, 099
Oklahoma	53, 325	33, 150	23, 250	69, 600	89, 320
Pennsylvania	56, 550	61, 425	59, 160	72, 192	67, 050
South Dakota	84, 075	93, 800	105, 400	91, 200	105, 600
Tennessee	78, 000	104, 400	78, 000	70, 620	93, 100
Texas	129, 200	75, 900	65, 000	195, 000	174, 200
Virginia	58, 800	56, 700	44, 800	46, 760	50, 100
Wisconsin	60, 840	42, 196	68, 742	86, 715	86, 044

TABLE 175.—*Corn: Yearly production and disposition of crop, United States, 1910 to 1920.*

[In millions of bushels; i. e., 000,000 omitted.]

Year.	Acreage.	Production.	Merchantable production.	Shipped out of county where grown.	Consumed in county where grown.	On farms following Mar. 1.	On farms following Nov. 1.	Domestic exports, including corn meal, fiscal year beginning July 1.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1910	104	2, 886	2, 493	662	2, 216	1, 165	124	66
1911	106	2, 531	2, 028	518	2, 073	884	65	42
1912	107	3, 125	2, 655	681	2, 371	1, 291	138	51
1913	106	2, 447	1, 961	422	2, 083	866	80	11
1914	103	2, 673	2, 260	498	2, 159	911	96	51
1915	106	2, 995	2, 128	561	2, 442	1, 117	88	40
1916	105	2, 567	2, 154	451	2, 170	782	34	67
1917	117	3, 065	1, 838	678	2, 307	1, 253	115	49
1918	104	2, 503	2, 062	363	2, 185	855	70	23
1919	100	2, 917	2, 535	474	....	1, 092	142	17
1920	105	3, 232	....	....	....	....	....	....

TABLE 176.—*Corn: Yearly production in foreign countries, 1901 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

Country.	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Canada	25,621	21,159	30,211	20,880	20,923	23,989	23,276	22,873	19,263	18,718
Mexico	93,459	78,099	90,879	88,131	86,544	110,065	100,000	150,000	170,000	190,766
Argentina	98,842	84,018	148,948	175,189	140,708	194,912	71,768	136,055	177,155	175,187
Chile	1,500	866	1,118	1,477	1,244	846	1,500	1,344	1,178	1,378
Uruguay	5,576	5,060	5,289	3,035	4,417	3,226	5,359	4,004	6,671	6,514
Austria-Hungary	175,193	139,126	183,994	89,757	139,307	210,472	196,620	190,649	210,241	240,196
Bulgaria	25,000	18,109	22,836	12,758	18,141	27,780	14,080	20,717	20,472	28,360
France	26,393	24,928	25,360	19,482	24,030	14,581	24,027	26,247	26,075	23,399
Italy	100,455	71,028	88,990	93,640	97,266	93,007	88,513	95,953	99,289	101,722
Portugal	15,000	16,000	14,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Roumania	116,945	68,447	80,272	19,598	59,275	130,546	57,576	78,892	70,138	103,665
Russian Empire	68,394	48,647	50,732	26,032	33,331	70,501	50,764	61,112	39,598	77,182
Serbia	18,849	18,396	19,479	9,498	21,431	27,786	17,691	21,010	34,453	33,204
Spain	25,759	25,272	18,759	21,300	31,880	18,714	25,372	20,115	26,433	27,366
Africa	37,208	36,899	36,118	38,862	50,810	50,844	55,702	85,402	85,426	90,850
Australia	10,169	7,846	5,615	10,519	8,880	9,262	10,912	8,907	9,644	11,863
Grand total	844,363	663,900	822,600	645,158	753,187	1,001,531	758,160	938,280	1,011,036	1,145,370

Country.	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Canada	19,185	16,950	16,773	13,924	14,368	6,282	7,763	14,205	16,940	14,335
Mexico	190,000	190,000	82,519	78,443	60,000	110,065	(1)	75,985	(1)	....
Argentina	27,675	295,849	196,642	263,135	338,235	161,133	58,839	170,660	240,144	258,686
Chile	1,221	1,527	1,647	1,505	1,842	1,570	1,338	1,446	1,702	1,689
Uruguay	3,643	7,963	5,343	7,142	11,382	4,604	6,815	7,086	6,574	2,784
Austria-Hungary	181,701	224,373	226,492	215,079	220,600	220,600	2,810	2,291	2,115	48,319
Bulgaria	30,589	28,475	33,200	30,901	29,821	17,471	17,780	8,144	39,412	39,650
France	16,860	23,753	21,078	22,530	17,104	16,636	14,902	9,760	9,976	16,793
Italy	93,680	98,668	108,388	104,966	121,824	81,547	82,771	76,590	85,846	86,661
Portugal	15,000	15,000	15,000	15,000	9,275	9,275	....	(1)	(1)	....
Roumania	110,712	103,921	114,662	102,552	86,412	86,412	....	(1)	137,412	92,950
Russian Empire	81,929	79,608	72,793	80,911	63,183	80,727	....	(1)	(1)	....
Serbia	26,531	22,833	23,621	20,000	12,000	12,000	....	(1)	(1)	....
Spain	28,730	25,069	25,140	30,325	29,096	28,642	29,369	24,141	25,555	27,692
Asia	8,843	11,612	100,034	100,449	102,055	118,265	110,992	111,628	(1)	....
Africa	99,287	92,061	88,268	109,433	76,760	94,666	100,575	45,143	41,525	....
Australia	13,933	9,500	8,841	9,173	8,455	6,792	8,526	8,843	6,912	....
Grand total.	949,519	1,247,142	1,140,441	1,205,468	1,202,412	1,056,687	442,480	555,922	614,113	589,559

[1] No official statistics.

TABLE 177.—*Corn: Yearly exports by principal exporting countries, 1901 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

Country.	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Argentina	43,789	46,960	82,846	97,222	87,488	106,048	50,262	67,390	89,499	104,727
Austria-Hungary	512	3,011	311	174	63	22	120	382	48	1,069
Belgium	4,657	4,347	6,580	6,288	8,078	6,589	7,645	6,135	7,088	7,582
British South Africa	....	....	....	....	....	....	1,667	1,686	5,469	6,517
Bulgaria	9,883	7,883	5,089	9,763	3,870	5,659	10,225	4,394	5,009	4,823
Netherlands	5,606	4,726	5,373	4,449	4,279	6,010	8,216	6,957	7,309	5,101
Roumania	45,724	43,013	31,080	18,042	1,441	23,756	54,721	28,960	29,092	23,419
Russia	19,160	44,149	25,350	18,634	7,372	9,880	38,636	23,545	26,536	17,686
Serbia	1,790	1,092	172	130	806	1,755	4,046	1,934	3,767	6,695
United States	28,029	76,639	94,467	47,896	113,189	105,259	86,524	39,013	38,114	44,072
Uruguay	929	704	1,004	2,002	28,519	10	[1] 89	20	776	192
Other countries	1,021	1,528	602	346	4,200	2,713	3,547	7,769	8,041	5,660
Total	161,099	234,051	252,873	204,947	230,815	267,701	265,698	188,185	220,748	227,543

[1] Year beginning July 1.

TABLE 177.—*Corn: Yearly exports by principal exporting countries, 1901 to 1920*—Contd.

Country.	1911	1912	1913	1914	1915	1916	1917	1918	1919
Argentina	4,928	190,353	189,240	139,461	170,490	113,143	35,194	26,171	97,851
Austria-Hungary	156	38	30	......	......	......	......	......	......
Belgium	8,846	10,999	6,134	......	......	......	......	......	612
British South Africa	3,892	3,756	741	4,926	6,930	6,748	11,284	13,507	13,582
Bulgaria	13,980	11,362	11,362	......	......	......	......	......	......
Netherlands	5,939	13,557	11,846	4,345	808	......	......	......	38
Roumania	61,233	42,725	42,725	41,804	......	......	......	......	26
Russia	52,759	30,289	22,900	11,275	53	97	......	......	......
Serbia	4,627	[1] 4,627	......	......	......	......	......	......	......
United States	63,533	32,627	46,923	17,018	50,223	55,237	57,011	47,059	16,002
Uruguay	19	14	14	3	93	14	5	......	......
Other countries	5,076	6,538	7,225	10,997	11,588	9,593	7,970	5,349	......
Total	224,988	346,885	343,767	229,829	240,185	184,832	111,464	92,086	128,111

[1] Year preceding.

TABLE 178.—*Corn: Imports by principal importing countries, 1901 to 1919.*

[In thousands of bushels, i. e., 000 omitted.]

Country.	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Austria-Hungary	8,647	5,875	11,130	14,090	18,511	7,199	4,003	3,107	4,051	2,494
Belgium	14,955	14,583	20,324	19,474	24,170	20,126	23,506	19,158	22,100	25,036
British South Africa	4,475	3,250	5,668	2,660	3,449	316	35	133	155	69
Canada	......	7,155	13,075	8,896	11,899	12,714	16,188	6,813	7,564	10,767
Cuba	1,486	1,150	619	697	1,843	2,489	3,153	1,838	2,250	3,002
Denmark	11,989	12,355	8,772	9,285	10,859	18,856	17,855	10,445	9,152	7,217
Egypt	427	55	143	53	1,280	1,438	197	845	749	83
France	11,612	8,675	11,347	10,124	11,122	14,509	16,850	9,630	11,213	15,335
Germany [1]	46,979	35,454	37,527	30,451	36,538	44,883	49,293	26,372	27,834	22,563
Italy	9,985	8,217	15,093	8,365	5,903	8,667	2,815	2,973	8,460	15,756
Mexico	963	142	496	121	1,115	1,882	1,554	179	1,168	8,907
Netherland	18,636	15,817	20,160	16,547	16,235	25,305	29,192	25,261	22,914	21,512
Norway	744	637	765	556	545	718	1,938	810	965	789
Portugal	424	760	367	532	2,724	371	578	2,015	2,368	518
Russia	352	136	458	626	164	456	551	356	213	181
Spain	2,638	993	1,484	2,761	1,904	2,648	4,552	3,320	6,411	7,526
Sweden	586	192	189	235	491	565	331	488	272	277
Switzerland	2,130	2,405	2,611	2,704	2,498	2,887	2,868	2,480	3,143	3,605
United Kingdom	105,819	89,371	101,285	86,077	84,156	97,737	106,708	68,186	78,057	73,487
Other countries	6,939	3,260	7,326	3,306	7,432	4,812	3,163	2,909	3,493	1,773
Total	249,786	210,483	258,874	217,561	242,840	268,579	285,328	187,319	212,532	220,917

Countries.	1911	1912	1913	1914	1915	1916	1917	1918	1919
Austria-Hungary	7,886	29,108	25,844	......	......	......	......	......	......
Belgium	24,814	32,021	25,036	......	......	......	......	......	1,483
British South Africa	29	114	818	52	340	132	196	56	86
Canada	16,440	9,331	9,041	8,347	10,980	8,832	8,101	11,757	6,459
Cuba	2,388	2,890	3,198	2,890	3,242	3,810	2,634	1,672	......
Denmark	11,085	13,809	15,938	10,399	27,354	17,767	9,508	105	......
Egypt	227	110	1,184	687	2	......	44	5	22
France	19,742	23,951	23,279	16,331	17,582	28,379	6,349	6,748	6,921
Germany	29,267	44,973	36,165	......	......	......	......	......	......
Italy	15,118	21,294	13,847	3,313	7,842	2,184	7,935	10,856	8,232
Mexico	9,050	1,548	1,548	......	......	......	......	......	......
Netherlands	25,743	38,262	39,467	25,674	43,338	27,514	8,528	346	9,635
Norway	1,019	1,471	1,149	1,672	1,925	1,889	1,305	2,531	......
Portugal	418	952	4,114	3,105	471	443	693	......	......
Russia	339	279	662	576	53	......	......	......	......
Spain	5,685	6,851	22,403	7,960	8,134	4,248	2,179	383	2,509
Sweden	460	3,975	2,395	2,195	8,292	2,023	1,212	1,374	3,199
Switzerland	4,059	4,342	4,785	3,068	4,461	4,767	3,241	652	5,274
United Kingdom	77,449	88,166	97,721	75,499	92,226	68,759	53,802	32,275	38,987
Other countries	3,258	5,668	9,422	4,866	5,003	4,241	1,983	926	......
Total	254,476	329,115	238,016	182,455	237,744	177,143	109,364	71,676	82,807

[1] Not including free ports prior to Mar. 1, 1906.

TABLE 179.—*Oats: Monthly and yearly average price per bushel of reported sales of No. 3 white, Chicago, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	$0.35	$0.41	$0.33	$0.42	$0.42	$0.41	$0.44	$0.61	$0.70	$0.73	$0.70	$0.48
September	.34	.45	.33	.43	.48	.34	.46	.60	.72	.68	.62	.49
October	.32	.47	.33	.40	.46	.36	.49	.60	.69	.70	.54	.48
November	.32	.48	.32	.40	.48	.36	.55	.65	.72	.73	.51	.50
December	.32	.47	.33	.40	.49	.42	.53	.77	.72	.82	.48	.53
January	.33	.50	.33	.39	.53	.48	.57	.82	.65	.86	....	.55
February	.31	.52	.33	.39	.58	.45	.56	.89	.58	.86	....	.55
March	.31	.53	.32	.39	.57	.42	.61	.93	.63	.93	....	.56
April	.32	.57	.35	.39	.57	.44	.69	.89	.70	1.01	....	.59
May	.34	.55	.38	.40	.54	.43	.70	.77	.69	1.09	....	.59
June	.39	.53	.40	.40	.49	.39	.67	.77	.70	1.13	....	.59
July	.44	.49	.40	.37	.53	.41	.78	.77	.78	.91	....	.59
Weighted average	.33	.50	.35	.40	.50	.41	.54	.71	.70	.80	....	.52

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 180.—*Oats: Ratio of price of No. 3 yellow corn to No. 3 white oats, Chicago, 1910–11 to 1920–21.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	....	1.6	2.3	1.8	2.0	2.0	1.9	3.4	2.5	2.6	2.3	2.5
September	....	1.5	2.2	1.7	1.6	2.2	1.9	3.5	2.2	2.2	2.1	2.1
October	....	1.6	2.0	1.8	1.6	1.8	2.0	3.4	2.0	2.0	1.7	2.0
November	1.5	1.4	1.6	1.8	1.4	1.8	1.8	3.4	1.8	2.0	1.5	1.9
December	1.4	1.3	1.4	1.7	1.3	1.6	1.7	2.3	2.0	1.8	1.5	1.7
January	1.4	1.2	1.4	1.6	1.3	1.5	1.7	2.2	2.2	1.8	....	1.7
February	1.5	1.2	1.5	1.6	1.3	1.6	1.8	2.0	2.3	1.7	....	1.7
March	1.5	1.3	1.5	1.6	1.3	1.7	1.8	1.8	2.4	1.7	....	1.7
April	1.6	1.4	1.6	1.7	1.3	1.7	2.0	1.9	2.3	1.7	....	1.8
May	1.6	1.4	1.5	1.8	1.4	1.7	2.3	2.1	2.5	1.9	....	1.9
June	1.4	1.4	1.5	1.8	1.5	1.9	2.5	2.1	2.5	1.7	....	1.9
July	1.4	1.4	1.6	1.9	1.5	2.0	2.6	2.2	2.5	1.7	....	1.9
Ratio of weighted averages	1.6	1.4	1.5	1.8	1.4	1.9	2.1	2.3	2.3	2.0	....	....
Quality of oats	93.8	84.6	91.0	89.1	86.5	87.5	88.2	95.1	93.6	84.7	....	....
Weight per bushel of oats	32.7	31.1	33.0	32.1	31.5	33.0	31.2	33.4	33.2	31.1	....	....

TABLE 181.—*Oats: Monthly and yearly farm price per bushel, United States, 1910–11 to 1920–21.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	$0.40	$0.40	$0.40	$0.39	$0.40	$0.42	$0.42	$0.68	$0.72	$0.74	$0.76	$0.50
September	.37	.41	.34	.39	.43	.37	.44	.62	.71	.70	.65	.48
October	.36	.43	.34	.39	.43	.35	.47	.62	.70	.69	.58	.48
November	.35	.44	.33	.39	.43	.36	.51	.64	.70	.70	.51	.49
December	.34	.45	.32	.39	.44	.38	.52	.70	.71	.75	.46	.50
January	.33	.46	.32	.39	.48	.42	.53	.76	.68	.80	....	.52
February	.33	.49	.33	.39	.51	.44	.56	.82	.63	.84	....	.53
March	.33	.51	.33	.39	.53	.42	.59	.88	.64	.88	....	.55
April	.33	.54	.34	.40	.53	.42	.66	.87	.68	.95	....	.57
May	.34	.56	.35	.40	.52	.42	.70	.82	.71	1.01	....	.58
June	.36	.54	.37	.39	.49	.41	.69	.77	.71	1.04	....	.58
July	.39	.48	.38	.38	.46	.40	.71	.75	.73	.93	....	.56
Crop year average	.35	.48	.35	.39	.47	.40	.57	.74	.69	.84	....	.53

TABLE 182.—*Oats: Monthly receipts at primary markets, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	36,970	20,940	26,577	30,800	41,763	28,032	53,337	35,958	46,699	27,468	25,943	34,854
September	16,394	14,860	31,630	28,926	33,486	33,925	36,510	38,209	33,855	17,225	29,540	28,502
October	16,325	16,548	31,648	22,557	35,213	29,678	38,789	36,706	29,223	21,199	18,952	27,789
November	12,312	10,257	26,037	16,238	23,617	35,290	26,141	32,999	27,908	16,156	13,227	22,696
December	17,778	12,907	20,042	18,791	23,372	25,041	18,588	22,481	30,168	13,845	12,408	20,301
January	13,858	9,787	21,586	17,800	22,175	24,773	17,317	19,773	21,095	17,792	....	18,596
February	10,638	14,351	17,939	13,312	19,967	23,778	13,967	24,804	14,004	18,146	....	17,091
March	10,960	13,600	15,497	19,220	21,993	17,593	22,920	30,968	14,765	16,872	....	18,439
April	9,297	11,963	14,266	12,465	15,308	19,263	21,960	33,815	17,376	11,305	....	16,702
May	15,118	12,712	17,101	13,730	12,326	29,615	18,133	20,004	16,758	14,665	....	17,061
June	16,467	10,808	26,816	19,235	11,892	17,858	17,411	17,601	24,139	12,873	....	17,510
July	13,837	10,075	20,181	19,308	13,361	19,661	16,906	25,192	23,737	16,781	....	17,804
Crop year total	189,954	158,808	269,320	232,382	274,473	304,507	301,979	338,510	298,727	204,327	....	257,293

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 183.—*Oats: Visible supply in United States, first of each month, 1910–11 to 1920–21* [1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	2,761	11,203	1,031	17,131	6,482	1,309	8,537	6,679	7,876	20,481	3,786	8,349
September	12,551	20,742	4,160	24,662	20,124	2,924	27,691	7,277	19,309	19,411	8,149	15,885
October	18,802	21,044	9,260	30,718	27,285	14,381	38,866	14,165	24,689	19,552	27,602	21,876
November	17,022	22,600	10,552	31,684	31,866	15,730	45,580	17,453	22,050	19,196	34,414	23,373
December	15,502	20,315	10,774	29,664	32,471	20,928	47,467	18,595	29,143	16,922	33,961	24,178
January	16,129	18,754	8,457	26,909	32,956	21,081	48,823	17,657	34,828	13,080	....	23,867
February	15,997	15,431	9,646	24,450	33,173	20,175	42,675	13,879	30,505	11,550	....	21,748
March	15,769	14,366	12,343	21,489	33,258	20,265	36,740	13,947	27,666	10,401	....	20,624
April	13,129	13,429	13,115	19,755	27,284	17,892	34,191	18,098	22,882	9,576	....	18,935
May	10,559	11,991	8,704	13,262	23,022	12,096	28,933	21,911	21,507	6,813	....	15,880
June	8,125	8,052	8,105	8,144	12,623	16,192	17,454	20,822	15,827	8,642	....	12,398
July	9,570	3,690	14,756	7,210	4,345	12,452	9,741	13,227	18,094	3,623	....	9,670

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 184.—*Oats: Monthly and yearly shipments from primary markets, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	14,962	10,734	14,842	15,446	22,321	15,200	25,179	20,045	22,479	17,138	11,909	17,529
September	13,556	9,035	22,725	19,686	27,237	27,934	22,042	28,829	24,484	14,898	12,698	20,957
October	14,221	10,476	26,233	19,966	27,298	22,516	24,672	25,821	22,608	16,124	10,722	20,644
November	12,135	8,416	25,348	16,261	22,520	28,951	24,213	25,711	26,313	14,772	9,586	20,209
December	11,895	9,786	16,534	19,040	19,774	20,161	16,908	19,934	24,141	12,200	9,357	16,784
January	13,306	9,516	18,520	19,972	20,630	19,768	12,255	15,877	18,887	14,749	....	16,348
February	10,469	10,911	13,480	13,434	18,157	20,358	12,795	15,635	13,076	12,102	....	14,042
March	11,985	13,917	14,607	19,386	24,698	19,121	19,935	20,802	15,076	13,903	....	17,343
April	10,706	14,083	14,185	13,166	22,769	20,437	27,901	28,329	14,801	8,047	....	18,042
May	13,629	12,893	15,490	18,621	21,553	27,584	22,552	22,637	16,066	9,820	....	18,085
June	16,896	11,600	15,599	18,456	13,002	20,243	21,570	33,571	16,689	13,381	....	18,101
July	12,780	9,725	15,970	17,366	11,736	18,069	16,421	17,526	14,742	11,111	....	14,545
Crop year total	156,540	131,092	213,533	216,800	251,695	260,342	246,443	274,717	229,362	158,245	....	213,877

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 185.—*Oats: Monthly and yearly receipts at Chicago, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	24, 373	13, 318	14, 550	13, 896	23, 729	16, 749	31, 715	14, 924	22, 765	12, 318	10, 687	18, 834
September	7, 191	8, 309	17, 674	12, 930	16, 715	18, 172	14, 271	14, 767	11, 417	8, 940	9, 697	13, 039
October	7, 706	9, 206	17, 857	8, 962	17, 873	12, 416	18, 161	13, 723	10, 942	9, 385	6, 511	11, 623
November	6, 866	5, 438	13, 506	6, 852	11, 844	16, 337	12, 353	13, 634	10, 957	5, 515	4, 473	10, 330
December	10, 293	6, 256	9, 805	8, 053	13, 194	10, 243	8, 461	8, 743	12, 472	5, 620	5, 134	9, 314
January	8, 860	5, 241	11, 327	8, 109	11, 689	12, 892	7, 758	5, 682	6, 606	7, 069	....	8, 523
February	5, 871	7, 063	9, 063	6, 594	11, 416	11, 689	6, 964	8, 773	4, 346	6, 841	....	7, 862
March	5, 610	7, 442	8, 305	8, 263	11, 569	8, 587	10, 692	9, 699	3, 719	5, 568	....	7, 945
April	5, 553	6, 146	7, 640	5, 895	6, 712	9, 456	9, 724	13, 606	5, 527	2, 691	....	7, 295
May	8, 873	7, 376	10, 788	6, 358	5, 526	17, 041	8, 596	9, 030	5, 838	4, 592	....	8, 402
June	9, 761	5, 979	16, 583	9, 203	6, 060	9, 208	8, 452	8, 208	10, 113	6, 303	....	8, 987
July	6, 945	5, 849	10, 005	10, 623	7, 486	8, 378	7, 928	13, 521	11, 012	7, 299	....	8, 905
Crop year total	107, 902	87, 623	177, 103	105, 738	143, 813	151, 168	145, 075	134, 310	115, 714	82, 141	....	125, 059

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 186.—*Oats: Visible supply at Chicago, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	1, 078	5, 578	359	8, 999	3, 613	338	3, 495	289	1, 734	6, 805	1, 009	3, 229
September	14, 025	10, 231	1, 834	11, 893	10, 211	2, 130	15, 985	2, 049	8, 839	6, 898	3, 547	8, 410
October	5, 960	10, 842	2, 049	14, 396	10, 385	4, 688	18, 118	3, 716	8, 389	7, 127	10, 574	8, 567
November	5, 522	10, 913	2, 345	14, 308	12, 305	4, 268	21, 298	3, 801	6, 129	7, 057	12, 881	8, 795
December	4, 589	9, 985	2, 413	13, 690	12, 706	6, 367	20, 979	4, 711	5, 981	4, 927	11, 835	8, 635
January	10, 750	8, 296	2, 167	11, 380	13, 690	6, 863	21, 846	6, 101	7, 285	3, 594	....	9, 197
February	10, 989	6, 872	3, 054	10, 939	14, 695	6, 115	21, 345	5, 913	6, 404	3, 515	....	8, 984
March	10, 261	6, 660	4, 576	10, 074	14, 503	7, 353	19, 838	6, 229	6, 781	3, 643	....	8, 992
April	8, 854	6, 012	4, 388	8, 566	13, 013	6, 747	18, 146	6, 617	3, 924	3, 014	....	7, 928
May	7, 417	4, 445	3, 896	6, 093	10, 020	3, 001	9, 225	3, 447	3, 994	2, 375	....	5, 391
June	7, 550	3, 858	4, 384	3, 405	3, 514	6, 890	4, 919	3, 436	2, 764	2, 425	....	4, 315
July	9, 279	1, 158	9, 213	2, 644	1, 067	4, 848	1, 511	2, 423	5, 147	1, 258	....	3, 855

[1] From Howard Bartel's Red Book.

TABLE 187.—*Oats: Monthly and yearly shipments from Chicago, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	8, 512	6, 691	7, 666	8, 152	12, 230	9, 281	11, 826	8, 167	9, 360	8, 321	4, 566	9, 021
September	8, 467	5, 073	14, 084	8, 630	17, 185	15, 579	11, 012	11, 096	8, 730	6, 506	3, 985	1, 064
October	7, 984	5, 550	14, 642	8, 278	13, 179	10, 547	10, 502	9, 208	6, 914	7, 863	3, 235	9, 467
November	6, 887	4, 250	13, 476	6, 372	11, 988	12, 850	10, 807	9, 257	9, 435	6, 761	3, 588	9, 208
December	6, 730	4, 721	8, 403	8, 649	10, 176	8, 023	6, 392	6, 144	9, 683	4, 991	3, 937	7, 391
January	7, 926	4, 561	9, 124	8, 385	10, 839	9, 430	4, 435	3, 423	5, 975	5, 618	....	6, 972
February	5, 450	4, 956	6, 565	5, 697	9, 905	9, 255	4, 968	4, 073	3, 495	3, 645	....	5, 801
March	6, 857	6, 964	8, 201	8, 618	12, 605	7, 692	7, 928	5, 924	5, 303	4, 679	....	7, 477
April	6, 133	7, 472	7, 018	7, 849	8, 924	10, 018	14, 304	10, 736	5, 138	1, 740	....	7, 933
May	8, 285	6, 657	8, 208	9, 263	10, 397	12, 539	10, 384	7, 436	7, 032	2, 442	....	8, 204
June	8, 653	7, 107	9, 235	9, 160	6, 724	8, 994	8, 860	3, 162	6, 211	3, 993	....	7, 210
July	7, 821	6, 088	9, 653	9, 088	6, 786	8, 072	6, 734	8, 099	6, 443	4, 233	....	7, 302
Crop year total	89, 705	70, 090	116, 275	98, 141	130, 938	122, 280	108, 152	86, 725	83, 719	60, 792	....	96, 682

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 188.—*Oats: Monthly and yearly receipts at Minneapolis, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	2,284	833	1,374	3,406	2,479	1,360	5,049	1,946	3,808	2,821	2,544	2,536
September	3,955	1,124	2,053	3,765	3,686	4,192	6,903	5,715	5,764	2,465	4,298	3,962
October	2,427	846	2,533	3,288	4,100	7,125	4,797	5,459	4,168	2,408	3,896	3,715
November	1,267	1,073	1,799	2,292	2,352	6,841	3,825	4,307	3,591	1,395	2,243	2,874
December	2,064	1,139	2,505	3,045	2,399	5,999	1,690	2,898	5,041	1,179	1,702	2,796
January	959	955	1,637	1,435	1,458	2,481	1,523	3,940	3,239	1,250	....	1,888
February	1,041	1,452	1,283	1,070	1,640	3,417	1,390	3,616	1,883	1,254	....	1,805
March	1,224	974	1,336	1,155	2,049	3,369	2,371	6,656	1,823	1,114	....	2,207
April	770	668	1,142	845	870	2,898	1,474	3,046	1,591	1,003	....	1,431
May	720	543	596	936	654	2,213	952	1,268	1,611	949	....	1,044
June	1,046	514	1,166	875	679	2,629	695	1,789	2,183	769	....	1,234
July	662	434	1,607	883	676	3,254	653	1,377	2,329	897	....	1,277
Crop year total	18,419	10,555	19,031	22,995	23,042	45,778	31,322	42,017	37,031	17,504	....	26,769

[1] Compiled from Minneapolis Chamber of Commerce Reports, and Daily Market Record.

TABLE 189.—*Oats: Visible supply at Minneapolis, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	210	376	27	974	92	9	250	5	566	3,169	286	268
September	1,146	575	125	1,778	801	216	1,926	227	924	3,550	1,715	1,127
October	2,932	1,175	467	3,124	2,751	987	5,628	1,007	2,854	4,142	3,500	2,507
November	3,290	1,709	788	3,356	3,959	2,190	6,945	2,053	1,867	4,265	5,936	3,042
December	2,879	1,970	634	3,452	4,482	3,367	7,038	2,716	1,254	4,262	7,282	3,205
January	3,049	1,982	783	3,157	4,554	3,406	7,158	1,259	882	3,802	....	3,003
February	2,797	1,756	1,043	2,584	4,267	3,288	7,004	1,519	770	3,204	....	2,823
March	2,281	1,795	1,112	2,219	4,005	3,413	6,706	1,617	590	3,000	....	2,674
April	1,724	1,258	1,383	1,749	2,019	3,165	6,613	1,481	1,272	2,657	....	2,332
May	1,067	763	790	947	1,233	2,221	6,119	1,012	2,461	2,109	....	1,872
June	553	334	116	570	522	1,784	4,485	507	2,056	1,667	....	1,259
July	515	205	179	197	134	665	1,020	382	2,580	480	....	636

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 190.—*Oats: Monthly and yearly receipts at Kansas City, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	762	588	845	1,828	993	420	789	2,824	2,774	1,197	899	1,302
September	595	692	694	1,076	901	527	1,797	2,445	3,065	622	896	1,241
October	558	525	763	1,379	741	665	2,016	2,156	891	794	886	1,049
November	350	486	753	838	748	525	838	1,948	751	672	724	791
December	585	510	411	816	488	644	420	1,346	442	456	275	612
January	369	510	794	918	461	357	592	1,261	1,556	677	....	750
February	432	714	697	728	729	464	367	1,537	1,352	1,034	....	803
March	428	510	461	1,302	520	258	513	1,518	1,396	757	....	766
April	376	469	666	757	544	308	833	966	1,482	189	....	659
May	468	410	602	486	444	214	723	1,071	1,301	384	....	610
June	549	284	520	694	269	209	394	636	959	289	....	480
July	808	320	498	503	500	311	777	636	719	544	....	562
Crop year total	6,280	6,018	7,704	11,325	7,338	4,882	10,059	18,344	16,688	7,615	....	9,625

[1] From Annual Report of Kansas City Board of Trade.

TABLE 191.—*Oats: Visible supply at Kansas City, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	61	196	16	243	17	78	250	44	295	828	64	203
September	205	286	240	746	290	66	546	365	1,350	1,058	439	515
October	205	228	55	989	681	172	1,418	828	3,276	......	622	785
November	253	219	37	1,252	795	378	3,566	1,295	2,446	1,169	1,307	1,141
December	194	245	62	1,264	952	607	3,864	1,189	2,243	1,018	1,500	1,164
January	279	269	68	1,178	1,000	771	3,705	1,121	1,844	896	......	1,113
February	172	119	91	1,043	824	877	3,586	871	1,631	644	......	986
March	133	134	88	901	814	764	2,667	947	1,619	382	......	845
April	111	201	81	810	549	668	1,399	1,624	1,180	430	......	705
May	87	105	83	576	439	592	881	1,171	1,071	347	......	535
June	83	84	53	178	338	351	247	818	799	177	......	313
July	84	46	165	67	188	287	32	567	710	62	......	221

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 192.—*Oats: Yearly average receipts, shipments, and local consumption at 10 primary markets for 5-year period, 1913 to 1917.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Market.	Receipts.	Shipments.	Local consumption.	Per cent of local receipts consumed.
Chicago	136,687	113,130	23,557	17.2
St. Louis	23,758	18,147	5,611	23.6
Indianapolis	16,267	11,405	4,862	29.9
Milwaukee	28,155	25,563	2,592	9.2
Kansas City	9,712	7,539	2,173	22.4
Cincinnati	7,014	5,410	1,604	22.9
Peoria	12,779	12,570	209	1.6
Minneapolis	30,446	30,562	[2] 116	......
Duluth	5,624	5,683	[2] 59	......
Omaha	15,846	15,857	[2] 11	......
Total	286,288	245,866	40,422	14.1

[1] From Federal Trade Commission.
[2] "Shipments" exceed "receipts" due to inconsistencies in collecting figures published or to decreases in stocks carried over.

TABLE 193.—*Oats: Graded by licensed inspectors, all inspection points, July, 1919 to December, 1920.*

(In carloads.)

ALL CLASSES.

Period.	Inspected receipts by grade.						Inspected shipments by grade.					
	No. 1.	No. 2.	No. 3.	No. 4.	Sample.	Total.	No. 1.	No. 2.	No. 3.	No. 4.	Sample.	Total.
July-December, 1919	3,132	28,711	55,520	12,728	2,642	102,733	1,456	22,986	39,551	3,319	395	67,707
January-June, 1920	2,643	24,445	41,019	5,401	1,150	74,658	1,693	17,269	26,117	1,523	333	46,935
Total crop year	5,775	53,156	96,539	18,129	3,792	177,391	3,149	40,255	65,668	4,842	728	114,642
July-December, 1920	3,934	33,105	44,396	6,746	3,952	92,133	1,127	19,809	18,399	944	335	40,614

BY CLASSES AND GRADES, JULY, 1919, TO JUNE, 1920, INCLUSIVE.

Color:												
White	4,994	49,057	89,734	13,714	2,598	160,097	2,914	38,266	60,719	3,158	489	105,546
Red	295	1,897	5,415	3,918	845	12,370	104	1,103	4,363	1,562	91	7,223
Gray	97	109	68	64	45	383	2	9	5	2	......	18
Black	3	8	1	1	1	14	1	3	2	......	......	6
Mixed	386	2,085	1,321	432	303	4,527	128	874	579	120	148	1,849
Total crop year	5,775	53,156	96,539	18,129	3,792	177,391	3,149	40,255	65,668	4,842	728	114,642

TABLE 194.—*Oats: Monthly and yearly exports, from United States, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	63	60	620	52	1,420	3,202	10,301	12,522	11,523	4,673	671	4,444
September	45	29	6,226	319	10,780	7,934	6,176	4,644	14,952	5,267	875	5,637
October	378	206	9,268	31	9,324	7,668	8,771	11,334	7,503	3,905	442	5,839
November	44	327	7,376	22	7,091	7,390	6,327	11,591	7,660	2,820	477	5,065
December	82	148	5,626	39	5,207	6,618	7,168	11,407	8,565	3,432	466	4,829
January	42	72	2,052	31	4,979	5,922	7,793	8,283	10,145	1,757	....	4,108
February	93	140	1,049	122	8,553	8,062	5,392	7,565	5,818	1,155	....	3,795
March	140	188	295	83	9,482	10,509	4,947	5,388	2,908	3,104	....	3,704
April	175	111	357	94	16,549	8,375	5,436	9,085	2,071	1,394	....	4,365
May	450	489	593	609	13,039	12,538	7,638	11,436	3,757	1,559	....	5,211
June	267	213	251	244	10,324	8,867	10,600	7,207	6,165	545	....	4,468
July	188	46	214	60	8,834	8,396	5,374	15,294	4,334	432	....	4,317
Crop year total	1,967	2,029	33,927	1,706	105,582	95,481	85,923	115,756	85,401	30,043	....	55,782

[1] Monthly Summary of Foreign Commerce.

TABLE 195.—*Oats: Monthly and yearly exports of oatmeal and rolled oats from United States, 1910–11 to 1920–21.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	377	464	692	664	979	1,145	14,567	41,994	33,791	30,807	945	12,548
September	1,529	1,007	1,133	625	2,842	2,113	5,983	27,169	31,194	33,388	1,815	10,698
October	1,585	906	3,529	502	3,623	3,289	5,217	35,050	19,862	20,619	6,373	9,418
November	2,888	475	2,899	526	4,441	1,815	4,946	36,731	25,793	24,379	12,964	10,489
December	3,183	691	4,333	715	4,882	3,725	5,905	32,423	9,780	14,567	16,140	8,020
January	2,957	572	6,474	913	8,578	5,707	4,867	17,458	16,271	7,995	....	7,179
February	8,252	785	6,097	800	12,141	12,400	5,222	19,964	13,848	8,256	....	8,777
March	4,533	468	6,534	1,126	14,692	4,322	6,434	38,724	5,573	4,262	....	8,667
April	3,826	495	6,955	2,253	9,279	9,251	7,410	35,011	17,569	1,339	....	9,339
May	2,897	555	5,847	2,308	3,056	5,251	17,189	14,900	12,601	2,443	....	6,705
June	3,004	412	3,416	2,552	1,999	2,356	29,383	22,148	10,731	2,187	....	7,819
July	2,282	625	3,014	1,882	3,374	3,779	24,989	30,576	20,614	1,215	....	9,235
Crop year total	37,313	7,455	50,923	14,866	69,886	55,153	132,112	352,148	217,627	151,457	....	108,894

[1] Monthly Summary of Foreign Commerce.

TABLE 196.—*Oats: Yearly exports from United States by grand divisions of destination, 1910 to 1920.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Europe	471	915	1,087	29,652	1,210	91,640	90,856	85,450	81,738	50,404	9,554
North America	550	587	538	3,251	483	4,094	4,447	3,277	32,656	4,809	3,209
South America	58	70	40	53	36	36	72	48	69	26	20
Asia	1	1	8	23	2	6	3	1	[2]	2	46
Oceania	602	469	499	341	127	1,030	512	148	....	53	49
Africa	3	3	[2]	439	2	3	29	20	[2]	[2]	[2]
Total	1,685	2,045	2,172	33,759	1,860	96,809	95,919	88,944	114,463	55,294	....

[1] Monthly Summary of Foreign Commerce. Year ending June 30, 1910–17; calendar years 1918–20.
[2] Less than 500 bushels.

TABLE 197.—*Oats: Yearly production in United States and principal producing States, 1910 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

State.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
United States	1,186,341	922,298	1,418,337	1,121,768	1,141,060	1,549,030	1,251,837	1,592,740	1,538,124	1,231,754	1,526,055
Illinois	164,350	121,536	182,726	104,125	125,990	195,435	172,095	239,200	198,352	125,400	161,950
Indiana	59,472	47,068	79,799	36,380	44,888	65,520	52,500	84,924	85,050	56,000	76,875
Iowa	192,780	126,225	217,818	168,360	165,000	198,000	188,700	254,364	244,566	196,182	299,866
Kansas	55,778	30,000	55,040	34,320	58,960	39,750	36,425	70,804	51,238	44,229	68,799
Michigan	51,510	42,900	51,826	45,000	50,752	64,260	42,690	55,800	66,320	35,625	56,430
Minnesota	85,440	67,214	122,932	112,644	85,120	138,675	88,112	120,250	134,562	91,700	126,488
Missouri	40,320	17,760	37,125	26,500	25,800	31,850	32,250	59,200	44,196	45,225	54,138
Nebraska	70,896	34,750	55,510	59,625	69,600	70,400	79,875	115,444	56,188	69,962	83,040
New York	45,540	38,645	36,714	42,712	40,162	54,270	31,356	42,000	51,660	28,560	44,275
North Dakota	15,155	51,230	95,220	57,825	64,904	98,000	53,750	38,625	60,512	35,340	59,640
Ohio	65,844	54,570	93,280	54,360	50,325	69,003	48,076	78,100	74,800	51,020	71,339
Oklahoma	25,514	8,181	23,494	18,540	30,250	36,450	14,500	26,450	31,200	47,025	48,000
Pennsylvania	40,269	31,724	36,377	35,774	32,190	43,320	35,030	40,250	47,190	36,859	45,825
South Dakota	35,650	11,396	52,390	42,135	44,165	72,450	56,425	72,692	79,950	53,650	75,446
Texas	24,080	18,499	31,140	32,500	22,500	53,250	42,750	37,050	22,197	94,500	44,100
Wisconsin	67,050	67,050	84,746	83,038	62,100	97,650	81,400	99,000	110,815	78,423	107,878

TABLE 198.—*Oats: Yearly acreage, production, exports, etc., in United States, 1910 to 1920.*

[In thousands of acres or bushels; i. e., 000 omitted.]

Year.	Acreage.	Average yield per acre.	Production.	On farms.		Exports, including oatmeal, fiscal year beginning July 1.	
				Following Mar. 1.	Following Aug. 1.	Quantity.	Per cent of crop.
1910	37,548	31.6	1,186,341	365,438	64,200	3,846	0.32
1911	37,763	24.4	922,298	442,665	67,801	2,678	0.29
1912	37,917	37.4	1,418,337	289,989	34,875	36,455	2.57
1913	38,399	29.2	1,121,768	604,249	103,916	2,749	0.25
1914	38,442	29.7	1,141,060	419,481	62,467	100,609	8.82
1915	40,996	37.8	1,549,030	379,369	55,607	98,960	6.39
1916	41,527	30.1	1,251,837	598,148	113,728	95,106	7.60
1917	43,553	36.6	1,592,740	394,211	47,834	125,091	7.85
1918	44,349	34.7	1,538,124	599,208	81,424	109,005	7.09
1919	41,835	29.4	1,231,754	590,251	93,045	43,437	3.53
1920	43,323	35.2	1,526,055	422,814	56,420	....	....

TABLE 199.—*Oats: Yearly production other than United States, 1910 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

Country.	1910	1911	1912	1913	1914
Canada	323,449	365,179	391,629	404,669	313,078
Mexico	17	17	17	17	17
South America	39,494	49,643	74,374	81,098	57,268
Europe	2,501,518	2,353,295	2,593,959	2,907,339	2,310,573
Asia	80,258	65,972	94,698	120,141	161,593
Africa	22,180	25,831	24,079	31,767	[1] 10,689
Australasia	29,153	26,326	20,301	30,638	30,918
Total	2,996,069	2,886,263	3,199,057	3,575,669	2,893,797

Country.	1915	1916	1917	1918	1919	1920
Canada	523,684	410,211	403,012	426,312	394,387	530,710
Mexico	17	15	(2)	(2)	(2)	(2)
South America	57,434	83,913	39,499	75,509	38,300	61,320
Europe	2,103,339	2,267,431	....	....	....	....
Asia	85,244	84,244	....	....	....	....
Africa	28,188	[1] 15,207	27,048	37,506	26,522	14,925
Australasia	15,775	24,189	19,387	15,331	17,326	....
Total	2,813,683	2,886,213	....	....	....	....

[1] Not including Union of South Africa.
[2] No official statistics.

TABLE 200.—*Oats: Yearly exports, by principal exporting countries, 1911 to 1919.*

[In thousands of bushels; i. e., 000 omitted.]

Exported from—	1911	1912	1913	1914	1915	1916	1917	1918	1919
Algeria	....	....	3,888	4,554	4,122	7,740	2,153	6,900	5,426
Argentina	35,232	61,731	61,298	24,368	40,840	55,421	18,719	37,347	22,948
Bulgaria	488	173	173	....	....	....	....	....	....
Canada	8,357	9,660	31,732	20,174	18,496	72,058	59,791	24,024	16,346
China	437	515	285	324	324	70	229	70	
Chile	1,096	2,714	3,687	3,372	7,312	4,413	3,460	496	....
Denmark	79	179	194	168	2	4	2	1	....
Finland	453	390	456	350	237	9	....	....	....
Germany	20,411	26,538	45,584	....	....	....	....	....	....
Netherlands	28,995	41,316	31,131	14,441	34	18	(1)	(1)	127
Roumania	16,073	2,000	11,963	7,030	....	....	....	....	....
Russia	96,071	58,457	41,309	19,235	364	27	....	....	....
Sweden	1,936	361	4,730	2,310	(1)	478	(1)	(1)	36
United Kingdom	1,948	631	1,655	1,321	717	1,271	147	107	....
United States	2,126	30,374	5,275	36,656	108,195	105,838	113,614	131,085	67,570
Other countries	1,595	5,365	4,221	3,866	4,436	4,148	6,504	8,633	....
Total	215,297	240,404	247,581	138,169	185,079	251,495	204,619	208,663	....

[1] Less than 500 bushels.

TABLE 201.—*Oats: Yearly imports, by principal importing countries, 1911 to 1919.*

[In thousands of bushels; i. e., 000 omitted.]

Imported by—	1911	1912	1913	1914	1915	1916	1917	1918	1919
Austria-Hungary	8,190	1,042	1,047	....	....	....	....	....	....
Belgium	7,419	9,560	9,555	....	....	....	....	....	3,948
Denmark	4,244	3,911	4,224	3,740	217	8	67	(1)	....
Cuba	1,147	1,432	1,503	1,534	1,004	1,149	1,491	1,649	....
Finland	1,488	1,070	1,002	1,037	148	18	....	....	....
France	37,316	14,929	39,992	35,473	56,610	72,324	42,819	33,353	31,632
Germany	43,287	45,879	34,793	....	....	....	....	....	....
Italy	8,960	10,830	7,331	4,549	27,647	38,308	19,802	19,258	12,046
Netherlands	35,689	51,304	38,711	20,006	4,332	4,902	2,712	1	2,870
Norway	879	822	393	517	594	18	25	11	....
Philippine Islands	152	770	537	74	441	165	200	53	....
Russia	1,122	1,200	2,608	1,899	599	4	....	....	....
Sweden	7,031	6,703	4,431	4,922	2,086	12	8	365	1,571
Switzerland	12,586	12,661	12,205	10,235	6,913	7,320	3,372	2,142	6,334
United Kingdom	64,870	64,924	64,470	52,905	59,165	48,986	58,014	55,595	32,041
United States	100	3,263	13,309	9,429	364	545	1,985	1,444	609
Other countries	2,110	2,678	2,461	5,102	7,603	2,882	2,213	4,219	....
Total	236,590	232,978	238,572	151,422	167,723	176,681	132,706	118,090	....

[1] Less than 500 bushels.

TABLE 202.—*Barley: Monthly and yearly average price per bushel of No. 2, Minneapolis, 1910–11 to 1920–21.* [1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	$0.61	$0.85	$0.46	$0.58	$0.59	$0.59	$0.81	$1.31	$1.02	$1.33	$1.02	$0.82
September	.63	.94	.49	.61	.58	.48	.81	1.33	.95	1.27	.99	.81
October	.63	.95	.50	.56	.55	.51	1.03	1.28	.91	1.29	.92	.82
November	.66	.98	.47	.53	.59	.56	1.11	1.27	.94	1.33	.82	.84
December	.70	.91	.45	.50	.57	.61	1.07	1.49	.92	1.52	.74	.87
January	.77	1.05	.49	.52	.68	.70	1.17	1.56	.90	1.52	....	.94
February	.74	1.00	.48	.50	.75	.66	1.17	1.88	.87	1.37	....	.94
March	.81	.95	.46	.48	.70	.65	1.21	2.12	.93	1.51	....	.98
April	.88	1.01	.46	.47	.70	.68	1.36	1.82	1.09	1.60	....	1.01
May	.75	.99	.50	.48	.70	.70	1.48	1.46	1.13	1.74	....	.99
June	.77	.76	.52	.47	.66	.68	1.38	1.23	1.12	1.49	....	.91
July	.87	.60	.48	.45	.68	.69	1.49	1.18	1.21	1.16	....	.88
Crop year average	.74	.92	.48	.51	.65	.63	1.17	1.49	1.00	1.43	....	.90

[1] Compiled from Minneapolis Daily Market Record.

TABLE 203.—*Barley: Monthly and yearly average farm price per bushel, United States, 1910–11 to 1920–21.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	$0.56	$0.73	$0.60	$0.53	$0.49	$0.54	$0.66	$1.12	$1.05	$1.17	$1.13	$0.75
September	.57	.79	.54	.56	.52	.49	.75	1.12	.98	1.15	.98	.75
October	.56	.83	.51	.56	.52	.48	.80	1.13	.95	1.16	.86	.75
November	.57	.86	.52	.54	.53	.51	.86	1.13	.93	1.19	.76	.76
December	.59	.87	.50	.53	.54	.54	.88	1.20	.92	1.26	.68	.78
January	.62	.89	.51	.52	.59	.58	.90	1.29	.89	1.34	....	.81
February	.64	.91	.50	.52	.65	.61	.95	1.47	.86	1.33	....	.84
March	.66	.92	.49	.51	.66	.58	1.00	1.66	.89	1.35	....	.87
April	.72	.94	.48	.51	.64	.58	1.11	1.64	.98	1.43	....	.90
May	.74	.94	.51	.49	.63	.60	1.20	1.47	1.07	1.47	....	.91
June	.72	.87	.53	.48	.59	.59	1.13	1.27	1.09	1.45	....	.87
July	.70	.74	.52	.46	.56	.59	1.11	1.14	1.14	1.32	....	.83
Crop year average	.64	.86	.52	.52	.58	.56	.95	1.30	.98	1.30	....	.82

TABLE 204.—*Barley: Visible supply, United States, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	995	683	338	1,319	902	253	1,641	1,202	1,031	8,741	3,034	2.014
September	928	1,356	960	1,822	1,193	774	1,905	3,206	1,510	6,534	2,238	2,019
October	2,444	2,767	2,708	3,967	3,965	2,946	2,459	5,111	2,550	4,542	3,415	5,365
November	2,958	4,514	4,129	5,197	5,091	3,465	3,938	4,466	3,666	4,157	3,552	4,668
December	1,879	4,210	4,051	5,549	5,077	5,616	4,742	3,910	6,101	2,940	3,501	4,475
January	1,660	3,828	3,610	5,712	5,116	4,066	4,289	3,581	7,514	3,189	....	4,256
February	1,544	2,716	2,711	4,762	4,489	3,291	4,443	4,136	9,456	3,184	....	4,073
March	1,341	2,661	2,335	4,973	3,763	2,810	4,474	4,343	9,712	3,073	....	3,949
April	1,190	2,243	2,635	4,206	2,959	2,840	4,720	5,709	12,240	3,230	....	4,197
May	1,455	1,003	1,706	2,487	2,394	2,530	3,440	4,299	14,235	3,382	....	3,693
June	936	571	1,259	1,761	1,234	2,105	1,724	3,358	9,756	3,224	....	2,593
July	637	502	1,478	1,197	708	1,990	1,759	2,089	10,807	2,632	....	2,380

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 205.—*Barley: Monthly and yearly receipts at Minneapolis, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	1,043	1,127	2,001	2,130	2,300	1,373	2,083	2,364	2,460	2,373	1,277	1,925
September	2,911	5,528	4,186	6,630	6,219	6,162	5,376	5,859	4,510	1,755	2,815	4,914
October	3,312	3,803	5,217	5,559	4,247	5,748	4,584	4,854	2,931	1,423	2,221	4,168
November	2,291	3,181	4,851	3,822	3,653	5,557	4,187	3,141	3,386	1,238	2,287	3,531
December	2,480	1,563	4,410	2,422	2,652	7,360	2,417	3,918	4,141	1,105	1,956	3,247
January	1,532	1,267	3,493	2,015	2,529	2,982	1,706	3,579	2,050	945	....	2,210
February	1,026	1,071	2,282	1,692	2,231	3,156	892	3,581	2,148	590	....	1,867
March	1,318	548	2,614	1,799	1,664	3,535	1,405	4,756	5,571	842	....	2,405
April	1,224	405	1,546	900	955	1,744	1,334	1,230	3,709	751	....	1,380
May	859	291	1,051	814	943	1,983	844	1,002	3,679	740	....	1,220
June	328	243	2,099	1,070	1,192	2,922	970	850	4,609	796	....	1,508
July	177	109	1,931	944	880	2,620	504	289	3,977	683	....	1,211
Crop year total	18,501	19,136	35,681	29,797	29,465	45,142	26,302	35,423	43,171	13,241	....	29,586

[1] Compiled from Minneapolis Chamber of Commerce Reports and Daily Market Record.

TABLE 206.—*Barley: Visible supply at Minneapolis, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	239	36	146	197	268	62	148	27	411	1,083	614	261
September	195	81	214	130	178	127	114	83	365	945	500	242
October	510	661	725	768	895	357	269	305	1,063	1,078	1,115	663
November	424	1,016	1,151	1,155	829	605	612	895	767	925	1,170	838
December	172	948	807	1,224	669	519	590	724	730	889	1,232	727
January	354	871	1,022	1,215	612	534	748	714	1,766	901	....	874
February	482	638	788	1,185	568	465	1,017	1,101	1,858	770	....	887
March	452	692	488	1,120	503	318	1,015	1,072	865	824	....	731
April	247	615	673	1,015	369	249	965	1,178	1,618	851	....	778
May	221	402	550	908	256	180	728	1,158	2,183	744	....	733
June	175	291	211	588	154	136	436	822	1,846	1,000	....	560
July	63	242	156	327	84	146	242	574	1,262	749	....	383

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 207.—*Barley: Monthly and yearly receipts at Chicago, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	863	1,188	865	1,186	851	729	2,194	1,600	1,365	1,324	519	1,217
September	1,805	3,350	1,449	2,167	3,021	1,834	3,175	2,475	1,183	1,336	1,076	2,179
October	2,518	3,888	3,717	4,844	4,038	2,990	4,172	2,813	2,301	1,010	942	3,229
November	2,427	3,216	3,845	2,667	3,187	3,815	3,588	2,590	1,886	980	1,515	2,820
December	3,071	2,280	3,714	2,581	2,781	5,298	2,867	2,206	2,266	1,105	1,221	2,817
January	2,048	1,872	3,685	2,437	2,249	4,478	2,528	1,287	2,714	1,000	....	2,430
February	1,501	1,593	3,398	2,015	2,323	2,884	1,576	1,805	2,052	968	....	2,011
March	1,981	1,014	2,996	2,047	2,004	3,219	1,959	2,245	3,443	959	....	2,187
April	1,260	865	2,276	1,452	1,340	2,263	1,729	1,198	3,586	527	....	1,650
May	1,244	604	1,580	1,289	1,153	1,932	990	1,338	2,084	806	....	1,302
June	756	427	2,322	1,590	1,373	1,519	1,059	1,095	3,516	869	....	1,452
July	630	262	1,926	753	1,124	2,238	821	475	2,810	867	....	1,191
Total	20,104	20,559	31,773	25,028	25,444	33,199	26,658	21,127	29,206	11,751	....	24,485

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 208.—*Barley: Visible supply at Chicago, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	9-yr. av.
August	....	29	29	65	94	27	21	4	162	1,003	371	159
September	....	36	56	63	93	20	70	37	570	317	222	132
October	....	55	73	84	295	44	129	122	632	231	340	185
November	....	132	136	108	909	71	142	175	1,359	256	255	365
December	....	158	165	222	1,102	98	244	450	1,349	289	372	453
January	....	172	222	322	893	165	424	506	1,706	503	....	546
February	....	137	196	393	621	236	542	535	2,505	659	....	647
March	....	131	119	397	536	366	508	497	2,379	656	....	621
April	....	101	164	359	567	414	379	818	2,884	657	....	705
May	....	41	108	283	390	417	350	564	2,585	594	....	592
June	....	36	64	99	206	251	152	370	1,235	821	....	359
July	....	49	59	82	175	52	53	271	1,429	450	....	292

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 209.—*Barley: Yearly average receipts, shipments, and local consumption at nine primary markets, for the 5-year period, 1913 to 1917.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Market.	Receipts.	Shipments.	Local consumption.	Per cent of local receipts consumed.
Chicago	28,033	8,370	19,663	70.1
Milwaukee	18,840	5,136	13,704	72.7
Minneapolis	33,171	30,154	3,017	9.1
St. Louis	1,883	193	1,690	89.8
Peoria	3,001	1,422	1,579	52.6
Cincinnati	905	72	833	92.0
Duluth	11,424	10,878	544	4.8
Omaha	872	448	424	48.6
Kansas City	1,084	928	156	14.4
Total	99,213	57,601	41,610	41.9

[1] From Report of Federal Trade Commission.

TABLE 210.—*Barley: Monthly and yearly exports from the United States, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	676	930	438	792	2,263	1,648	2,841	1,456	587	6,469	2,377	1,810
September	1,426	57	1,009	251	2,781	2,632	1,734	1,560	199	4,711	2,066	1,636
October	1,304	133	1,383	590	2,854	2,704	1,780	3,925	1	2,383	2,515	1,706
November	2,354	165	2,494	604	2,577	3,462	805	2,135	260	1,484	1,623	1,634
December	1,357	4	2,662	361	2,074	3,691	642	1,320	794	434	2,520	1,334
January	913	4	3,069	848	4,082	3,213	1,662	1,498	933	1,264	....	1,749
February	210	2	2,910	821	2,975	1,999	632	3,966	7	954	....	1,448
March	364	(2)	1,606	23	2,251	2,650	340	2,436	1,841	1,444	....	1,296
April	335	2	1,061	611	1,050	1,356	1,182	3,513	3,130	887	....	1,313
May	155	8	458	671	587	1,654	2,289	3,211	4,825	635	....	1,449
June	106	97	350	343	918	1,936	597	702	6,046	557	....	1,165
July	183	95	729	2,342	491	1,877	762	1,835	5,464	1,013	....	1,479
Crop year total	9,383	1,497	18,169	8,257	24,903	28,822	15,266	27,557	24,087	22,235	....	18,018

[1] Compiled from Monthly Summary of Foreign Commerce.
[2] Less than 500 bushels.

TABLE 211.—*Barley: Yearly exports from the United States, by grand divisions of destination, 1910 to 1919.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Europe	3,942	8,106	888	15,922	6,443	24,029	26,824	15,988	18,213	36,734
North America	283	289	129	279	159	484	576	354	591	868
South America	....	....	96	186	2	15	37	34	(2)	9
Asia	(2)	....	....	25	36	7	(2)	(2)	1	1
Oceania	5	83	90	79	5	330	30	1	(2)	(2)
Africa	81	921	382	1,046	....	1,890	6	4	(2)	(2)
Total	4,311	9,399	1,585	17,537	6,645	26,755	27,473	16,381	18,805	37,612

[1] Compiled from Monthly Summary of Foreign Commerce. Year ending June 30, 1910–16, calendar years 1917–19.
[2] Less than 500 bushels.

TABLE 212.—*Barley: Yearly production in United States and principal producing States, 1911 to 1920.*

[In thousands of bushels; i e., 000 omitted.]

State.	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
United States	160,240	223,824	178,189	194,953	228,851	182,309	211,759	256,225	161,345	202,024
California	40,600	41,760	33,150	42,060	39,440	33,320	39,150	34,320	30,000	28,750
Iowa	10,950	14,570	10,000	9,360	8,525	8,702	10,500	16,947	8,032	7,810
Kansas	1,625	4,136	1,944	5,880	8,370	6,000	6,000	6,040	14,499	21,285
Minnesota	28,025	42,018	34,800	31,694	38,125	26,125	34,425	40,300	18,200	25,000
North Dakota	20,475	35,162	25,500	28,275	46,400	26,738	22,812	37,281	13,800	22,680
South Dakota	5,508	23,062	16,765	19,550	24,000	18,728	31,482	39,088	19,250	26,825
Wisconsin	20,910	24,843	18,125	18,428	19,170	18,300	19,200	25,418	13,674	15,913

TABLE 213.—*Barley: Yearly production other than United States, 1910 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

Country.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Canada	45,148	44,415	49,378	48,319	36,201	54,017	42,770	55,058	77,287	56,389	63,311
Mexico	6,329	6,500	6,500	7,000	10,839	10,000	10,840	(1)	17,711	(1)	......
South America	....	....	6,133	9,089	13,769	9,011	9,903	7,115	......	......	......
Europe	1,007,829	997,853	1,035,758	1,184,343	929,491	871,984	951,562	......	......	......	......
Asia	94,288	98,764	104,650	159,218	256,107	275,463	272,980	......	......	......	......
Africa	57,450	62,266	37,316	58,656	40,359	66,453	54,044	51,659	83,285	51,085	25,839
Australasia	3,858	3,248	3,418	5,451	5,278	1,927	4,623	4,818	......	......	......
Total	1,214,902	1,213,046	1,243,153	1,472,076	1,292,044	1,288,855	1,346,722	......	......	......	......

[1] No official statistics.

TABLE 214.—*Barley: Yearly exports by principal exporting countries, 1911 to 1919.*

[In thousands of bushels; i. e., 000 omitted.]

Exported from—	1911	1912	1913	1914	1915	1916	1917	1918	1919
Algeria	....	....	4,342	3,530	1,302	5,992	1,758	3,743	15,696
Argentina	223	656	1,871	1,152	3,440	3,104	566	218	1,871
Austria-Hungary	4,875	9,522	8,190	....	....	....	....	....	....
Belgium	3,539	4,737	2,612	....	....	....	....	....	320
British India	9,475	31,843	10,069	1,290	7,441	7,705	14,531	14,848	598
Bulgaria	3,461	819	819	....	....	....	....	....	....
Canada	1,274	4,788	13,906	6,843	4,677	9,980	7,218	4,556	13,172
Chile	920	476	427	3,051	1,557	1,149	1,054	1,450	....
China	588	655	738	524	191	45	61	97	....
Denmark	3,301	3,552	3,566	3,582	167	642	32	437	....
France	720	669	438	357	1,173	627	590	96	354
Germany	85	53	280	....	....	....	....	....	....
Netherlands	31,035	23,956	31,993	13,784	151	....	23	....	44
Roumania	21,824	10,928	17,519	9,284	....	....	....	....	....
Russia	197,596	126,927	180,344	90,930	643	488	....	....	....
United Kingdom	170	102	48	902	3,699	1,593	478	65	154
United States	3,555	8,195	12,782	18,870	28,578	27,152	21,644	19,620	46,745
Other countries	17,267	13,456	15,957	1,281	2,683	3,782	1,639	3,518	....
Total	299,908	241,334	305,701	154,180	55,702	62,259	49,533	48,551	78,954

TABLE 215.—*Barley: Yearly imports, by principal importing countries, 1911 to 1919.*

[In thousands of bushels; i. e., 000 omitted.]

Imported into—	1911	1912	1913	1914	1915	1916	1917	1918	1919
Argentina	1,157	1,316	1,456	1,032	656	988	764	885	1,123
Austria-Hungary	1,833	331	353	....	....	....	....	....	....
Belgium	20,260	22,443	18,004	....	....	....	....	....	2,264
Brazil	725	967	1,241	639	865	655	691	309	622
British South Africa	372	361	319	265	216	264	138	34	60
Canada	76	59	363	136	82	10	36	8	75
Cuba	234	328	273	285	343	347	437	273	....
Denmark	3,679	628	1,986	2,413	4,995	1,104	466	12	....
Egypt	436	464	1,824	512	452	224	73	1	107
France	9,653	6,384	5,428	4,938	4,374	10,442	9,440	11,022	15,247
Finland	437	497	645	292	530	486	23	....	....
Germany	169,630	139,063	151,939	....	....	....	....	....	....
Italy	840	878	728	1,050	633	513	1,530	7,604	1,306
Netherlands	44,937	34,030	44,585	23,994	6,569	5,846	2,360	136	7,325
Norway	5,142	3,862	3,994	4,007	1,368	2,465	2,255	557	....
Russia	952	812	1,158	781	271	1	....	....	....
Switzerland	4,538	4,590	4,192	3,556	2,641	2,268	1,479	616	1,370
United Kingdom	56,748	45,970	52,464	36,547	27,976	36,957	21,462	11,725	38,824
Other countries	1,749	3,198	1,815	2,264	1,405	978	1,542	823	....
Total	323,398	266,181	292,767	82,711	53,376	63,548	42,696	34,005	68,323

TABLE 216.—*Rye: Monthly and yearly average price per bushel of No. 2, Chicago, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$0.77	$0.84	$0.74	$0.63	$0.64	$1.08	$0.98	$2.27	$1.73	$1.55	$2.04	$1.12
August	.75	.85	.72	.66	.84	1.00	1.13	1.90	1.67	1.54	1.90	1.11
September	.74	.91	.69	.67	.95	.96	1.20	1.86	1.63	1.40	1.99	1.10
October	.76	.97	.69	.65	.92	1.01	1.33	1.84	1.63	1.38	1.69	1.12
November	.79	.95	.64	.64	1.02	.99	1.47	1.78	1.68	1.42	1.59	1.14
December	.81	.93	.61	.63	1.10	.97	1.41	1.82	1.59	1.66	1.61	1.15
January	.84	.94	.64	.61	1.19	1.01	1.43	2.01	1.61	1.76	....	1.21
February	.82	.92	.62	.62	1.23	.97	1.46	2.39	1.38	1.56	....	1.20
March	.89	.91	.60	.61	1.17	.93	1.61	2.84	1.61	1.72	....	1.29
April	.95	.94	.62	.62	1.17	.96	1.87	2.64	1.73	1.99	....	1.35
May	1.02	.93	.62	.65	1.19	.98	2.20	2.20	1.59	2.13	....	1.35
June	.90	.83	.62	.63	1.17	.98	2.40	1.80	1.46	2.27	....	1.30
Weighted average	.84	.91	.65	.64	1.05	.99	1.54	2.11	1.61	1.70	....	1.20

[1] From Howard Bartel's "Red Book."

TABLE 217.—*Rye: Monthly and yearly average farm price per bushel, United States, 1910–11 to 1920–21.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$0.75	$0.76	$0.81	$0.62	$0.62	$0.91	$0.83	$1.78	$1.67	$1.44	$1.79	$1.02
August	.74	.76	.74	.62	.68	.87	.92	1.70	1.62	1.44	1.69	1.01
September	.73	.78	.70	.64	.77	.84	1.02	1.66	1.57	1.37	1.66	1.01
October	.72	.81	.69	.64	.80	.84	1.10	1.70	1.53	1.33	1.52	1.02
November	.72	.83	.68	.63	.80	.85	1.19	1.67	1.52	1.32	1.35	1.02
December	.72	.83	.65	.63	.88	.84	1.20	1.68	1.51	1.43	1.26	1.04
January	.73	.84	.66	.62	.95	.87	1.21	1.73	1.45	1.53	....	1.06
February	.73	.84	.66	.62	1.03	.87	1.25	1.88	1.36	1.50	....	1.07
March	.74	.85	.63	.62	1.03	.85	1.31	2.18	1.39	1.51	....	1.11
April	.76	.85	.63	.63	1.01	.84	1.50	2.28	1.51	1.70	....	1.17
May	.77	.85	.63	.64	1.00	.84	1.74	2.04	1.50	1.84	....	1.19
June	.77	.85	.64	.64	.96	.84	1.80	1.79	1.41	1.86	....	1.16
Crop year average	.74	.82	.68	.63	.88	.86	1.26	1.84	1.50	1.52	....	1.07

TABLE 218.—*Rye: Visible supply, United States, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	378	15	427	449	369	210	452	515	707	9,014	4,423	1,254
August	243	16	243	382	168	95	350	480	580	9,866	2,555	1,242
September	172	316	441	674	290	536	418	727	1,325	12,327	2,210	1,723
October	353	511	1,103	1,549	1,245	1,239	1,007	2,029	4,723	15,395	4,407	2,356
November	433	1,166	1,256	2,032	1,897	1,304	2,009	3,550	6,694	17,248	2,778	3,589
December	507	1,351	1,888	2,299	1,683	2,686	1,962	3,818	11,511	17,198	4,320	4,490
January	491	1,432	1,719	2,226	1,448	3,093	2,577	2,097	15,687	17,477	....	4,816
February	390	1,009	1,469	2,085	1,445	3,150	2,230	1,676	20,764	19,195	....	5,431
March	251	1,003	1,202	1,822	1,363	2,377	2,014	1,225	17,896	20,389	....	4,954
April	114	828	912	1,447	779	1,844	1,693	16,493	15,193	18,467	....	5,727
May	60	651	684	1,165	945	1,687	1,300	1,000	17,246	15,560	....	4,030
June	32	544	503	613	286	951	708	852	11,384	11,570	....	2,744

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 219.—*Rye: Monthly and yearly receipts at Minneapolis, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	54	64	55	211	111	56	155	97	108	959	422	187
August	162	392	843	693	740	270	287	857	992	1,104	621	634
September	238	349	1,085	1,057	1,154	726	1,543	1,824	2,396	1,203	606	1,157
October	198	450	1,017	1,010	846	1,414	1,473	2,054	923	1,010	596	1,039
November	153	385	779	583	806	1,434	1,360	1,508	1,301	591	410	890
December	191	211	532	466	832	1,091	695	1,268	3,201	632	606	912
January	126	135	411	283	431	405	287	977	684	861	....	460
February	77	101	339	257	348	418	168	1,098	421	669	....	390
March	136	125	281	277	190	350	408	1,095	3,020	775	....	666
April	70	75	239	221	94	245	307	641	1,504	810	....	421
May	81	82	175	259	98	187	232	294	1,133	388	....	296
June	33	87	187	221	87	179	202	210	785	373	....	233
Crop year total	1,519	2,456	5,943	5,538	5,737	6,775	7,117	11,923	16,468	9,375	....	7,285

[1] Compiled from Minneapolis Chamber of Commerce Reports and Daily Market Record.

TABLE 220.—*Rye: Visible supply at Minneapolis, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	143	2	124	129	33	8	29	21	....	4,180	1,372	467
August	110	2	15	93	8	5	26	6	6	4,365	192	464
September	9	65	127	129	8	4	8	25	82	5,282	97	574
October	152	88	400	374	353	10	228	107	1,551	5,942	88	921
November	184	285	431	586	220	89	567	368	1,270	6,330	54	1,033
December	152	351	561	753	187	361	673	615	1,465	6,639	84	1,176
January	122	378	480	748	246	556	628	592	3,569	6,339	....	1,366
February	130	352	444	681	160	559	562	606	4,100	5,237	....	1,283
March	109	342	491	603	122	566	493	488	4,163	4,933	....	1,231
April	56	313	322	420	123	358	327	206	6,124	4,510	....	1,276
May	41	227	235	392	79	271	252	113	5,783	4,377	....	1,177
June	15	202	164	101	27	164	67	147	4,128	3,472	....	848

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 221.—*Rye: Monthly and yearly receipts at Chicago, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	40	53	51	186	144	112	162	105	171	467	369	149
August	105	174	235	250	285	440	361	337	694	783	501	366
September	79	293	308	367	381	641	545	551	612	327	554	410
October	101	329	660	414	347	503	727	640	344	439	443	450
November	118	256	504	359	354	981	796	500	730	270	265	487
December	172	179	257	216	537	745	786	326	622	305	655	415
January	104	159	276	313	409	532	433	148	1,343	754	....	447
February	100	212	230	233	216	444	251	185	1,181	700	....	375
March	129	144	289	299	141	373	453	482	1,017	829	....	416
April	67	117	222	218	172	345	440	234	1,192	222	....	323
May	57	88	140	152	131	237	323	146	396	545	....	222
June	45	71	126	199	157	298	182	112	165	478	....	183
Crop year total	1,117	2,075	3,298	3,206	3,274	5,651	5,459	3,766	8,467	6,119	....	4,243

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 222.—*Rye: Visible supply at Chicago, first of each month, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	14	0	128	31	46	2	34	4	393	1,351	148	240
August	9	4	114	49	49	11	29	6	418	1,621	171	235
September	10	4	41	110	44	29	39	14	776	2,363	70	236
October	15	11	74	187	66	71	84	45	1,234	2,547	257	433
November	14	25	110	286	83	50	73	137	439	2,742	45	396
December	12	72	136	398	65	118	55	182	687	2,685	266	441
January	11	119	143	347	60	134	274	270	1,398	2,294	....	505
February	2	104	108	398	68	94	263	263	2,965	1,911	....	618
March	2	104	94	340	23	125	228	186	4,043	1,825	....	697
April	0	110	70	237	16	140	196	465	2,614	1,476	....	532
May	0	115	31	192	16	66	97	471	1,524	721	....	323
June	0	124	20	97	66	70	11	426	1,676	401	....	288

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 223.—*Rye: Yearly average receipts, shipments, and local consumption at 10 primary markets, for the 5-year period, 1913 to 1917.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Market.	Receipts.	Shipments.	Local consumption.	Per cent of local receipts consumed.
Minneapolis	6,882	4,590	2,292	33.3
Chicago	4,259	3,203	1,056	24.8
Milwaukee	3,308	2,635	673	20.3
Cincinnati	649	318	331	51.0
Indianapolis[2]	218	7	211	96.8
St. Louis	518	386	132	25.5
Omaha	805	687	118	14.7
Peoria	468	376	92	19.7
Kansas City	375	303	72	19.2
Duluth	3,299	3,273	26	.8
Total	20,781	15,778	5,003	24.1

[1] From Report of Federal Trade Commission.
[2] Two-year average, 1916 and 1917.

TABLE 224.—*Rye: Monthly exports from the United States, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	(2)	2	(2)	282	294	390	490	367	122	2,000	7,595	395
August	(2)	(2)	(2)	128	37	95	591	98	212	548	5,083	171
September	(2)	(2)	133	146	812	1,187	1,044	137	308	1,143	2,464	491
October	(2)	1	177	12	1,613	3,055	1,679	1,248	466	895	2,696	909
November	1	1	120	62	1,824	1,323	2,083	2,918	1,094	1,654	4,802	1,108
December	(2)	1	102	16	1,690	830	1,622	2,892	1,099	2,420	5,626	1,067
January	(2)	(2)	138	141	1,558	1,372	1,203	1,829	1,202	961	....	840
February	(2)	(2)	131	43	1,320	1,218	1,179	1,066	1,873	2,029	....	886
March	1	(2)	150	153	1,525	1,216	540	1,001	3,739	4,532	....	1,286
April	(2)	(2)	315	350	796	1,054	840	125	2,905	4,833	....	1,122
May	(2)	(2)	293	338	932	1,610	1,249	118	7,397	10,148	....	2,209
June	(2)	1	323	553	144	1,181	740	190	7,122	6,301	....	1,656
Total	2	6	1,822	2,224	12,545	14,531	13,260	11,989	27,539	37,464	....	12,139

[1] Compiled from Monthly Summary of Foreign Commerce.
[2] Less than 500 bushels.

TABLE 225.—*Rye flour: Monthly and yearly exports from the United States, 1910–11 to 1920–21.*[1]

[In thousands of barrels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	1	(2)	1	1	1	6	3	12	317	62	49	40
August	(2)	(2)	(2)	(2)	1	2	12	8	255	56	95	33
September	(2)	(2)	(2)	1	5	3	7	4	101	333	31	45
October	(2)	(2)	(2)	(2)	14	3	5	3	56	53	40	13
November	1	(2)	(2)	1	19	7	11	66	20	19	9	14
December	(2)	(2)	(2)	(2)	7	30	4	89	13	16	1	16
January	1	1	1	1	6	12	4	55	1	26	....	11
February	1	(2)	1	1	11	6	(2)	23	123	17	....	18
March	(2)	1	(2)	1	2	6	(2)	171	77	19	....	28
April	(2)	(2)	(2)	1	10	17	1	104	57	41	....	23
May	(2)	(2)	1	1	(1)	13	6	113	99	22	....	26
June	(2)	(2)	(2)	1	4	17	20	216	370	14	....	64
Total	4	2	4	9	80	122	73	864	1,489	678	....	333

[1] Compiled from Monthly Summary of Foreign Commerce.
[2] Less than 500 barrels.

Table 226.—*Rye: Yearly exports from the United States to Europe and North America, 1910 to 1919.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Exported to—	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Europe	218	....	....	1,737	2,156	12,498	14,392	12,130	7,509	31,512
North America	2	3	6	86	67	47	141	1,130	121	1,386
Total	220	3	6	1,823	2,223	12,545	14,533	13,260	7,630	32,898

[1] Compiled from Monthly Summary of Foreign Commerce. Year ending June 30, 1910–17; calendar years 1918–19.

Table 227.—*Rye: Yearly production in United States and principal producing States, 1910 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

State.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
United States	34,897	33,119	35,664	41,381	42,779	54,050	48,862	62,933	91,041	88,909	69,318	54,814
Illinois	1,009	874	768	808	784	906	666	2,100	3,800	4,950	3,276	1,904
Indiana	1,264	1,000	928	1,566	1,614	3,200	2,590	4,110	6,600	5,040	4,340	2,932
Iowa	648	540	665	1,092	1,121	1,110	935	900	1,425	1,113	1,071	965
Kansas	280	198	477	630	1,000	800	870	1,540	2,502	2,520	1,612	1,130
Michigan	6,395	5,840	4,921	5,362	5,936	5,425	4,648	4,774	7,364	13,500	9,702	6,715
Minnesota	4,352	4,488	6,026	5,700	5,245	6,825	5,250	6,716	8,700	7,875	8,160	6,303
Nebraska	944	676	880	1,740	1,952	3,500	3,072	3,354	5,005	6,650	3,722	2,863
New Jersey	1,332	1,181	1,260	1,260	1,295	1,420	1,330	1,276	1,388	1,280	1,155	1,289
New York	2,562	2,254	2,112	2,288	2,283	2,805	2,250	2,375	1,848	1,932	1,872	2,235
North Dakota	255	598	864	1,800	2,240	4,200	5,985	9,880	19,950	15,560	9,340	6,425
Ohio	1,072	930	884	1,600	1,615	1,750	1,088	1,872	1,887	1,804	1,152	1,423
Pennsylvania	4,896	4,304	4,935	4,900	5,040	4,932	4,420	4,165	3,740	2,880	2,656	4,261
South Dakota	221	130	312	660	1,020	3,900	4,500	6,560	10,350	6,500	4,320	3,498
Wisconsin	5,440	6,035	6,240	7,438	6,798	7,770	6,075	7,585	8,061	8,327	7,728	7,045

Table 228.—*Rye: Production other than United States, 1910 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

Country.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Canada	1,544	2,492	2,428	2,300	2,017	2,486	2,876	3,857	8,504	10,207	11,306
Mexico	70	70	70	70	70	70	70	[1]	[1]	[1]	[1]
South America	....	....	623	1,565	3,502	1,997	2,196	951	.....	.....	.....
Europe	1,612,795	1,518,324	1,816,498	1,805,937	1,511,293	1,495,967	.....	.....	.....	.....	.....
Asia	23,928	19,686	31,086	28,948	37,104	22,945	.....	.....	.....	.....	.....
Australia	239	242	148	186	117	68	.....	.....	.....	.....	.....
Total	1,638,576	1,540,814	1,850,853	1,839,006	1,554,103	1,523,533	.....	.....	.....	.....	.....

[1] No official statistics.

Table 229.—*Rye: Yearly exports, by principal exporting countries, 1911 to 1919.*

[In thousands of bushels; i. e., 000 omitted.]

Exported from—	1911	1912	1913	1914	1915	1916	1917	1918	1919
Argentina	22	445	861	451	194	129	....	2	160
Belgium	914	1,155	673	....	....	....	....	....	1
Bulgaria	2,950	2,029	2,029	....	....	....	....	....	....
Canada	80	1	127	146	501	989	833	798	1,897
Denmark	295	296	319	349	371	385	555	641	....
Germany	40,090	42,784	51,979	....	....	....	....	....	....
Netherlands	19,897	16,423	20,291	10,418	26	14	....	....	483
Roumania	5,148	2,481	2,604	1,241	....	....	....	....	....
Russia	45,234	26,359	33,170	20,298	13,331	12,315	....	....	....
United States	31	501	2,034	8,158	13,655	15,838	14,689	16,308	40,494
Other countries	476	582	480	104	82	64	1,425	252	....
Total	115,137	93,056	114,567	41,165	28,160	29,734	17,502	18,001	43,035

TABLE 230.—*Rye: Yearly imports, by principal importing countries, 1911 to 1919.*

[In thousands of bushels; i. e., 000 omitted.]

Imported into—	1911	1912	1913	1914	1915	1916	1917	1918	1919
Austria-Hungary	2,069	1,336	268	....	....	....	....	....	....
Belgium	6,791	5,309	6,372	....	....	....	....	....	548
Denmark	7,746	8,170	9,846	5,701	2,757	2,350	443	41	....
Finland	17,730	12,873	15,813	9,898	13,425	12,639	....	....	....
France	5,014	3,688	3,712	1,441	36	14	21	1,346	665
Germany	24,253	12,501	13,946	....	....	....	....	....	....
Italy	294	623	1,245	378	4	1	1,440	3,506	379
Netherlands	33,083	27,714	32,273	17,539	2,232	1,156	356	751	1,906
Norway	11,305	9,168	11,088	8,128	7,885	7,329	5,095	3,095	....
Russia	4,468	3,455	7,769	5,453	1	....	....	....	....
Sweden	2,153	4,708	4,446	2,586	1,986	1,168	461	138	3
Switzerland	776	750	661	267	16	42	198	452	1,632
United Kingdom	2,343	1,965	2,276	2,073	1,436	2,054	5,353	5,300	....
Other countries	429	713	886	546	77	29	103	201	....
Total	118,454	92,973	110,601	54,010	29,855	26,782	13,470	14,930	48,168

TABLE 231.—*Buckwheat: Monthly and yearly average farm price per bushel, United States, 1910–11 to 1920–21.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	$0.66	$0.73	$0.66	$0.76	$0.77	$0.79	$1.08	$1.57	$1.70	$1.49	$1.30	$1.02
December	.66	.73	.66	.76	.77	.80	1.15	1.61	1.65	1.49	1.27	1.03
January	.65	.74	.68	.76	.81	.81	1.16	1.62	1.61	1.53	....	1.04
February	.64	.75	.68	.75	.85	.82	1.20	1.65	1.53	1.55	....	1.04
March	.65	.77	.68	.76	.85	.83	1.27	1.69	1.49	1.59	....	1.06
April	.66	.78	.70	.77	.85	.84	1.39	1.73	1.48	1.66	....	1.09
May	.68	.82	.71	.78	.86	.86	1.67	1.84	1.56	1.75	....	1.15
June	.71	.86	.72	.82	.90	.90	1.96	1.96	1.63	1.91	....	1.24
July	.74	.85	.73	.83	.91	.91	1.99	1.97	1.63	1.92	....	1.25
August	.70	.80	.71	.81	.85	.88	1.77	1.91	1.63	1.79	....	1.19
September	.72	.73	.72	.79	.78	.88	1.59	1.85	1.61	1.68	....	1.14
October	.71	.68	.75	.78	.76	.97	1.54	1.77	1.57	1.45	....	1.10
Crop year average	.68	.77	.70	.78	.83	.86	1.48	1.76	1.59	1.65	....	1.11

TABLE 232.—*Buckwheat: Yearly production in United States and principal producing States, 1910 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

State.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	11-yr. av.
United States	17,598	17,549	19,249	13,833	16,881	15,056	11,662	16,022	16,905	15,244	13,789	15,799
Indiana	106	92	95	92	88	70	144	300	300	165	200	150
Maine	520	450	412	416	348	338	336	322	340	216	270	361
Maryland	204	240	210	182	204	220	190	231	240	299	300	229
Michigan	1,102	1,206	1,088	900	1,054	870	770	585	780	621	609	871
Minnesota	128	126	126	99	102	122	150	154	340	285	300	176
New York	6,578	5,964	6,593	4,004	6,302	4,940	3,300	5,670	4,725	5,126	4,420	5,238
Ohio	414	399	410	324	432	414	354	464	480	632	543	422
Pennsylvania	5,714	6,373	7,405	5,180	5,740	5,460	3,780	5,076	5,850	4,968	4,176	5,429
Virginia	450	384	516	531	446	520	480	696	672	475	540	519
West Virginia	874	864	888	798	774	836	659	900	916	840	780	830
Wisconsin	280	315	289	297	298	195	280	281	636	486	432	344

Table 233.—*Kafir: Monthly and yearly average price per 100 pounds, No. 2 white, Kansas City, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	$1.12	$1.06	$0.98	$1.57	$1.04	$0.91	$2.34	$3.40	$2.96	$2.67	$1.39	$1.81
December	.96	.99	.86	1.63	1.14	.99	2.11	3.25	2.61	2.93	1.17	1.75
January	.96	1.19	.85	1.72	1.33	.99	2.43	3.33	2.69	2.49	....	1.80
February	.93	(2)	.83	1.72	1.38	.96	2.48	3.69	2.70	2.17	....	1.87
March	.94	1.29	.81	1.76	1.28	.93	2.66	3.84	2.56	2.31	....	1.84
April	.94	1.43	.82	(2)	1.18	1.06	3.17	3.37	2.67	2.38	....	1.89
May	1.06	1.44	.88	2.00	1.14	1.05	3.79	2.93	2.97	2.65	....	1.98
June	1.24	1.25	1.11	(2)	1.20	1.11	3.36	2.65	3.42	2.52	....	1.98
July	1.42	1.63	1.09	(2)	1.16	1.22	4.00	3.03	3.51	2.36	....	2.15
August	1.34	1.68	1.41	(2)	1.09	1.58	4.48	3.40	3.61	2.43	....	2.33
September	1.27	1.36	1.53	(2)	1.04	1.71	4.34	3.40	2.41	2.24	....	2.15
October	1.21	1.13	1.51	(2)	1.06	1.84	3.69	3.27	2.34	1.81	....	1.98
Crop year average	1.12	1.31	1.06	1.74	1.17	1.19	3.24	3.28	2.86	2.41	....	1.94

[1] Compiled from Kansas City Price Current, and Grain Market Review.
[2] No quotations.

Table 234.—*Hay: Monthly and yearly average price per ton, No. 1 timothy, Chicago, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$18.75	$23.50	$19.75	$15.00	$16.25	$19.25	$16.00	$17.75	$21.50	$34.50	$38.50	$20.23
August	19.50	21.50	18.50	17.75	16.75	20.25	16.00	19.25	26.50	35.00	40.25	21.10
September	17.25	20.00	18.50	17.75	15.50	19.00	15.50	21.00	32.00	29.00	33.75	20.55
October	17.25	20.50	18.00	18.00	15.25	17.00	16.25	25.00	31.00	28.00	32.25	20.63
November	17.50	21.25	17.00	17.00	15.50	15.50	16.25	27.25	30.00	29.50	32.00	20.68
December	17.50	21.00	15.50	16.25	15.50	15.50	16.25	27.00	30.00	30.00	28.50	20.45
January	18.00	21.75	15.75	15.50	16.25	16.25	15.50	28.25	29.50	32.50	....	20.93
February	16.25	20.75	14.25	14.75	15.50	15.50	15.75	29.00	26.00	34.00	....	20.18
March	16.25	21.50	14.75	15.25	15.25	16.75	15.75	28.00	30.50	35.25	....	20.93
April	17.75	24.00	15.50	16.00	16.25	18.75	18.00	24.00	33.50	43.00	....	22.68
May	21.00	26.00	15.25	16.25	17.00	18.75	20.50	23.00	35.50	46.50	....	23.98
June	21.75	21.25	14.25	15.25	17.50	18.00	18.75	19.00	33.00	42.75	....	22.15
Crop year average	18.23	21.92	16.42	16.23	16.04	17.54	16.71	24.04	29.92	35.00	....	21.21

[1] Compiled from Chicago Board of Trade.

Table 235.—*Hay: Monthly and yearly average price per ton, No. 1 prairie, Kansas City, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$10.83	$15.93	$8.79	$10.60	$12.10	$11.32	$8.50	$18.14	$19.26	$20.89	$17.21	$13.64
August	10.82	12.93	7.96	13.62	9.96	8.65	8.06	18.57	25.25	19.98	19.52	13.58
September	11.67	11.50	8.39	15.76	11.58	8.63	9.36	18.06	26.57	19.32	18.47	14.08
October	11.34	11.60	8.96	16.00	11.35	9.71	9.47	19.60	27.58	19.75	16.45	14.54
November	11.16	12.07	8.91	15.66	10.94	9.54	10.74	25.07	26.84	21.12	16.13	15.21
December	10.86	12.61	9.39	15.57	10.98	8.97	11.15	25.47	24.04	25.34	14.49	15.44
January	11.07	13.84	10.45	14.20	11.25	8.84	10.57	24.00	28.25	21.40	....	15.39
February	10.95	13.66	9.37	14.50	10.89	9.15	10.92	23.79	26.82	20.68	....	15.07
March	10.84	16.70	9.19	14.40	11.26	8.96	12.92	23.42	32.35	20.64	....	16.07
April	11.31	20.85	9.56	16.00	11.41	9.50	18.68	21.13	36.63	21.70	....	17.68
May	11.55	20.48	9.53	16.42	11.02	9.74	19.74	19.17	38.91	24.02	....	18.06
June	13.61	15.16	9.97	15.43	11.03	8.65	20.57	17.66	37.34	18.95	....	16.84
Crop year average	11.33	14.78	9.21	14.85	11.15	9.31	12.56	21.17	29.15	21.15	....	15.47

[1] Compiled from Kansas City Daily Price Current.

TABLE 236.—*Hay: Monthly and yearly average price per ton, No. 1 alfalfa, Kansas City, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$12.08	$15.13	$12.59	$12.12	$12.38	$11.54	$11.29	$21.18	$22.60	$26.93	$27.21	$15.78
August	13.50	14.44	13.00	14.80	13.42	11.90	13.40	24.09	29.08	27.63	29.49	17.53
September	13.89	14.87	13.58	16.14	13.33	12.25	13.58	24.07	31.45	24.86	27.22	17.80
October	14.25	15.00	15.11	16.54	12.51	13.11	15.68	27.43	30.14	30.24	23.95	19.00
November	14.25	15.27	15.11	16.00	13.21	12.83	18.50	31.10	31.21	33.39	25.05	20.01
December	14.23	15.50	15.00	16.01	13.79	14.35	19.33	32.76	31.01	35.10	23.01	20.71
January	13.51	17.72	14.79	15.96	13.75	14.54	19.81	30.01	32.85	35.75	....	20.87
February	12.93	18.37	12.86	15.25	13.73	15.34	20.25	31.33	31.01	34.83	....	20.59
March	13.07	20.49	14.06	15.18	14.75	13.92	21.10	27.56	34.56	33.79	....	20.85
April	13.67	22.73	13.75	15.30	15.11	14.44	24.33	24.11	37.90	34.10	....	21.54
May	13.29	19.34	13.28	15.54	13.73	14.45	24.52	22.64	36.20	35.46	....	20.85
June	12.38	11.62	10.70	14.23	13.42	11.42	21.87	20.57	36.43	31.75	....	18.44
Crop year average	13.42	16.71	13.65	15.26	13.59	13.34	18.64	26.40	32.04	31.99	....	19.50

[1] Compiled from Kansas City Daily Price Current.

TABLE 237.—*Hay: Monthly and yearly average price per ton, No. 2 alfalfa, Kansas City, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	$10.30	$13.81	$10.38	$9.25	$8.75	$7.78	$7.85	$18.69	$17.24	$18.76	$20.59	$12.28
August	11.25	12.34	11.25	12.27	11.17	7.80	8.44	21.12	25.73	21.61	24.50	14.30
September	11.64	12.89	11.66	14.36	10.96	7.75	9.56	20.32	27.50	23.04	21.22	14.97
October	12.00	13.25	13.41	14.01	9.91	8.43	12.82	22.90	26.95	24.60	16.52	15.83
November	12.00	13.65	12.60	13.13	10.21	8.33	14.79	26.83	27.13	26.69	18.62	16.54
December	11.98	14.00	12.24	13.12	10.59	9.36	14.44	27.52	23.91	28.92	16.13	16.61
January	11.18	16.34	11.53	12.97	10.50	8.89	14.46	24.76	24.25	28.72	....	16.36
February	9.68	17.37	9.18	11.85	10.87	9.89	14.29	24.69	25.25	24.31	....	15.74
March	10.06	19.53	11.42	12.50	12.01	8.23	16.37	21.10	30.59	22.59	....	16.44
April	10.89	20.80	10.32	12.78	11.70	9.13	21.30	14.17	32.57	23.51	....	16.72
May	10.54	16.64	9.20	11.07	9.14	8.04	21.98	12.45	28.00	25.90	....	15.30
June	10.51	9.65	7.89	9.71	9.54	7.90	18.46	13.62	19.74	22.50	....	12.95
Crop year average	11.00	15.02	10.92	12.25	10.45	8.46	14.56	20.68	25.74	24.26	....	15.34

[1] Compiled from Kansas City Daily Price Current.

TABLE 238.—*Hay: Average farm price per ton, timothy, United States, 15th of each month, 1914–15 to 1920–21.*

Month.	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	6-yr. av.
July	$13.06	$13.43	$12.97	$14.68	$17.61	$24.22	$26.59	$16.00
August	13.09	12.39	11.74	14.11	18.98	23.89	24.35	15.70
September	13.54	12.32	11.57	14.89	20.85	23.65	24.15	16.14
October	13.66	12.14	11.54	16.23	22.60	23.04	22.74	16.54
November	13.69	12.24	12.03	18.33	22.93	22.90	22.09	17.02
December	13.69	12.73	12.29	20.31	22.94	23.71	21.18	17.61
January	14.07	13.11	12.61	21.37	23.48	24.59	....	18.21
February	14.28	13.39	12.91	22.25	22.69	25.49	....	18.50
March	14.28	13.61	13.20	22.53	22.68	26.75	....	18.84
April	14.53	14.00	14.26	21.47	24.74	27.99	....	19.50
May	14.74	14.50	15.31	20.40	27.27	29.92	....	20.36
June	14.33	14.71	15.76	18.55	27.50	30.05	....	20.15
Crop year average	13.91	13.21	13.02	18.76	22.86	25.52	....	17.88

Table 239.—*Hay: Average farm price per ton, prairie, United States, 15th of each month, 1914–15 to 1920–21.*

Month.	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	6-yr. av.
July	$7.49	$7.37	$7.25	$10.11	$12.51	$16.10	$15.38	$10.14
August	7.29	6.83	6.96	10.82	13.26	16.10	13.74	10.21
September	7.33	6.64	7.21	11.40	14.35	15.90	12.93	10.47
October	7.59	6.44	7.26	12.29	15.06	15.88	11.83	10.75
November	7.49	6.75	7.85	13.32	15.47	16.91	11.47	11.30
December	7.37	6.95	8.14	14.91	16.30	17.19	10.75	11.81
January	7.65	7.38	8.58	15.39	16.33	17.54	....	12.15
February	7.86	7.34	8.60	15.74	16.55	17.36	....	12.24
March	8.03	7.39	9.32	15.47	17.38	16.52	....	12.35
April	8.58	7.56	10.94	14.47	18.85	16.66	....	12.84
May	8.29	7.71	12.02	12.75	20.22	18.06	....	13.18
June	7.72	7.97	11.84	12.78	18.71	17.59	....	12.77
Crop year average	7.72	7.19	8.83	13.29	16.25	16.82	....	11.68

Table 240.—*Hay: Average farm price per ton, clover, United States, 15th of each month, 1914–15 to 1920–21.*

Month.	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	6-yr. av.
July	$11.85	$11.65	$10.84	$12.95	$15.73	$22.02	$24.63	$14.17
August	12.09	10.87	9.93	12.76	17.18	21.58	22.82	14.07
September	12.44	10.82	10.01	13.79	19.27	21.74	22.57	14.68
October	12.47	10.60	10.08	15.01	20.60	21.17	21.29	14.99
November	12.70	10.59	10.46	17.14	21.13	21.61	20.60	15.61
December	12.76	10.95	10.86	18.67	21.26	22.60	19.91	16.18
January	13.07	11.24	11.38	19.82	21.69	23.78	....	16.83
February	13.36	11.41	11.65	21.11	21.11	24.94	....	17.26
March	13.41	11.70	11.90	21.37	21.25	26.13	....	17.63
April	13.65	11.87	13.06	19.68	23.36	26.93	....	18.09
May	13.79	12.52	13.94	18.30	25.33	28.31	....	18.70
June	12.78	12.46	14.22	16.54	25.48	27.80	....	18.21
Crop year average	12.86	11.39	11.53	17.26	21.12	24.05	....	16.37

Table 241.—*Hay: Average farm price per ton, alfalfa, United States, 15th of each month, 1914–15 to 1920–21.*

Month.	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	6-yr. av.
July	$8.65	$8.28	$9.87	$14.13	$16.58	$20.15	$21.70	$12.94
August	8.38	8.28	9.80	15.28	18.22	20.72	20.43	13.45
September	8.72	8.22	10.06	16.33	19.72	20.89	19.12	13.99
October	8.96	8.14	10.25	17.59	20.23	20.56	18.03	14.29
November	9.20	8.72	11.37	19.19	20.42	21.63	12.88	15.09
December	9.05	9.52	12.31	20.39	20.74	22.95	16.56	15.83
January	9.48	9.89	12.79	21.27	20.42	24.13	....	16.33
February	9.32	10.35	13.63	21.38	20.91	24.41	....	16.67
March	9.79	10.74	14.08	20.82	21.40	24.68	....	17.02
April	9.81	10.73	17.68	18.97	22.28	24.57	....	17.34
May	9.58	10.56	17.92	17.84	23.32	25.68	....	17.48
June	8.50	10.49	16.77	16.74	20.89	24.20	....	16.27
Crop year average	9.12	9.49	13.09	18.33	20.43	22.88	....	15.56

TABLE 242.—*Hay: Monthly and yearly receipts at Chicago, in tons, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	18,768	11,955	19,550	16,922	15,927	12,733	23,381	24,974	23,015	15,919	12,605	18,314
August	22,105	28,428	13,194	14,354	17,231	20,664	13,105	17,185	19,185	15,432	6,667	18,088
September	26,249	21,578	29,546	25,647	28,388	24,466	23,751	22,416	24,310	20,538	9,872	24,689
October	25,134	27,497	22,630	30,562	33,512	19,874	23,608	30,962	27,034	19,288	12,957	26,010
November	18,723	26,131	24,511	29,183	23,600	28,620	21,287	36,883	24,711	16,705	12,269	25,035
December	26,060	32,449	28,540	35,103	34,103	24,742	20,632	34,681	21,322	26,077	19,969	28,371
January	20,643	32,034	29,774	38,144	43,182	19,616	21,907	21,338	25,129	21,562	....	27,333
February	26,695	35,997	28,192	31,954	30,775	29,008	13,649	26,920	19,082	26,540	....	26,881
March	25,654	36,314	20,852	43,319	31,690	28,044	17,016	38,882	20,371	27,626	....	28,977
April	17,696	32,594	16,804	42,982	25,573	21,163	14,882	41,878	26,028	8,308	....	24,791
May	20,927	32,468	16,984	27,804	23,510	20,576	20,973	27,400	27,737	12,840	....	23,122
June	25,329	34,185	24,192	33,058	17,604	23,675	23,741	29,211	29,107	14,215	....	25,432
Crop year total	273,983	351,630	274,769	369,032	325,095	273,181	237,932	352,730	287,031	225,050	....	297,043

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 243.—*Hay: Monthly and yearly shipments from Chicago, in tons, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	1,119	925	2,803	786	2,292	1,815	2,776	1,705	2,186	3,727	2,007	2,013
August	1,516	685	1,421	1,178	2,469	2,444	1,297	1,411	2,741	931	1,097	1,609
September	2,005	1,619	2,410	2,771	6,256	5,168	1,857	1,938	2,330	2,226	2,377	2,858
October	1,534	1,073	2,545	3,340	7,688	4,274	1,232	2,157	9,339	2,414	1,446	3,560
November	840	1,477	1,664	2,534	5,309	6,645	1,674	5,023	3,941	984	1,325	3,009
December	1,235	3,094	1,986	2,939	10,947	6,247	1,423	9,399	1,609	1,873	1,791	4,075
January	1,498	3,055	3,075	3,192	10,644	3,585	1,693	4,474	2,938	2,233	....	3,639
February	1,540	6,179	2,436	3,993	9,360	4,857	2,130	5,928	2,974	4,781	....	4,418
March	2,265	10,104	2,240	4,729	10,471	6,925	2,264	10,344	4,253	9,356	....	6,295
April	1,239	11,474	827	5,652	7,520	5,098	4,299	10,106	8,573	1,405	....	5,619
May	2,147	5,346	574	4,469	6,694	4,236	8,003	7,526	6,504	1,284	....	4,678
June	1,073	4,129	700	3,601	3,764	4,497	4,791	2,654	5,414	1,423	....	3,205
Crop year total	18,011	49,160	22,681	39,184	83,414	55,791	33,439	62,665	52,802	32,637	....	44,978

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 244.—*Hay: Monthly and yearly receipts at Kansas City, in tons, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	21,060	17,328	30,024	24,600	34,284	27,576	30,588	36,648	20,208	37,656	36,468	27,997
August	40,704	19,032	35,016	37,680	36,468	34,884	26,280	29,976	38,508	48,408	44,028	34,696
September	31,740	16,308	27,360	21,384	28,848	34,776	21,768	38,700	36,432	47,352	47,820	30,467
October	31,224	31,680	32,460	28,188	27,036	43,692	28,608	43,464	45,540	38,952	22,512	35,084
November	25,368	31,860	35,424	26,724	27,048	31,572	36,348	42,036	36,408	53,268	35,184	34,606
December	29,280	33,096	34,536	15,984	31,680	37,236	39,900	33,960	27,276	53,952	27,156	33,690
January	30,828	39,840	30,528	32,784	47,064	29,460	41,412	35,712	44,796	77,676	....	41,010
February	25,176	35,532	22,308	19,284	35,016	46,200	33,336	44,124	45,624	73,128	....	37,973
March	24,828	24,792	25,512	29,016	38,796	30,216	30,996	48,564	30,792	71,148	....	35,466
April	18,492	27,708	22,116	17,652	46,752	25,404	25,992	27,864	29,736	25,524	....	26,724
May	17,712	24,240	27,996	14,124	22,188	39,684	22,164	25,824	16,248	27,492	....	23,767
June	12,528	17,532	20,112	17,868	23,424	17,472	21,924	13,092	14,892	44,784	....	20,363
Crop year total	308,940	318,948	343,392	285,288	398,604	398,172	359,316	419,964	386,460	599,340	....	381,842

[1] From Kansas City Board of Trade.

TABLE 245.—*Hay: Monthly and yearly shipments from Kansas City, in tons, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	5,700	5,136	7,140	5,532	5,892	3,336	8,544	16,200	6,564	14,004	15,276	7,805
August	9,828	7,224	6,960	6,852	8,136	4,176	7,188	10,092	13,704	13,584	17,112	8,774
September	5,700	3,864	4,296	6,444	4,296	3,276	5,940	11,652	13,032	14,208	16,272	7,271
October	5,268	4,008	5,688	5,508	3,816	2,364	6,732	16,920	17,904	12,336	7,092	8,054
November	5,832	4,956	5,844	6,120	5,316	5,220	14,160	26,424	13,332	20,904	11,304	10,811
December	7,944	4,680	8,436	5,244	4,944	5,448	18,876	19,728	11,784	25,320	14,940	11,240
January	10,356	4,260	10,356	8,868	7,080	5,988	17,532	20,328	17,484	37,236	....	13,949
February	10,572	6,588	9,768	10,056	7,308	11,172	15,144	28,392	21,948	34,332	....	15,528
March	7,608	5,016	6,912	9,552	5,820	11,796	15,996	28,932	9,636	42,252	....	14,352
April	9,780	4,716	7,596	7,152	8,328	7,092	12,864	20,748	10,128	14,172	....	10,258
May	9,660	4,308	6,360	4,056	3,936	9,048	7,176	12,648	3,492	14,304	....	7,499
June	5,580	4,140	5,820	3,372	2,736	4,752	8,280	10,848	4,032	15,432	....	6,499
Crop year total	93,828	58,896	85,176	78,756	67,608	73,668	138,432	222,912	143,040	258,084	....	....

[1] From Kansas City Board of Trade.

TABLE 246.—*Hay: Yearly production in United States and principal producing States, 1910 to 1920.*

[In thousands of tons, i. e., 000 omitted.]

State.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
United States	69,378	54,916	72,691	64,116	70,071	85,920	91,192	83,308	76,660	91,883	91,193
California	4,392	4,375	3,825	3,600	5,265	4,230	4,375	4,800	2,970	4,894	5,002
Colorado	1,562	1,570	1,905	1,824	2,328	2,134	1,988	2,376	2,287	2,700	2,966
Idaho	1,890	2,083	1,938	2,044	1,868	1,828	1,750	2,175	2,001	1,750	2,250
Illinois	4,070	2,124	3,266	2,450	1,912	3,850	4,785	3,671	4,552	4,736	4,080
Indiana	2,502	1,622	2,582	1,800	1,764	3,030	3,312	3,107	3,204	2,562	2,844
Iowa	4,168	2,858	4,952	4,440	4,071	6,300	5,920	4,096	4,206	5,181	4,350
Kansas	1,898	1,318	2,440	1,350	2,492	4,062	2,604	3,880	3,233	4,379	3,702
Michigan	3,328	2,778	3,185	2,520	3,011	3,458	4,675	3,837	2,676	3,180	1,149
Minnesota	1,797	1,582	2,541	2,490	3,294	3,247	3,496	3,022	2,730	3,800	3,434
Missouri	4,224	1,754	4,143	1,800	1,820	4,636	4,433	3,657	2,690	3,746	3,902
Nebraska	1,291	988	1,552	1,675	2,535	4,550	3,885	2,544	2,381	4,299	4,209
New York	6,310	4,814	5,900	5,358	5,584	5,492	7,047	6,325	5,375	6,579	5,482
Ohio	4,448	2,793	4,026	3,848	3,170	4,049	5,102	4,154	4,235	4,250	4,252
Pennsylvania	4,255	3,022	4,537	4,146	4,020	4,340	5,208	4,360	4,181	4,104	3,951
Tennessee	1,406	925	1,154	1,089	960	1,396	1,449	1,260	1,674	1,729	2,002
Wisconsin	2,430	2,700	3,600	3,848	4,462	4,508	4,420	4,622	3,636	4,802	4,814

TABLE 247.—*Feed: Monthly and yearly average price per ton of reported sales, No. 3 yellow shelled corn, Chicago, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
November	$17.50	$24.29	$18.57	$25.71	$23.93	$22.50	$35.00	$78.93	$47.50	$52.14	$27.50	$34.61
December	16.07	21.79	16.43	23.57	22.86	24.64	32.86	63.21	51.79	52.50	26.43	32.57
January	16.07	22.14	16.43	22.14	25.36	26.43	35.00	63.21	51.07	53.93	....	33.18
February	16.07	22.86	17.14	22.14	26.43	26.43	35.71	64.64	45.36	52.14	....	32.89
March	16.07	24.29	17.50	22.86	25.71	26.07	38.93	60.71	54.64	56.43	....	34.32
April	17.86	27.86	19.64	23.93	26.79	27.14	50.00	58.93	57.86	60.36	....	37.04
May	19.29	28.21	20.36	25.00	27.50	26.79	56.79	57.14	62.14	72.14	....	39.54
June	19.64	26.79	21.43	25.71	26.43	26.43	60.71	57.86	63.57	67.50	....	39.61
July	22.50	24.29	22.14	25.36	27.86	28.93	71.07	60.71	68.57	56.43	....	40.79
August	23.21	28.21	26.43	29.29	28.93	30.36	73.57	61.43	69.64	56.43	....	42.75
September	23.93	26.43	26.79	28.21	26.43	30.71	75.00	56.43	55.36	46.79	....	39.61
October	26.07	23.21	25.00	26.07	23.21	34.29	72.50	50.36	50.36	32.50	....	36.36
Weighted average	18.93	25.36	18.93	25.00	25.00	28.21	39.64	58.21	57.86	56.79	....	35.36

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 248.—*Feed: Monthly and yearly average price per ton, reported sales of No. 3 white oats, Chicago, 1910–11 to 1920–21.* [1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	$21.88	$25.63	$21.25	$26.25	$26.25	$25.63	$27.50	$38.13	$43.75	$46.25	$43.75	$30.25
September	21.25	28.13	20.63	27.50	30.00	21.25	28.75	37.50	45.00	43.13	38.75	30.31
October	20.00	29.38	20.63	25.00	28.75	22.50	30.63	37.50	43.13	43.75	33.75	30.13
November	20.00	30.00	20.00	25.00	30.00	22.50	34.38	40.63	45.00	45.63	31.88	31.31
December	20.00	29.38	20.63	25.00	30.63	26.25	33.13	48.13	45.00	51.25	30.00	32.94
January	20.63	31.25	20.63	23.75	33.13	30.00	35.63	51.25	40.63	53.75	....	34.07
February	19.38	32.50	20.63	24.38	36.25	28.13	35.00	55.63	35.00	53.75	....	34.07
March	19.38	33.13	20.00	24.38	35.63	26.25	38.13	58.13	39.38	58.13	....	35.25
April	20.00	35.63	21.88	24.38	35.62	27.50	43.13	55.63	43.75	63.13	....	37.07
May	21.25	34.38	23.75	25.00	33.75	26.88	43.75	48.13	43.13	68.13	....	36.82
June	24.38	33.13	25.00	25.00	30.63	24.38	41.88	48.13	43.75	70.63	....	36.69
July	27.50	30.63	25.00	23.13	33.13	25.63	48.75	48.13	48.75	56.88	....	36.75
Weighted average	20.63	31.25	21.88	25.00	31.25	25.63	33.75	44.38	43.75	50.00	....	32.75

[1] Compiled from Chicago Daily Trade Bulletin.

TABLE 249.—*Feed: Monthly and yearly average price per ton of bran, Minneapolis, 1916 to 1920.* [1]

Month.	1916	1917	1918	1919	1920	5-yr. av.
January	$18.78	$28.75	$32.50	$47.26	$41.98	$33.85
February	20.10	32.55	32.50	42.83	42.68	34.13
March	18.54	34.20	32.85	38.09	46.69	34.08
April	18.63	38.54	33.04	39.78	50.26	36.05
May	19.05	33.77	31.27	37.39	53.25	34.95
June	18.32	26.97	30.74	34.20	50.78	32.20
July	17.69	32.15	26.00	37.41	47.83	32.22
August	20.03	31.83	29.31	40.38	41.88	32.69
September	21.71	30.28	29.06	37.49	38.42	31.39
October	24.50	30.55	28.45	36.82	30.63	30.19
November	27.08	33.46	27.80	37.94	31.85	31.63
December	25.93	38.02	33.49	41.50	28.23	33.43
Yearly average	20.87	32.59	30.58	39.26	42.04	36.07

[1] Compiled from Minneapolis Daily Market Record.

TABLE 250.—*Feed: Monthly and yearly average price per ton of middlings, Minneapolis, 1916 to 1920.* [1]

Month.	1916	1917	1918	1919	1920	5-yr. av.
January	$19.41	$28.83	$34.50	$48.84	$43.97	$35.11
February	21.61	32.55	34.50	44.14	47.28	36.01
March	20.22	34.20	34.85	38.56	51.57	35.88
April	19.50	39.56	35.04	40.74	54.88	37.94
May	20.06	36.15	33.27	44.81	57.77	38.41
June	20.10	33.27	32.69	42.90	56.06	37.00
July	19.88	41.90	27.61	47.22	54.22	38.17
August	21.48	41.78	31.00	53.08	52.56	39.98
September	22.50	35.09	30.90	51.46	45.65	37.14
October	27.19	36.25	30.77	44.44	30.62	33.85
November	30.81	37.40	30.09	41.22	28.86	33.68
December	27.88	39.05	36.27	43.13	23.94	34.05
Yearly average	22.56	36.33	32.63	45.06	45.62	36.44

[1] Compiled from Minneapolis Daily Market Record.

TABLE 251.—*Feed: Monthly and yearly average price per ton, oil meal, New York 1910–11 to 1920–21.* [1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
September	$37.46	$40.00	$35.38	$32.50	$33.62	$39.70	$39.50	$53.00	$55.00	$81.58	$60.00	$44.77
October	36.90	40.75	35.30	32.00	32.83	38.75	42.28	54.00	56.00	73.80	60.00	44.26
November	35.50	40.12	34.38	31.40	32.75	38.50	45.45	54.42	55.75	78.75	56.80	44.70
December	35.50	39.00	32.75	31.25	35.10	40.50	47.50	57.00	56.50	80.75	52.00	45.59
January	35.50	39.65	32.34	31.25	38.75	40.60	48.50	58.15	62.15	81.50	....	46.84
February	35.50	40.17	31.90	31.35	41.00	39.50	48.50	58.50	63.35	71.75	....	46.15
March	35.50	39.75	29.20	31.25	37.13	36.63	48.33	58.50	65.50	70.40	....	45.22
April	34.12	38.80	27.86	31.50	35.50	32.86	47.00	57.00	65.50	62.50	....	43.26
May	33.75	38.10	28.12	31.50	32.50	31.50	49.44	52.50	70.50	60.00	....	42.79
June	33.50	37.30	28.25	32.27	32.50	32.12	49.25	50.00	75.50	60.00	....	43.07
July	34.33	36.57	29.40	32.80	35.31	33.00	51.08	52.80	82.30	60.00	....	44.76
August	35.71	35.50	30.12	34.60	37.71	37.00	53.50	54.00	90.25	60.00	....	46.84
Crop year average	35.27	38.81	31.25	31.97	35.39	36.72	47.53	54.99	66.53	70.09	....	44.86

[1] From Annual Statistical Review of New York Produce Exchange and the Oil, Paint, and Drug Reporter.

TABLE 252.—*Feed: Monthly and yearly price per ton, cottonseed meal, Memphis, 1910–11 to 1920–21.* [1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	$26.00	$26.50	$26.75	$31.75	$28.00	$25.63	$28.25	$45.50	$46.50	$76.25	$55.00	$36.11
September	25.75	25.75	25.63	27.00	23.75	27.13	30.75	43.00	46.50	63.00	51.25	33.83
October	25.38	24.63	24.38	27.13	22.75	30.50	35.25	45.50	46.50	66.50	39.50	34.85
November	24.38	24.63	24.63	27.38	22.38	32.00	39.25	49.75	54.00	70.25	34.13	36.87
December	24.38	24.63	25.50	27.25	23.50	34.00	39.00	46.50	54.00	69.25	28.00	36.80
January	23.88	24.38	25.75	26.75	24.75	32.25	37.50	46.50	54.00	71.00	....	36.68
February	23.25	25.13	25.13	26.13	27.25	29.00	36.25	46.50	54.00	65.00	....	35.76
March	23.25	26.00	25.13	26.75	26.88	28.38	36.25	46.50	54.00	65.75	....	35.89
April	23.88	27.25	26.75	27.63	26.50	28.88	38.50	46.50	54.00	64.81	....	36.47
May	23.88	28.00	28.00	27.75	26.00	27.75	39.50	46.50	54.00	65.13	....	36.65
June	24.50	27.25	28.75	27.50	25.25	27.25	42.25	46.50	59.13	63.63	....	37.20
July	25.63	26.75	30.63	27.75	25.13	37.25	44.50	46.50	69.75	59.40	....	38.33
Crop year average	24.51	25.91	26.42	27.56	25.18	29.17	37.27	46.31	53.87	66.66	....	36.29

[1] Figures prior to 1919 from Cotton Oil Press.

TABLE 253.—*Flaxseed: Monthly and yearly price per bushel, Minneapolis, 1910–11 to 1920–21.* [1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
September	$2.66	$2.47	$1.76	$1.45	$1.51	$1.70	$2.11	$3.38	$4.09	$4.92	$3.23	$2.61
October	2.62	2.35	1.60	1.38	1.33	1.86	2.54	3.16	3.59	4.32	2.83	2.48
November	2.61	2.04	1.35	1.35	1.45	1.99	2.78	3.29	3.77	4.83	2.27	2.55
December	2.42	2.06	1.25	1.44	1.54	2.07	2.84	3.40	3.54	4.99	2.06	2.56
January	2.60	2.15	1.29	1.49	1.83	2.31	2.89	3.60	3.41	5.12	....	2.67
February	2.68	2.06	1.34	1.53	1.86	2.32	2.81	3.74	3.45	5.09	....	2.69
March	2.60	2.06	1.26	1.58	1.91	2.27	2.90	4.08	3.75	5.02	....	2.74
April	2.56	2.15	1.29	1.54	1.93	2.13	3.18	4.09	3.88	4.68	....	2.74
May	2.47	2.23	1.30	1.56	1.95	1.96	3.33	3.93	4.12	4.53	....	2.74
June	2.24	2.25	1.31	1.59	1.76	1.80	3.11	3.86	4.86	3.92	....	2.70
July	2.10	1.97	1.38	1.68	1.67	1.96	3.01	4.40	5.94	3.48	....	2.76
August	2.34	1.86	1.47	1.64	1.67	2.15	3.46	4.39	5.87	3.28	....	2.81
Crop year average	2.49	2.14	1.38	1.52	1.70	2.04	2.91	3.78	4.19	4.52	....	2.67

[1] From Annual Reports of Minneapolis Chamber of Commerce and the Daily Market Record.

TABLE 254.—*Flaxseed: Monthly and yearly average farm price per bushel, United States, 1910–11 to 1920–21.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
September	$2.27	$2.05	$1.56	$1.26	$1.33	$1.46	$1.95	$3.06	$3.81	$4.78	$2.85	$2.35
October	2.32	2.08	1.41	1.21	1.23	1.56	2.17	3.03	3.58	4.10	2.60	2.27
November	2.31	1.97	1.24	1.20	1.23	1.69	2.42	2.97	3.37	4.11	2.09	2.25
December	2.27	1.85	1.11	1.22	1.31	1.80	2.50	3.04	3.34	4.37	2.14	2.28
January	2.28	1.89	1.08	1.26	1.50	1.99	2.53	3.19	3.19	4.46	....	2.34
February	2.38	1.88	1.14	1.31	1.61	2.07	2.54	3.39	3.19	4.65	....	2.42
March	2.38	1.88	1.17	1.33	1.63	2.03	2.60	3.65	3.38	4.65	....	2.47
April	2.39	1.86	1.14	1.34	1.69	1.97	2.84	3.77	3.55	4.52	....	2.51
May	2.34	1.93	1.15	1.36	1.70	1.85	3.00	3.69	3.75	4.35	....	2.51
June	2.16	2.02	1.15	1.37	1.62	1.70	2.89	3.57	4.17	3.91	....	2.46
July	2.03	1.87	1.16	1.44	1.49	1.71	2.75	3.80	4.93	3.32	....	2.45
August	2.02	1.69	1.24	1.45	1.45	1.84	2.88	3.96	5.30	2.97	....	2.48
Crop year average	2.26	1.91	1.21	1.31	1.48	1.81	2.59	3.43	3.80	4.18	....	2.40

TABLE 255.—*Flaxseed: Yearly production in United States and principal producing States, 1910 to 1920.*

[In thousands of bushels; i. e., 000 omitted.]

State.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
United States	12,718	19,370	28,073	17,853	13,749	14,030	14,296	9,164	13,369	7,661	10,990
Minnesota	2,828	3,200	4,121	3,150	2,930	3,150	1,700	2,090	3,536	2,312	3,040
Montana	2,100	3,272	5,520	3,600	2,560	1,890	3,088	1,749	1,641	615	1,353
North Dakota	4,021	9,120	12,086	7,200	6,972	6,534	8,137	3,764	6,240	3,220	3,896
South Dakota	2,850	3,217	5,323	3,060	2,400	1,650	930	980	1,425	1,160	2,200

TABLE 256.—*Flaxseed: Monthly and yearly price per gallon of linseed oil, New York, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
September	$0.90	$0.87	$0.66	$0.50	$0.57	$0.52	$0.70	$1.25	$1.90	$2.04	$1.22	$0.99
October	.90	.88	.62	.47	.49	.55	.82	1.18	1.83	1.79	1.20	.95
November	.95	.84	.56	.46	.44	.60	.90	1.15	1.55	1.75	.98	.92
December	.95	.71	.43	.48	.45	.61	.92	1.21	1.58	1.82	.82	.92
January	.95	.74	.42	.48	.48	.66	.94	1.29	1.50	1.77	....	.92
February	.96	.71	.46	.48	.56	.72	.95	1.29	1.45	1.77	....	.94
March	.96	.70	.45	.50	.55	.77	.94	1.41	1.48	1.80	....	.96
April	.91	.73	.44	.51	.58	.76	1.07	1.57	1.54	1.83	....	.99
May	.91	.73	.46	.50	.62	.75	1.21	1.57	1.61	1.69	....	1.01
June	.89	.76	.45	.50	.63	.67	1.21	1.57	1.81	1.65	....	1.01
July	.87	.77	.47	.52	.54	.63	1.12	1.64	2.10	1.52	....	1.02
August	.80	.66	.49	.59	.50	.71	1.18	1.88	2.22	1.41	....	1.04
Crop year average	.91	.76	.49	.50	.53	.66	1.00	1.42	1.71	1.74	....	.97

[1] Figures for 1910–15 from Monthly Labor Review, 1916–18 from War Industries Board Price Bulletin, 1919–20 from Oil, Paint, and Drug Reporter.

TABLE 257.—*Flaxseed: Monthly and yearly receipts at Minneapolis, 1910–11 to 1920–21.*[1]

[In thousands of bushels; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
September	854	563	700	756	901	347	316	265	536	753	580	599
October	1,530	1,212	1,657	1,686	1,890	1,038	2,380	980	915	570	1,444	1,386
November	1,292	1,570	1,520	1,505	1,247	1,506	1,694	1,112	857	568	861	1,287
December	535	1,716	2,245	1,131	1,016	1,113	1,045	614	788	492	699	1,070
January	338	531	1,450	711	599	319	544	533	558	344	....	593
February	300	459	1,246	478	443	399	442	553	473	368	....	516
March	232	397	1,057	592	384	810	441	527	829	409	....	568
April	112	468	742	270	142	486	384	283	439	159	....	349
May	118	571	518	139	77	440	263	349	436	295	....	321
June	122	440	514	165	146	363	565	648	942	522	....	443
July	133	487	432	233	239	441	325	208	642	554	....	369
August	191	160	281	117	115	199	92	94	196	297	....	264
Crop year total	5,757	8,574	12,362	7,783	7,199	7,461	8,491	6,166	7,611	5,331	....	7,765

[1] Compiled from Minneapolis Chamber of Commerce Reports and Daily Market Record.

TABLE 258.—*Timothy seed: Monthly and yearly average spot price per 100 pounds, prime contract grade, Chicago, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	$6.36	$14.31	$6.13	$5.59	$6.31	$8.19	$7.00	$8.25	$8.90	$11.75	$8.89	$8.28
September	9.45	15.20	4.81	5.58	6.34	9.19	4.99	8.44	10.00	11.50	7.50	8.55
October	9.32	15.81	4.44	5.51	5.64	8.35	5.43	8.56	10.00	11.25	6.71	8.43
November	9.64	16.00	4.05	5.41	5.48	8.46	5.50	7.82	10.30	11.50	6.69	8.42
December	9.97	16.45	4.13	5.55	6.61	8.73	5.74	7.63	11.00	12.25	6.13	8.81
January	10.41	16.25	4.13	5.53	7.89	8.70	5.55	8.25	11.00	13.62	....	9.13
February	11.40	16.25	3.88	5.45	7.45	8.75	5.55	8.94	10.00	14.30	....	9.20
March	12.03	15.60	3.76	5.19	7.35	8.55	5.78	8.55	10.50	13.07	....	9.04
April	12.00	14.50	3.88	5.30	8.84	8.50	6.81	8.25	11.00	11.76	....	9.08
May	12.00	13.70	4.16	5.47	6.88	8.94	8.20	8.41	12.00	12.00	....	9.18
June	11.55	11.63	4.69	5.63	7.25	9.20	8.14	7.81	12.00	12.00	....	8.99
July	13.50	10.25	5.28	5.87	7.40	8.75	8.01	8.88	12.00	11.85	....	9.18
Crop year average	10.64	14.66	4.45	5.51	6.95	8.69	6.39	8.32	10.73	12.24	....	8.86

[1] From Chicago Board of Trade and the Seed World.

TABLE 259.—*Clover seed: Monthly and yearly average spot price per 100 pounds, prime contract grade, Chicago, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
September	$16.13	$20.10	$17.56	$11.00	$17.19	$18.40	$14.85	$22.36	$35.00	$50.00	$26.58	$22.26
October	15.13	20.63	18.38	13.35	15.08	21.05	16.00	25.16	35.50	53.10	22.28	23.34
November	14.45	20.63	18.05	13.96	15.00	20.06	17.50	26.81	36.00	51.20	21.67	23.37
December	14.86	20.75	18.88	14.88	15.59	20.72	17.91	27.45	37.50	52.00	17.50	24.05
January	15.04	21.81	19.90	14.75	15.84	19.59	18.19	31.40	42.60	54.23	....	25.34
February	14.80	23.13	19.88	14.46	15.29	21.19	19.38	34.35	42.60	55.73	....	26.08
March	15.25	22.50	19.25	14.04	14.30	18.00	18.81	33.72	51.60	54.22	....	26.17
April	15.13	21.63	21.38	13.00	13.80	16.69	17.90	32.15	50.00	44.96	....	24.66
May	15.81	20.55	18.40	13.00	13.50	16.00	18.33	30.51	46.60	35.00	....	22.77
June	16.10	20.13	16.00	13.50	13.50	14.60	18.39	30.45	45.80	35.00	....	22.35
July	15.75	20.00	15.50	14.15	13.50	14.00	19.08	....	49.10	35.00	....	21.79
August	19.25	16.00	14.70	17.81	15.19	15.63	20.33	....	50.00	29.85	....	22.08
Crop year average	15.64	20.66	18.16	13.99	14.82	17.99	18.06	29.44	43.53	45.86	....	23.82

[1] From Chicago Board of Trade and the Seed World.

TABLE 260.—*Alfalfa seed: Monthly and yearly average spot price per 100 pounds, Kansas City, 1910–11 to 1920–21.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
July	(2)	(2)	$10.50	$10.00	$9.50	(2)	$17.81	$12.00	$12.90	$14.50	$25.00	$14.03
August	(2)	(2)	10.27	9.57	10.20	$14.17	17.58	12.52	13.91	17.77	25.00	14.55
September	$13.34	$11.50	9.84	8.25	11.88	14.98	12.63	13.25	13.02	20.00	14.79	13.04
October	12.88	10.48	9.64	8.12	10.34	15.69	11.23	13.33	13.12	23.50	14.67	13.00
November	12.88	10.00	10.00	7.70	10.00	15.57	10.50	13.50	13.45	27 72	12.50	13.08
December	12.88	10.17	10.00	7.75	10.77	16.08	10.66	13.50	13.31	30.00	14.00	13.56
January	12.88	11.03	9.90	8.00	12.30	17.32	10.62	13.50	13.58	30.00	....	13.91
February	12.88	10.90	9.81	8.00	13.15	16.23	11.00	13.50	13.75	33.77	....	14.30
March	12.88	10.91	9.88	8.00	13.11	17.25	11.00	13.50	13.75	30.34	....	14.06
April	(2)	10.45	10.09	8.42	12.53	17.25	11.18	14.38	14.00	25.00	....	13.71
May	(2)	10.75	10.25	9.35	12.65	17.25	11.80	15.00	14.27	25.00	....	14.04
June	(2)	10.60	10.02	9.50	12.75	17.25	12.00	12.42	14.21	25.00	....	13.75
Crop year average	12.95	10.68	10.02	8.56	11.52	16.28	12.33	13.37	13.61	25.22	....	13.54

[1] Compiled from Kansas City Price Current and the Seed World.
[2] No quotations.

TABLE 261.—*Alsike clover seed: Monthly and yearly average spot price per bushel, Toledo, 1914–15 to 1920–21.*[1]

Month.	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	5-yr. av.
September	....	$9.59	$9.83	$12.57	....	$25.30	$16.84	$14.32
October	....	10.27	10.24	13.34	$18.17	28.72	17.35	16.15
November	....	10.35	10.72	14.35	....	29.97	17.70	16.35
December	....	10.33	11.10	14.46	19.66	31.47	16.96	17.41
January	....	10.26	11.30	15.31	18.70	34.57	....	18.03
February	$8.96	10.07	11.62	....	16.92	35.17	....	18.45
March	8.59	9.40	11.51	15.59	20.09	35.71	....	18.46
April	8.17	9.15	11.56	15.31	25.41	[2] 30.89	....	18.48
May	8.05	9.10	11.50	15.22	....	24.37	....	15.05
June	[2] 7.90	9.48	11.40	12.37	....	25.52	....	14.69
July	8.52	9.53	11.62	....	24.23	23.95	....	17.33
August	9.13	9.88	11.74	....	25.00	19.24	....	16.47
Crop year average	....	9.78	11.18	14.28	21.02	28.74	....	17.00

[1] Compiled from the Seed World.
[2] Price based on very few sales.

TABLE 262.—*Timothy seed: Monthly and yearly receipts at Chicago, 1910–11 to 1920–21.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	1,878	4,451	2,916	3,601	4,914	1,201	2,487	3,810	764	7,450	3,313	3,347
September	7,509	5,829	6,875	5,947	11,208	9,894	10,565	6,525	3,198	13,191	12,777	8,074
October	3,778	4,011	5,505	4,232	3,469	5,578	5,631	5,172	5,175	6,124	9,013	4,868
November	1,741	2,649	3,608	3,421	2,650	4,039	3,989	2,966	3,242	2,582	5,269	3,089
December	1,563	1,120	2,182	2,131	3,487	2,416	3,051	1,915	1,463	1,643	3,445	2,097
January	1,311	792	2,361	2,191	3,050	1,431	2,149	2,006	1,578	3,186	....	2,006
February	1,560	879	3,019	1,763	3,087	2,203	2,478	2,242	2,234	3,381	....	2,285
March	1,205	868	2,831	4,393	4,129	2,167	6,279	2,554	2,985	3,118	....	3,053
April	368	557	3,964	1,977	1,165	1,019	3,367	1,434	3,772	1,338	....	1,896
May	106	388	1,509	828	1,101	1,039	2,442	1,250	2,398	1,093	....	1,215
June	55	242	1,764	1,446	403	704	1,117	392	1,348	641	....	811
July	87	158	2,647	2,410	752	296	924	677	891	1,135	....	998
Crop year total	21,161	21,944	39,181	34,340	39,415	31,987	44,479	30,943	29,048	44,882	....	33.738

[1] From Chicago Board of Trade and the Seed World.

TABLE 263.—*Timothy seed: Monthly and yearly shipments from Chicago, 1910–11 to 1920–21.*[1]

[In thousands of pounds, i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	1,825	2,452	1,951	1,774	2,056	1,372	2,826	2,605	1,218	2,340	2,233	2,042
September	4,198	5,038	7,504	3,735	4,845	5,344	7,956	3,887	1,774	6,301	4,072	5,058
October	1,701	2,035	4,375	3,285	2,511	5,283	5,363	2,816	2,674	3,142	4,150	3,318
November	676	2,051	4,912	1,896	2,124	3,796	4,071	1,511	3,903	1,964	1,787	2,690
December	899	688	2,224	1,893	3,549	2,485	3,128	1,291	2,688	2,588	1,594	2,143
January	2,078	482	3,313	2,065	2,565	1,982	2,921	1,720	1,659	4,007	....	2,270
February	2,109	958	3,152	2,021	1,877	2,326	4,082	2,049	3,178	3,737	....	2,549
March	2,751	1,356	4,426	3,977	2,430	4,203	7,775	5,160	3,621	3,404	....	3,910
April	1,004	761	4,629	1,955	2,623	2,715	4,321	1,459	4,579	1,852	....	2,590
May	159	360	2,229	888	1,727	1,212	2,288	147	1,817	2,497	....	1,332
June	4	54	1,521	786	955	162	779	509	780	735	....	629
July	3	158	1,344	2,592	1,205	395	729	427	1,253	1,057	....	916
Crop year total	17,407	16,393	41,578	26,867	28,467	31,185	46,239	23,581	29,144	33,624	....	29,449

[1] From Chicago Board of Trade and the Seed World.

TABLE 264.—*Clover seed: Monthly and yearly receipts at Chicago, 1910–11 to 1920–21.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
September	1,340	519	271	188	789	2,190	1,356	1,346	192	1,539	1,549	973
October	1,375	198	950	225	596	1,921	1,308	945	1,597	1,816	2,448	1,093
November	865	176	521	939	1,136	1,953	995	1,149	1,337	1,941	1,033	1,101
December	231	95	295	1,446	1,723	1,205	1,416	587	1,146	1,606	1,314	975
January	94	331	493	1,035	1,773	980	660	1,079	1,974	2,840	....	1,126
February	524	337	545	418	1,993	1,236	1,192	1,688	1,002	2,557	....	1,149
March	751	357	901	837	900	1,123	833	797	1,175	2,239	....	991
April	378	307	279	412	438	974	798	217	464	884	....	515
May	364	213	109	210	55	294	393	298	88	7	....	203
June	405	194	165	836	0	0	307	108	0	200	....	222
July	59	343	41	429	48	53	2	22	271	195	....	146
August	270	574	40	1,180	327	138	602	135	798	213	....	428
Crop year total	6,656	3,644	4,610	8,155	9,778	12,067	9,862	8,371	10,044	16,037	....	8,922

[1] From Chicago Board of Trade and the Seed World.

TABLE 265.—*Clover seed: Monthly and yearly shipments from Chicago, 1910–11 to 1920–21.*[1]

[In thousands of pounds; i. e., 000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
September	165	51	141	138	309	714	279	423	191	271	107	268
October	183	111	309	152	124	596	602	483	527	386	589	347
November	244	204	862	264	484	1,506	1,021	430	1,447	952	691	741
December	224	131	372	668	1,665	879	962	1,144	787	888	769	772
January	480	426	502	882	1,197	1,125	1,065	908	984	2,589	....	1,016
February	682	621	835	1,576	1,583	1,438	1,696	1,923	1,139	1,619	....	1,311
March	504	420	1,525	1,591	1,290	2,027	2,086	1,116	1,109	926	....	1,259
April	252	363	707	740	792	1,481	1,606	182	653	842	....	762
May	185	106	90	544	188	415	583	246	18	248	....	262
June	52	48	78	301	13	39	157	4	94	98	....	88
July	12	144	33	381	69	78	309	60	25	118	....	123
August	118	59	65	264	104	88	429	167	136	61	....	149
Crop year total	3,101	2,684	5,519	7,501	7,818	10,386	10,795	7,086	7,110	8,998	....	7,10[illegible]

[1] From Chicago Board of Trade and the Seed World.

PART V. FRUITS AND VEGETABLES.

TABLE 266.—*Apples: Monthly range and average jobbing price per barrel and box, at ten markets, 1919 and 1920.*

BARRELS.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
January	$5.00–$6.25	$5.71	$5.00–$10.50	$6.55	$4.25–$7.00	$5.85	$4.50–$7.50	$5.97	....	......
February	....	......	....	......	....	......	5.50– 9.50	7.89	....	......
March	....	......	....	......	....	......	....	......	....	......
September	4.50–10.00	7.18	5.50–10.00	7.76	3.50–10.00	7.06	5.00– 8.00	6.75	$4.50–$8.00	$7.16
October	4.00–13.00	8.19	6.00–10.00	8.41	4.00–10.00	6.89	5.00– 9.00	7.25	4.00– 9.25	6.01
November	5.00–12.00	7.79	5.50–10.00	8.73	4.50– 9.00	7.08	5.00– 9.00	7.69	5.00– 9.25	6.55
December	5.00–10.00	7.63	6.50–10.00	8.41	4.00–10.00	7.01	4.75– 9.00	7.84	7.00– 8.25	7.54
1920.										
January	4.00–11.00	8.01	5.50–10.00	8.10	3.00–10.00	7.03	6.00– 9.50	8.36	6.75– 9.00	7.58
February	5.50–11.50	8.96	6.00–10.50	8.05	3.50– 9.00	6.90	5.00– 9.80	8.18	6.50– 9.50	7.71
March	4.00–11.00	7.96	6.50–12.00	9.04	4.00– 9.50	7.06	5.50– 9.50	8.02	7.25–10.00	8.13
April	6.00–13.50	10.57	7.00–12.00	8.34	4.00–12.00	7.47	5.50–11.00	8.40	7.25–10.00	8.42
September	2.75– 8.00	4.86	3.50– 8.00	5.86	2.00– 7.50	5.00	3.00– 6.50	4.99	3.00– 7.25	5.34
October	2.00– 9.00	5.23	3.50– 9.00	6.28	2.50– 8.50	4.93	3.00– 6.00	4.46	2.75– 7.50	4.67
November	3.00– 9.50	5.66	3.00– 9.00	6.29	2.50– 7.50	4.49	3.00– 6.25	4.81	3.00– 6.50	4.97
December	2.50– 8.00	4.71	3.25– 8.00	5.23	2.00– 6.00	4.13	2.50– 6.00	4.68	3.50– 6.00	4.83

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
January	$5.00–$9.00	$6.69	[1]$6.50–$7.00	[1]$6.75	[1]$6.50–$11.00	[1]$7.08	$5.75–$9.50	$7.95	....	......
February	5.00–10.50	8.33	[1]7.00–10.00	[1]8.67	[1]6.50–10.00	[1]8.00	6.75–10.00	8.11	....	......
March	7.50–12.50	10.02	[1]9.50–12.00	[1]10.73	[1]9.00–11.00	[1]10.31	8.00–12.25	10.69	....	......
September	5.50– 9.50	7.19	9.50–10.00	9.59	9.00–10.50	9.76	8.00– 9.00	8.32	$5.00–$9.00	$7.54
October	5.00– 9.50	7.42	7.00–10.50	9.37	7.50–10.50	9.17	7.50– 8.50	8.14	8.00– 9.50	9.17
November	5.75– 8.50	7.69	7.00–11.00	8.95	7.50–10.50	9.00	7.50– 9.00	8.20	6.00– 9.50	8.50
December	7.00– 8.75	7.86	7.00–11.00	8.80	7.50–10.50	9.00	7.00– 9.00	7.62	6.00– 9.25	8.09
1920.										
January	5.50–10.00	7.50	6.50–10.50	7.86	7.00–10.50	8.93	6.75– 7.50	7.24	6.00– 9.00	7.79
February	5.50– 9.50	7.69	6.50– 8.00	7.17	7.00–10.50	8.38	6.75– 7.25	7.00	6.00– 9.50	7.47
March	5.50–10.00	8.23	7.00– 9.00	8.40	7.50–11.50	9.31	6.75– 8.00	7.47	5.50–10.50	8.48
April	4.75–11.00	8.60	....	......	8.50–10.50	8.93	7.50– 8.00	7.75	4.00–11.00	8.10
September	4.00– 6.00	5.40	7.00–12.50	8.79	6.50–11.50	9.63	7.50– 9.00	8.45	3.50– 7.50	5.90
October	2.75– 6.00	4.63	5.50–10.00	7.81	5.75–11.00	8.88	5.00– 8.00	7.25	3.00–14.00	5.74
November	3.50– 6.00	4.45	5.00– 6.50	5.85	5.25–10.50	7.85	5.00– 6.50	5.95	3.00– 7.50	5.46
December	4.00– 5.75	4.87	5.00– 6.50	5.53	4.75– 7.00	5.84	5.00– 6.25	5.66	4.00– 7.00	5.52

BOXES.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
January	$2.75–$4.25	$3.20	$2.40–$3.75	$3.03	....	......	$2.25–$3.50	$2.81	....	......
February	3.25– 4.25	3.83	3.00– 4.25	3.60	....	......	....	......	....	......
March	3.50– 4.35	3.96	3.75– 4.50	4.14	....	......	....	......	....	......

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
January	$2.25–$3.00	$2.74	[1]$2.50–$4.00	[1]$3.25	[1]$3.25–$4.00	[1]$3.69	$2.65–$4.00	$3.15	$2.75–$4.75	$3.83
February	....	......	....	......	[1]3.25– 3.50	[1]3.38	3.25– 5.00	3.64	3.25– 5.50	4.11
March	....	......	....	......	....	......	3.50– 5.35	4.46	4.00– 5.25	4.52

[1] Sales chiefly direct to retailers.

TABLE 267.—*Cabbage: Monthly range and average jobbing prices, Danish, Holland, and domestic, per hundred pounds, at ten markets, 1919 and 1920.*

DANISH AND HOLLAND.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
January	$0.88–$1.88	$1.39	$1.00–$2.05	$1.44	$1.20–$2.00	$1.49	$1.20–$1.75	$1.49	$1.13–$2.88	$1.57
February	1.00–2.13	1.35	1.08–2.23	1.49	.95–2.10	1.50	1.25–1.60	1.47	.88–2.00	1.41
March	1.88–3.00	2.12	1.88–2.75	2.16	1.58–3.25	2.15	1.50–3.00	2.26	1.38–3.13	2.21
October[1]	1.30–1.75	1.51	1.15–1.79	1.35	1.45–1.95	1.68	...	...	1.30–2.10	1.73
November	1.60–2.50	1.91	1.30–2.63	1.73	1.58–2.18	1.78	1.80–2.28	1.99	.93–2.75	1.66
December	2.63–4.00	3.59	3.00–3.88	3.38	2.75–4.75	3.61	3.13–4.50	3.63	2.75–3.75	3.38
1920.										
October[2]	.88–1.00	.99	...	...	.70–1.00	.81	.88–1.40	1.12	...	...
November	.75–1.13	.94	.43–.73	.52	.55–1.18	.82	.70–1.50	1.00	...	...
December	.70–.83	.76	.60–.83	.70	.50–.75	.62	.60–.80	.69	.90–.95	.91

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[3]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
January	$1.08–$2.00	$1.66	...	...	...	...	$1.18–$2.88	$1.99	$1.75–$2.50	$2.14
February	1.43–2.00	1.74	...	...	...	...	1.25–2.50	1.91	1.63–2.50	1.89
March	1.75–3.50	2.53	...	...	...	...	2.50–5.00	3.17	2.50–2.88	2.65
October[1]	1.75–2.38	2.06	...	...	...	...	1.63–2.25	1.98	...	...
November	1.63–2.75	2.22	...	...	...	...	1.50–3.00	1.95	...	...
December	3.00–4.25	3.80	...	...	...	...	3.50–4.25	3.89	...	...
1920.										
November[2]	.55–1.33	.96	...	...	...	...	...	...	...	...
December	.50–.90	.72	...	...	...	...	.80–1.25	1.05	...	...

DOMESTIC.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
October[2]	$0.75–$1.50	$1.16	$0.83–$1.75	$1.09	$0.88–$1.75	$1.24	...	...	...	...
November	...	...	...	...	1.13–1.70	1.30	...	...	...	...
1920.										
October[2]	.73–.88	.77	.38–.53	.50	.50–.75	.59	$0.45–$1.00	$0.78	...	...
November	...	...	...	...	.35–.95	.60	.48–.68	.57	...	...

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
October[2]	$1.25–$1.95	$1.73	...	...	...	...	...	...	...	...
November	1.00–1.50	1.23	...	...	...	...	...	...	...	...
1920.										
October[2]	.55–.83	.69	...	...	...	...	...	...	...	...
November	.58–1.30	.93	...	...	...	...	...	...	...	...

[1] Intervening months of little account in shipment.
[2] Preceding months showed very few quotations.
[3] Sales chiefly direct to retailers.

TABLE 268.—*Cantaloupes: Monthly range and average jobbing prices at ten markets, 1919 and 1920.*

CALIFORNIAS—SALMON TINTS AND GREEN MEATS, STANDARDS 45'S.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
June	$3.00–$12.00	$6.30	$2.50–$8.50	$4.92	$2.50–$12.00	$5.51	$2.75–$10.00	$4.87	$2.75–$7.50	$4.01
July	2.50– 6.50	4.00	1.50– 5.00	3.32	2.00– 6.50	3.95	2.00– 5.50	3.60	1.00– 4.25	3.21
August	1.00– 5.25	2.51	1.75– 3.50	2.39	1.00– 4.00	2.33	1.50– 3.75	2.60	.75– 4.00	2.49
September	1.75– 4.00	2.74	....	......	....	......	....	......	....	......
1920.										
June	3.25–15.00	5.80	3.50–10.50	5.13	3.50–15.00	5.74	3.25–12.00	5.55	3.75–10.00	4.79
July	3.00– 7.00	4.45	3.25– 6.00	4.11	2.00– 6.50	3.87	3.00– 7.00	3.86	2.50– 4.25	3.73
August	1.00– 6.00	2.87	1.25– 5.50	2.84	.75– 7.00	2.96	1.50– 6.50	3.14	1.25– 4.50	2.54

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
June	$2.75–$9.00	$4.33	$3.00–$10.00	$5.68	$2.75–$9.00	$4.97	$2.75–$8.00	$4.38	$3.00–$10.50	$5.84
July	2.00– 5.00	3.55	3.50– 5.00	4.00	3.00– 4.75	3.72	1.50– 4.50	3.13	....	......
August	2.00– 3.75	2.84	1.50– 3.75	2.85	1.25– 3.25	2.58	1.25– 3.25	2.33	....	......
1920.										
June	3.50–15.00	5.20	3.25– 7.50	5.03	3.50– 7.00	4.96	3.50– 7.00	4.76	4.00–15.00	5.58
July	3.25– 5.00	4.06	3.50– 5.25	4.14	3.50– 6.50	4.11	3.00– 4.00	3.64	2.50– 6.00	4.05
August	1.50– 5.00	2.95	1.25– 5.50	2.92	1.25– 6.00	2.92	....	......	1.75– 4.50	2.94

CALIFORNIAS—SALMON TINTS AND GREEN MEATS, FLATS 12'S AND 15'S.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
June	$1.25–$4.00	$2.33	$1.00–$3.00	$1.83	$1.10–$3.00	$1.94	$1.10–$3.50	$1.88	$1.00–$2.25	$1.36
July	.75– 2.50	1.67	.50– 2.00	1.42	.85– 2.50	1.64	.75– 2.25	1.41	.75– 1.60	1.21
August	.50– 2.50	1.21	.75– 1.60	1.07	.40– 1.85	1.05	.60– 1.50	1.10	.15– 2.00	1.01
September	.85– 1.60	1.16	.75– 1.00	.87	1.00– 2.00	1.48	.75– 1.25	1.02	....	......
1920.										
June	1.25– 4.00	2.00	1.50– 2.50	1.87	1.00– 3.50	1.92	1.15– 2.25	1.68	1.50– 1.75	1.62
July	1.25– 3.00	1.91	1.50– 2.50	1.70	.75– 2.75	1.51	1.25– 2.50	1.52	1.35– 1.60	1.50
August	.65– 2.75	1.30	.40– 2.25	.97	.50– 2.50	1.22	.75– 2.50	1.32	.65– 1.50	.93
September	1.00– 1.75	1.37	.50– 1.50	.95	.75– 1.50	1.00	.75– 1.25	.90	....	......

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
June	$1.15–$3.00	$1.62	$1.25–$4.00	$2.07	$1.25–$4.00	$2.09	$1.00–$3.00	$1.54	$1.25–$4.00	$2.08
July	1.10– 2.00	1.53	1.25– 2.25	1.63	1.30– 1.95	1.50	.50– 2.50	1.35	....	......
August	.75– 1.50	1.15	.75– 1.65	1.33	.75– 1.50	1.34	.75– 1.50	1.12	....	......
September	.75– 1.25	1.02	....	......	....	......	....	......	....	......
1920.										
June	1.50– 2.25	1.83	1.25– 2.50	1.93	1.25– 2.50	1.85	1.25– 3.00	1.89	1.50– 5.00	2.05
July	1.50– 1.75	1.66	1.50– 2.00	1.70	1.25– 2.25	1.67	1.25– 1.50	1.48	.50– 2.25	1.67
August	.75– 2.25	1.08	.60– 2.25	1.22	.50– 2.25	1.16	.25– 1.50	.89	.75– 2.00	1.31
September	.75– 1.00	.86	....	......	....	......	....	......	1.25– 1.50	1.38

[1] Sales chiefly direct to retailers.

TABLE 268.—*Cantaloupes: Monthly range and average jobbing prices at ten markets, 1919 and 1920*—Continued.

MARYLANDS, DELAWARES, AND COLORADOS—SALMON TINTS AND GREEN MEATS, STANDARDS, 45'S.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
August[1]	$0.50–$2.25	$1.20	....	......	$0.25–$2.00	$1.05	$0.50–$2.00	$1.43	....	......
September[2]	1.50– 4.00	2.85	$1.50–$3.00	$2.49	1.75– 4.25	2.87	1.50– 4.00	2.75	$1.75–$3.25	$2.34
1920.										
August[1]	.50– 4.00	1.78	....	......	.50– 4.50	1.79	....	......	....	......
September[2]	.75– 5.00	2.71	1.25– 3.50	2.32	1.00– 4.00	2.81	1.50– 4.00	2.82	1.00– 3.00	2.28

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[3]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
September[2]	$1.50–$3.25	$2.69	....	......	....	......	$1.75–$3.25	$2.38	....	......
1920.										
September[2]	1.25– 3.50	2.14	....	......	....	......	1.00– 3.00	2.29	$1.50–$4.50	$3.03

MARYLANDS, DELAWARES, AND COLORADOS—SALMON TINTS AND GREEN MEATS, FLATS 12'S AND 15'S.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
September[2]	$0.90–$1.75	$1.23	$0.75–$1.35	$1.06	$0.75–$2.25	$1.31	$0.75–$1.50	$1.05	$0.65–$1.25	$0.93
1920.										
August[1]	.25– 2.00	.86	....	......	....	......	....	......	....	......
September[2]	.40– 2.25	1.19	.50– 1.50	1.00	.50– 2.00	1.17	.40– 1.75	1.05	.50– 1.15	.91

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[3]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
September[2]	$0.75–$1.25	$1.08	....	......	....	......	$0.70–$1.25	$0.96	....	......
1920.										
September[2]	.60– 1.35	.88	....	......	....	......	.50– 1.25	1.02	$0.75–$1.75	$1.18

[1] Marylands and Delawares.
[2] Colorados.
[3] Sales chiefly direct to retailers.

TABLE 269.—*Onions: Monthly range and average jobbing prices, per hundred pounds, at ten markets, 1919 and 1920.*

BERMUDAS, YELLOW.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
April	$8.00–$11.00	$9.32	$6.70–$8.50	$7.67	$7.50–$10.00	$8.73	$8.50–$12.00	$10.22	....	......
May	7.00– 11.50	8.81	6.00– 9.00	7.57	7.00– 11.00	8.77	7.00– 10.00	8.55	$6.50–$8.50	$7.41
June	8.00– 10.00	8.84	6.00– 8.50	7.71	6.00– 10.00	8.50	6.50– 10.00	8.24	5.00– 8.00	6.56
1920.										
April	11.00– 12.00	11.44	7.00–11.00	9.03	....	......	....	......	....	......
May	3.00– 12.00	5.92	2.00– 7.50	4.59	2.70– 10.00	5.14	2.50– 10.00	5.00	3.00– 7.50	4.57
June	2.00– 3.50	2.53	1.50– 3.20	2.83	1.70– 4.50	2.53	1.50– 3.50	2.31	1.50– 3.50	2.31

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
April	....	......	....	......	....	......	$7.50–$9.00	$8.19	$9.00–$11.00	$10.14
May	$7.00–$8.00	$7.67	$7.00– $9.00	$8.07	[1]$7.50–$9.00	[1]$8.23	6.00– 8.00	6.99	8.00– 10.50	9.15
June	7.50– 8.00	7.89	7.50– 8.50	8.08	[1]7.50– 8.50	[1]7.92	6.00– 8.00	7.18	7.00– 10.00	8.21
1920.										
April	....	......	....	......	....	......	6.50–11.00	8.90	9.00– 12.00	10.33
May	3.00– 8.50	5.08	4.00–10.50	6.04	4.00–11.00	5.87	....	......	5.00– 9.00	6.59
June	2.00– 4.00	2.62	2.00– 4.30	2.81	2.00– 4.00	2.77	2.00– 3.30	2.47	2.50– 5.50	3.58

BERMUDAS, CRYSTAL WHITE WAX.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
May	$6.00–$11.00	$8.29	$7.00–$9.50	$8.18	$8.00–$10.50	$9.25	$8.00–$10.00	$9.01	$6.00–$9.00	$8.01
June	6.00– 10.00	7.99	6.00– 9.50	7.81	....	......	7.50– 9.50	8.61	5.00– 8.50	6.73
1920.										
May	2.50– 10.00	5.56	2.00– 8.00	5.08	....	......	3.00– 9.00	5.36	3.50– 8.50	6.05
June	1.50– 3.00	2.25	1.50– 3.25	2.41	2.00– 3.00	2.48	2.00– 3.00	2.40	....	......

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
May	$8.00–$9.50	$8.57	$9.30–$10.50	$9.83	[1]$9.50–$11.00	[1]$9.95	$7.50–$9.50	$8.19	$9.00–$11.00	$10.00
June	8.00– 8.50	8.17	[1]8.00– 10.00	[1]8.49	[1]8.00– 9.50	[1]8.58	7.50– 8.00	7.63	7.00– 9.50	8.23
1920.										
May	4.50–10.50	6.48	5.00– 9.00	6.13	4.50– 11.00	6.50	....	......	7.00– 10.00	7.92
June	....	......	2.00– 5.00	3.19	2.50– 4.50	3.31	2.50– 4.00	3.11	....	......

[1] Sales chiefly direct to retailers.

TABLE 269.—*Onions: Monthly range and average jobbing prices, per hundred pounds, at ten markets, 1919 and 1920*—Continued.

VARIOUS COMMON VARIETIES.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
January	$1.25–$2.60	$1.98	$1.50–$2.50	$2.08	$1.65–$2.25	$1.99	$1.50–$2.35	$1.94	....	.....
February	1.75–4.50	2.58	1.75–3.50	2.22	1.75–4.25	2.44	1.75–4.00	2.45	$1.75–$3.35	$2.59
March	2.00–4.25	3.24	2.50–5.75	4.03	2.25–4.50	3.50	1.75–5.50	3.26	2.00–5.25	3.70
April	3.00–6.00	4.26	2.50–5.75	4.33	3.00–6.50	4.49	3.25–6.25	4.64	3.00–4.50	3.82
May	4.00–9.00	5.62	4.00–7.22	5.45	....	.....	....	.....	....	.....
June	....	.....	4.00–6.63	5.66	....	.....	....	.....	4.00–7.00	5.79
July	2.50–7.50	5.32	3.75–7.34	5.22	4.00–6.00	5.00	3.50–6.70	5.50	....	.....
August	2.00–5.50	3.32	2.75–4.50	3.45	2.00–4.75	3.65	2.00–5.50	3.72	2.25–4.00	3.20
September	2.50–4.50	3.39	2.75–3.75	3.42	1.80–4.00	3.19	2.25–4.50	3.67	2.75–3.75	3.21
October	2.75–4.00	3.46	3.00–5.00	3.91	2.00–3.75	3.05	3.00–4.50	3.57	2.50–4.25	3.52
November	2.75–6.00	4.42	4.00–5.50	4.59	2.25–6.00	4.18	3.50–5.50	4.61	3.50–5.25	4.40
December	4.25–6.50	5.70	4.50–5.75	5.18	4.75–6.35	5.71	5.00–6.00	5.82	4.00–6.00	5.19
1920.										
January	5.50–6.75	6.24	4.75–6.00	5.56	5.50–6.50	6.20	5.75–6.75	6.21	4.50–6.25	5.58
February	4.50–6.50	5.69	4.25–5.75	5.03	4.00–6.15	5.42	5.00–6.00	5.45	....	.....
March	5.00–6.75	5.92	4.75–6.75	5.75	5.75–7.00	6.35	5.50–7.00	6.38	6.00–6.75	6.38
April	....	.....	6.00–8.50	6.79	5.00–10.50	7.98	6.00–10.00	8.15	6.75–7.50	7.10
September	1.00–3.00	2.24	1.75–2.35	1.94	1.00–2.75	2.03	1.50–3.50	2.30	1.20–2.35	1.67
October	1.00–2.15	1.56	1.25–1.90	1.59	1.00–1.75	1.49	1.25–2.25	1.74	1.25–2.00	1.55
November	1.00–2.00	1.55	1.35–1.75	1.56	.75–1.90	1.51	1.25–2.00	1.65	1.25–1.75	1.55
December	1.00–1.50	1.23	1.00–1.50	1.31	.85–1.40	1.23	.75–1.50	1.05	.75–1.35	1.06

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
January	$1.50–$2.75	$2.03	....	.....	....	.....	$1.65–$2.50	$2.10	$1.75–$2.75	$2.33
February	2.00–3.50	2.50	....	.....	....	.....	2.25–4.00	2.58	2.25–3.50	2.63
March	3.75–5.25	4.48	[1]$4.25–$5.00	[1]$4.64	[1]$3.75–$4.50	[1]$4.41	3.00–7.50	4.38	3.00–5.00	4.13
April	3.50–6.00	4.43	3.75–4.50	3.99	[1]3.75–5.00	[1]4.39	3.00–6.00	4.52	3.50–8.50	5.80
May	....	.....	....	.....	....	.....	5.50–7.00	6.09	....	.....
June	....	.....	4.50–5.56	5.07	[1]4.50–6.39	[1]5.44	5.00–6.50	5.82	....	.....
July	4.00–5.25	4.55	4.00–8.00	5.91	4.75–8.50	6.11	5.00–6.50	5.94	5.50–7.00	6.15
August	3.00–3.50	3.25	3.50–5.25	4.08	3.50–5.25	3.93	3.25–4.00	3.64	3.50–6.00	4.81
September	3.00–3.75	3.51	....	.....	....	.....	2.75–4.00	3.34	3.75–4.50	4.05
October	3.00–4.25	3.61	....	.....	....	.....	3.50–4.50	3.92	3.00–4.00	3.67
November	4.00–5.25	4.66	....	.....	....	.....	4.00–5.50	4.63	....	.....
December	4.75–6.25	5.62	....	.....	....	.....	5.00–6.50	5.78	....	.....
1920.										
January	5.50–6.50	6.02	....	.....	....	.....	5.50–6.50	6.07	....	.....
February	4.75–6.00	5.39	....	.....	....	.....	5.00–6.00	5.58	....	.....
March	5.25–7.00	6.13	....	.....	....	.....	5.00–7.50	6.65	6.25–7.00	6.58
April	7.00–8.50	7.83	7.00–8.25	7.53	7.15–8.50	7.94	7.25–8.00	7.71	8.00–10.00	9.06
September	1.20–2.50	1.76	1.00–2.25	1.99	1.00–2.50	2.12	1.50–2.50	1.98	2.00–2.75	2.61
October	1.25–2.00	1.48	....	.....	....	.....	1.50–1.75	1.68	1.60–2.50	1 95
November	1.25–1.65	1.45	....	.....	....	.....	1.50–1.75	1.67	1.65–2.25	1.92
December	1.00–1.50	1.30	....	.....	....	.....	1.35–1.65	1.52	1.50–2.00	1.86

[1] Sales chiefly direct to retailers.

TABLE 270.—*Peaches: Monthly range and average jobbing prices per six-basket carrier and bushel, at ten markets, 1919 and 1920.*

SIX-BASKET CARRIERS.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
June	$0.75–$4.00	$2.40	$1.50–$3.75	$2.51	$1.00–$4.25	$2.28	$1.50–$4.25	$2.81	$1.00–$4.75	$2.77
July	.75– 4.00	2.21	1.50– 3.50	2.35	1.00– 4.50	2.47	1.50– 3.75	2.49	1.50– 3.25	2.43
August	1.00– 4.50	2.25	...	...	1.50– 4.50	3.26	1.35– 3.75	2.51	...	...
September	1.25– 4.00	2.89	...	...	...	...	...	...	...	...
1920.										
June	1.25– 5.00	3.03	.75– 5.50	2.77	1.25– 5.00	2.75	2.00– 3.75	2.80	1.50– 3.50	2.93
July	1.50– 6.00	3.32	1.50– 4.50	3.00	.75– 5.50	2.60	1.50– 5.00	2.96	1.25– 4.50	3.17
August	1.25 –4.50	2.95	1.25– 4.25	3.26	.75– 4.00	2.78	1.25– 4.50	3.19	3.50– 4.50	3.98
September	1.75 –4.25	3.00	...	...	...	...	...	...	...	...

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
June	$1.00–$3.75	$2.38	...	...	...	...	...	...	$1.50–$4.25	$2.83
July	1.50– 3.00	2.30	...	...	$2.50–$3.25	$2.85	...	...	2.00– 5.00	3.02
August	1.75– 4.00	2.96	...	...	...	...	...	...	1.75– 5.00	2.98
September	...	...	...	...	...	...	...	...	2.00– 4.00	3.39
1920.										
June	1.50– 3.00	2.39	...	...	...	...	...	...	1.00– 5.00	3.00
July	1.00– 3.75	2.68	[2]$1.75–$3.25	[2]$2.33	[2]1.65– 3.50	[2]2.44	...	...	1.50– 4.50	2.92
August	1.50– 3.60	2.81	[2].90– 2.00	[2]1.64	[2]1.50– 1.90	[2]1.68	$1.25–$3.50	$1.68	1.25– 4.00	2.79
September	...	...	[2]2.00– 2.40	[2]2.31	[2]1.90– 2.65	[2]2.31	...	...	2.25– 4.00	3.11

BUSHELS.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
June	...	...	$1.50–$3.25	$2.25	...	...	...	...	$1.25–$4.00	$2.09
July	$1.50–$4.50	$2.66	1.50– 4.50	2.99	$1.50–$4.00	$2.88	$1.75–$4.00	$2.95	1.50– 3.50	2.68
August	1.00– 4.25	2.43	1.50– 4.00	3.17	1.00– 3.75	2.68	1.00– 4.00	2.89	1.00– 4.25	2.50
September	1.25– 4.50	2.84	2.00– 4.00	2.65	.75– 3.75	2.65	1.50– 4.00	3.04	1.75– 3.50	2.80
1920.										
June	...	...	2.00– 3.75	2.79	...	...	...	...	...	...
July	1.50– 3.50	2.54	1.00– 4.00	2.68	...	...	...	...	1.15– 4.00	2.74
August	...	...	1.00– 4.50	3.08	...	...	1.50– 5.25	3.48	2.40– 5.00	3.82
September	1.00– 4.00	2.52	1.00– 5.00	2.58	.90– 3.25	1.89	1.00– 3.75	2.50	1.50– 5.25	2.83

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
June	$1.00–$3.50	$2.22	...	...	...	...	$2.00–$4.00	$2.74	...	...
July	1.75– 4.00	2.83	...	...	$2.50–$3.50	$2.75	2.00– 4.00	3.00	...	...
August	1.75– 4.25	3.13	...	...	...	...	2.00– 3.75	2.96	$1.75–$4.00	$2.80
September	1.25– 4.00	3.11	...	...	...	...	2.00– 3.25	2.69	1.50– 4.50	3.16
1920.										
June	1.75– 3.50	2.45	...	...	...	...	...	...	...	...
July	1.25– 4.00	2.85	...	...	...	...	...	...	...	...
August	1.00– 4.25	3.31	...	...	...	...	3.00– 4.50	3.98	1.00– 3.00	2.28
September	1.50– 5.50	2.87	...	...	2.50– 5.75	3.65	3.00– 5.00	3.72	1.75– 4.50	2.84

[1] Sales chiefly direct to retailers.

[2] Boxes.

TABLE 271.—*Potatoes (white): Monthly range and average jobbing prices, per hundred pounds, at ten markets, 1919 and 1920.*

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
January	$2.08–$3.78	$2.64	$2.00–$2.50	$2.28	$1.75–$3.00	$2.41	$1.93–$2.35	$2.12	...	...
February	1.82– 3.03	2.14	1.75– 2.20	1.95	1.65– 2.40	1.97	1.75– 2.17	1.92	...	...
March	1.42– 2.58	1.99	...	...	1.50– 2.50	2.03	1.75– 2.40	1.92	...	...
April	2.03– 3.11	2.55	...	...	2.15– 2.75	2.48	2.00– 2.50	2.24	$1.75–$2.60	$2.06
May	3.18– 5.46	4.29	4.45– 6.50	5.32	3.89– 5.84	4.77	4.50– 5.76	4.99	4.00– 6.75	5.62
June	2.27– 6.52	4.37	2.75– 6.00	4.33	2.43– 6.36	4.11	2.65– 6.89	4.56	1.50– 5.25	3.33
July	2.58– 4.27	3.43	2.95– 5.00	4.18	2.65– 4.40	3.61	2.80– 4.70	4.07	2.75– 4.40	3.62
August	2.27– 4.02	3.39	...	...	2.42– 4.16	3.48	3.08– 4.78	4.10	2.60– 3.50	3.12
September	2.00– 3.75	2.79	2.75– 3.75	3.44	2.00– 3.00	2.51	2.50– 3.80	3.18	2.00– 3.50	2.90
October	2.00– 3.58	2.57	2.65– 3.00	2.74	2.17– 2.92	2.48	2.47– 3.17	2.74	2.25– 3.10	2.71
November	2.20– 3.25	2.63	2.90– 3.50	3.22	2.23– 3.10	2.64	2.00– 3.00	2.80	2.55– 3.25	2.99
December	2.35– 3.48	3.09	3.40– 4.25	3.83	2.76– 3.63	3.25	2.91– 3.67	3.33	3.15– 3.50	3.32
1920.										
January	3.50– 5.08	4.23	4.00– 6.00	5.54	3.62– 4.83	4.07	3.83– 5.00	4.51	3.90– 5.25	4.61
February	3.79– 5.46	4.49	4.60– 5.15	4.80	3.75– 5.00	4.35	4.29– 4.75	4.52	4.25– 4.85	4.49
March	4.70– 6.14	5.49	5.00– 7.25	6.00	4.33– 6.17	5.24	4.67– 5.83	5.57	4.60– 6.40	5.80
April	5.34– 9.09	7.58	...	...	5.00– 8.00	6.67	5.80– 8.00	7.02	6.25– 9.25	7.62
May	7.42–11.11	9.03	8.06–12.77	9.14	6.67–11.11	8.39	7.92–12.22	9.54	8.33–13.50	10.75
June	5.00– 8.79	6.93	6.32–10.91	8.38	5.15– 8.03	6.87	6.21– 9.09	7.48	6.50–11.00	8.35
July	2.42– 7.73	5.54	...	...	3.17– 7.20	5.58	3.50– 7.50	5.98	4.00– 8.00	6.60
August	1.75– 3.50	2.56	...	...	2.00– 3.03	2.59	1.67– 3.94	3.01	2.75– 5.00	3.69
September	1.42– 2.35	1.83	...	...	1.42– 2.43	1.89	1.79– 3.00	2.31	1.75– 3.48	2.71
October	1.03– 2.73	1.93	...	...	1.50– 2.50	1.87	1.92– 2.87	2.33	1.40– 3.10	2.25
November	1.36– 2.33	1.96	...	...	1.89– 2.43	2.09	2.22– 2.63	2.48	2.00– 2.85	2.33
December	1.52– 2.04	1.82	...	...	1.25– 1.75	1.48	1.50– 2.20	1.84	1.40– 2.50	1.87

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
January	$1.80–$2.25	$2.03	...	...	...	...	...	...	$2.33–$3.75	$2.69
February	1.90– 2.75	2.47	...	...	...	...	...	...	2.08– 2.33	2.25
March	1.70– 2.00	1.89	...	...	...	...	...	...	2.08– 2.45	2.20
April	1.90– 2.40	2.17	...	...	...	...	...	...	2.25– 2.67	2.50
May	4.24– 5.07	4.71	...	...	...	...	$3.82–$9.00	$7.01	4.72– 5.61	5.33
June	2.27– 6.07	4.33	[1]$2.75–$7.00	[1]$4.45	[1]$2.75–$6.50	[1]$4.24	1.90– 4.91	3.32	3.03– 6.21	4.56
July	2.95– 4.55	3.87	3.50– 4.70	4.16	3.25– 4.75	4.13	...	...	3.18– 4.63	3.88
August	3.25– 4.50	3.83	...	...	...	...	...	...	3.00– 4.40	3.98
September	2.65– 3.50	2.99	...	...	...	...	...	...	2.58– 3.75	3.03
October	2.50– 3.25	2.94	...	...	...	...	...	...	2.67– 3.17	2.86
November	2.60– 3.40	2.97	...	...	...	...	...	...	2.67– 3.17	2.96
December	3.00– 3.75	3.29	...	...	...	...	...	...	2.50– 4.00	3.44
1920.										
January	3.75– 5.00	4.60	...	...	...	...	...	...	3.92– 5.00	4.59
February	4.00– 4.83	4.51	...	...	...	...	...	...	4.75– 4.92	4.81
March	4.50– 7.00	5.51	...	...	...	...	...	...	5.00– 6.00	5.54
April	6.00– 9.00	7.15	...	...	...	...	...	...	6.00– 8.00	7.27
May	6.67–10.55	8.65	...	...	...	...	...	...	7.92–11.39	9.05
June	5.34– 9.38	7.59	7.78–11.00	8.80	7.22–$11.00	9.02	6.50–11.50	8.77	5.70– 8.18	6.81
July	4.58– 7.57	6.49	7.50– 9.50	8.44	6.50– 10.00	8.29	...	...	3.93– 6.82	5.82
August	2.67– 4.68	3.41	...	...	...	...	2.60– 3.15	2.81	2.83– 3.83	3.26
September	2.00– 3.34	2.57	...	...	...	...	2.40– 2.85	2.69	1.95– 2.67	2.23
October	1.50– 2.81	2.19	...	...	...	...	1.75– 2.25	2.06	1.92– 2.33	2.22
November	2.17– 4.50	2.60	...	...	...	...	2.00– 2.50	2.27	2.33– 2.58	2.52
December	1.58– 4.25	1.92	...	...	...	...	...	...	2.25– 2.50	2.32

[1] Sales chiefly direct to retailers.

TABLE 272.—*Strawberries: Monthly range and average jobbing prices, per quart, at ten markets, 1919 and 1920.*

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
April	$0.19–$0.55	$0.38	$0.22–$0.44	$0.33	$0.25–$0.55	$0.38	$0.29–$0.45	$0.35	$0.27–$0.46	$0.36
May	.15– .38	.29	.17– .36	.25	.17– .40	.27	.18– .42	.31	.17– .33	.24
June	.10– .35	.24	.18– .31	.24	....	......	.20– .33	.28	....	......
1920.										
April	.20– .75	.43	.23– .39	.34	.25– .65	.39	.34– .52	.41	.33– .42	.37
May	.25– .75	.35	.18– .44	.32	.20– .40	.30	.24– .47	.34	.16– .32	.23
June	.20– .38	.31	.16– .32	.27	.19– .32	.26	.21– .32	.26	....	......

Month.	Cincinnati.		St. Paul.[1]		Minneapolis.[1]		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
April	$0.21–$0.50	$0.32	$0.33–$0.49	$0.40	$0.33–$0.49	$0.40	$0.20–$0.42	$0.36	$0.30–$0.50	$0.39
May	.15– .30	.25	.24– .38	.30	.22– .39	.31	.19– .36	.26	.19– .50	.27
June	....	......	.30– .32	.30	.30– .35	.31	.13– .29	.23	....	......
1920.										
April	.24– .50	.34	.35– .50	.39	.33– .50	.39	.22– .44	.34	.25– .75	.40
May	.17– .35	.26	.28– .46	.39	.26– .48	.40	.18– .45	.31	.18– .38	.28
June	.20– .26	.21	.33– .39	.35	.29– .41	.35	.27– .31	.29	.18– .45	.28

[1] Sales chiefly direct to retailers.

TABLE 273.—*Tomatoes: Monthly range and average jobbing prices per four and six-basket carriers, at ten markets, 1919 and 1920.*

FOUR-BASKET CARRIERS.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
June	$1.25–$2.50	$1.69	$0.75–$2.50	$1.53	$0.90–$2.10	$1.54	$1.00–$2.60	$1.59	$1.10–$2.50	$1.53
July	1.50– 2.00	1.70	.75– 2.50	1.50	1.75– 2.25	2.08	1.00– 2.25	1.73	1.00– 1.75	1.39
1920.										
June	1.50– 2.25	1.85	1.00– 4.00	2.37	1.25– 2.75	1.74	1.25– 3.50	2.06	1.35– 3.00	2.19
July	1.00– 2.10	1.46	.75– 1.75	1.35	1.25– 2.25	1.70	1.00– 2.00	1.50	.50– 1.50	1.24

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
June	$1.00–$2.00	$1.55	$1.25–$2.25	$1.83	$1.25–$2.25	1.61	$1.00–$2.25	1.49	$1.50–$2.00	1.71
July	1.25– 2.00	1.59	1.75– 2.25	1.98	1.25– 2.50	1.97	1.35– 1.65	1.48	....	......
1920.										
June	1.65– 2.50	1.97	....	......	....	......	1.60– 3.00	2.12	1.50– 3.25	2.05
July	.65– 1.90	1.30	....	......	....	......	1.00– 2.25	1.43	1.75– 2.25	2.03

[1] Sales chiefly direct to retailers.

TABLE 273.—*Tomatoes: Monthly range and average jobbing prices per four and six basket carriers at ten markets, 1919 and 1920*—Continued.

SIX-BASKET CARRIERS.

Month.	New York.		Chicago.		Philadelphia.		Pittsburgh.		St. Louis.	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
March	$2.75–$5.00	$3.64	$3.50–$6.75	$4.95	$3.00–$5.50	$4.01	$3.00–$6.00	$4.41	$3.50–$5.00	$4.28
April	3.00– 5.00	3.59	3.00– 5.00	3.66	2.50– 4.25	3.39	3.00– 4.50	3.56	3.50– 5.25	4.31
May	3.50– 5.75	4.40	2.75– 5.50	4.10	2.00– 5.75	4.28	2.50– 6.00	4.18	3.00– 5.50	4.57
June	1.40– 3.50	2.41	2.00– 3.75	3.15	.75– 3.25	1.87	1.00– 3.25	2.40	1.50– 3.25	2.63
1920.										
May	5.50– 9.00	6.51	4.00– 6.50	4.95	4.00– 7.50	5.91	5.00– 7.50	6.33		
June	3.00– 7.00	5.17	4.00– 5.25	4.75	1.25– 6.00	3.67	2.25– 7.00	4.88		
July					1.00– 3.00	2.25				

Month.	Cincinnati.		St. Paul.		Minneapolis.		Kansas City.		Washington.[1]	
	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.	Range.	Average.
1919.										
March	$3.75–$5.50	$4.57					$4.50–$6.00	$5.29	$3.50–$5.50	$4.67
April	3.50– 4.50	4.14					4.00– 5.50	4.56	3.50– 5.00	4.26
May	3.50– 5.25	4.43					4.50– 5.00	4.65	3.50– 5.50	4.78
June	2.25– 3.75	3.19							1.75– 4.00	2.93
1920.										
May	5.50– 7.00	6.21							4.00– 6.00	5.01
June	4.00– 5.75	4.88							1.50– 6.00	3.56
July									2.00– 3.00	2.50

[1] Sales chiefly direct to retailers.

TABLE 274.—*Apples: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920.*

1917.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Maine	97	39	32	4	4				3	170	823	92	1,264
New Hampshire	5									102	153	8	268
Massachusetts					1				1	114	224	5	345
New York	867	737	972	722	669	172	4	19	397	1,339	1,149	439	7,486
New Jersey	16	10	8	1			54	358	204	248	117	13	1,029
Pennsylvania	1		8	2				12	36	526	145	62	792
Delaware						1	145	75	14	100	14		349
Maryland	5	4		2			21	23	104	236	26		421
Virginia	3				4	6	36	115	1,091	1,887	548	131	3,821
West Virginia							9	24	231	478	223	98	1,063
Georgia						8		11	52	113	68	10	262
Ohio	20	1	2	4	32		1	2	1	113	78	13	267
Indiana	1	11	10	10	15	9	6	11	24	95	37	1	230
Illinois		17	22	36	29	22	353	140	1,242	3,001	664	3	5,529
Michigan	2							127	271	432	511	23	1,366
Iowa							2	25	57	227	25		336
Missouri	12	10	10	7	1	1	3	52	389	1,466	393	26	2,370
Nebraska								11	60	496	91	1	659
Kansas		1							86	919	121	5	1,132
Arkansas								26	230	903	202	51	1,412
Montana			5	3						83	65	15	171
Colorado	23	35	38					5	60	980	770	177	2,088
New Mexico	1	1	1					32	130	346	100	23	634
Utah									1	101	199	42	343
Idaho	15	31	60	20	3			3	27	935	1,301	573	2,988
Washington	780	846	682	195	78	22		56	409	5,280	4,582	1,447	[1] 14,477
Oregon	220	180	213	109	3			4	43	629	1,207	627	3,235
California	25	11	26	11	1		112	173	514	404	216	62	1,555
Potomac valley	280	212	82	45	89	33							[2] 741
All other	7	5	2	4	3	27	9	5	42	152	113	46	415
Total	2,380	2,151	2,173	1,175	932	301	755	1,309	5,719	21,895	14,165	3,993	57,048

[1] Includes 100 cars, unsegregated.
[2] Potomac valley: Potomac valley territory of Maryland, Pennsylvania, Virginia and West Virginia.

TABLE 274.—*Apples: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920*—Continued.

1918.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Maine	46	38	55	19	2	......	......	......	1	40	52	66	319
Massachusetts	5	9	......	......	......	......	......	......	6	83	123	9	235
New York	426	693	685	470	186	46	8	486	2,026	7,662	4,199	2,388	[1]19,293
New Jersey	2	2	3	......	......	......	236	268	116	206	96	7	936
Pennsylvania	28	42	18	39	5	......	15	24	103	539	234	24	[2]1,659
Delaware	......	......	......	......	......	29	272	114	12	48	......	......	375
Maryland	1	1	13	11	......	1	54	37	128	264	82	33	[3]690
Virginia	131	250	211	156	27	......	20	50	767	1,369	605	235	[4]4,315
West Virginia	37	87	66	27	......	......	23	71	404	1,110	718	202	[5]2,989
Georgia	6	5	......	......	......	5	1	7	26	45	32	6	133
Ohio	9	27	16	13	......	2	17	16	58	244	44	17	463
Indiana	1	18	17	23	......	......	17	6	32	37	10	5	166
Illinois	12	49	33	37	8	24	244	81	518	1,210	219	46	2,481
Michigan	6	5	10	......	......	......	88	414	480	1,532	307	27	2,869
Missouri	30	79	77	80	6	......	3	43	290	539	108	22	1,327
Kansas	......	......	......	......	......	......	......	1	109	282	6	......	398
Arkansas	17	38	46	32	......	10	7	94	275	597	42	17	1,175
Colorado	20	15	32	5	......	......	......	7	385	1,274	274	29	2,041
New Mexico	4	1		......	......	......	1	32	120	147	83	16	404
Utah	5	6	......	1	......	......	......	......	62	298	77	3	452
Idaho	262	99	243	64	1	......	......	......	50	269	87	25	1,100
Washington	1,043	1,461	967	513	77	2	22	138	1,023	6,209	4,481	2,139	18,075
Oregon	219	260	335	117	7	......	2	9	59	723	746	359	2,836
California	22	34	36	30	25	8	66	468	486	797	585	501	3,058
All other	12	13	19	10	3	102	34	23	164	424	203	44	1,051
Total	2,344	3,232	2,882	1,647	347	229	1,130	2,289	7,700	25,998	13,413	6,220	[6]68,840

1919.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Maine	55	23	20	......	......	......	......	......	348	878	720	256	2,300
New Hampshire	11	1	1	......	......	......	......	......	13	288	180	21	515
Vermont	1	......	......	......	......	......	......	......	9	141	38	......	189
Massachusetts	13	12	5	1	......	......	......	......	10	134	176	56	407
New York	2,215	1,951	1,130	564	228	43	23	169	978	3,195	1,171	829	12,496
New Jersey	2	......	4	1	......	......	172	304	116	102	39	3	743
Pennsylvania	43	23	5	......	......	......	2	14	170	699	121	76	[7]1,349
Delaware	......	......	......	......	......	5	329	69	44	47	1	......	495
Maryland	5	15	6	2	......	5	22	38	182	221	43	41	[8]602
Virginia	183	136	53	92	49	9	43	238	1,933	2,732	592	394	[9]6,619
West Virginia	38	13	12	......	3	......	23	90	620	1,267	365	160	[10]2,672
North Carolina	1	......	......	......	......	......	......	22	60	39	21	8	151
Ohio	22	21	8	......	......	......	......	......	3	225	16	3	298
Illinois	66	100	69	46	39	48	342	79	807	1,142	131	11	2,880
Michigan	5	4	4	1	......	......	12	608	1,040	1,587	175	7	3,443
Missouri	38	6	28	20	20	......	5	26	548	941	302	12	1,946
Nebraska	......	1	2	......	......	......	......	......	18	126	17	......	164
Kansas	......	......	......	......	......	......	1	......	155	323	55	......	534
Arkansas	9	12	1	1	......	21	33	192	960	2,265	818	56	4,368
Montana	4	7	4	2	......	......	......	23	108	269	73	8	498
Colorado	7	5	2	......	1	......	......	15	437	1,865	805	66	3,203
New Mexico	3	3	2	......	......	......	......	147	184	442	157	27	965
Utah	......	......	1	......	......	......	......	......	11	132	48	2	194
Idaho	24	50	16	1	11	3	1	8	542	1,767	872	229	3,524
Washington	700	814	420	211	60	15	35	164	1,763	9,401	6,682	1,875	22,140
Oregon	126	128	72	15	7	......	4	10	192	1,354	1,478	781	4,167
California	198	226	81	42	12	10	273	441	877	908	709	370	4,147
All other	25	22	15	1	......	30	23	51	112	151	37	7	474
Total	3,794	3,573	1,961	1,000	430	189	1,343	2,708	12,240	32,641	15,842	5,298	[11]81,483

[1] Includes 18 cars, unsegregated.
[2] Includes 588 cars, unsegregated.
[3] Includes 65 cars, unsegregated.
[4] Includes 494 cars, unsegregated.
[5] Includes 244 cars, unsegregated.
[6] Includes 1,409 cars, unsegregated.
[7] Includes 196 cars, unsegregated.
[8] Includes 22 cars, unsegregated.
[9] Includes 165 cars, unsegregated.
[10] Includes 81 cars, unsegregated.
[11] Includes 464 cars, unsegregated.

TABLE 274.—*Apples: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920*—Continued.

1920.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Maine	65	21	12	37	6	......	......	......	6	64	139	30	380
New Hampshire	......	2	3	......	......	......	......	......	......	145	67	6	223
Massachusetts	4	4	22	1	......	......	......	......	16	173	205	86	511
New York	632	992	1,218	576	447	56	4	684	2,279	8,851	7,629	3,171	26,539
New Jersey	1	......	......	......	......	......	100	288	126	134	102	11	762
Pennsylvania	93	62	21	3	5	......	27	27	190	1,358	565	281	2,632
Delaware	......	3	......	......	......	......	494	69	46	132	9	1	754
Maryland	14	23	10	1	......	......	125	49	262	552	124	87	1,247
Virginia	313	336	308	114	72	......	46	102	1,523	3,130	1,131	816	7,891
West Virginia	96	82	71	61	15	......	63	75	744	2,217	816	166	4,406
North Carolina	......	......	......	......	......	......	......	18	130	165	140	96	549
Ohio	2	3	2	1	......	......	22	16	39	339	169	12	605
Indiana	11	24	23	12	14	3	23	4	38	54	21	1	228
Illinois	73	90	111	47	55	63	524	135	776	1,239	263	32	3,408
Michigan	2	......	1	1	2	......	55	1,140	1,183	2,042	1,155	152	5,733
Missouri	33	75	70	41	30	3	3	26	353	721	230	60	1,645
Kansas	......	......	1	......	......	......	......	6	117	545	33	......	702
Tennessee	......	......	......	......	......	82	48	3	......	......	1	......	134
Arkansas	38	61	88	19	2	7	30	195	791	1,108	215	92	2,646
Montana	5	4	5	5	......	......	......	......	22	208	141	19	409
Colorado	6	7	24	......	......	......	1	2	198	1,646	737	108	2,729
Utah	......	2	4	......	......	......	......	......	28	355	208	14	611
Idaho	192	193	111	20	8	......	......	......	102	1,303	723	205	2,857
Washington	1,854	1,881	1,864	1,133	498	19	33	111	653	7,141	4,940	2,056	22,183
Oregon	798	406	232	108	79	......	1	3	36	881	1,085	444	4,073
California	155	148	173	48	41	11	244	723	901	926	756	374	4,500
All other	7	......	4	1	1	18	5	21	140	351	98	27	673
Total	4,394	4,419	4,378	2,229	1,275	262	1,848	3,697	10,699	35,780	21,702	8,347	99,030

TABLE 275.—*Beans (dry): Monthly and yearly carlot shipments, by States of origin, 1919 and 1920.*

1919.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
New York	21	12	9	6	11	......	6	7	8	8	33	23	144
Michigan	176	62	181	67	107	110	62	87	135	338	257	183	1,765
Wisconsin	9	12	......	......	1	......	......	......	......	......	1	1	24
Colorado	119	23	22	23	23	6	3	14	10	36	56	28	[1] 478
New Mexico	43	17	13	5	11	5	8	11	12	114	109	74	422
Idaho	12	5	11	43	50	32	15	22	12	16	5	9	232
Washington	......	2	......	5	1	1	......	4	......	1	......	8	22
California	308	222	341	539	535	317	244	466	198	503	578	430	4,681
All other	11	1	......	2	......	3	......	......	......	3	1	2	23
Total	699	356	577	690	739	474	338	611	375	1,019	1,040	758	[1] 7,791

1920.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
New York	14	10	7	6	16	20	4	11	4	34	53	54	233
Michigan	107	78	53	125	238	96	79	48	104	287	329	251	1,795
Colorado	21	13	5	8	12	14	1	9	3	19	23	16	144
New Mexico	63	35	31	77	61	37	6	13	40	73	117	63	616
Idaho	14	14	8	18	16	23	8	3	2	10	11	10	137
California	440	268	338	191	452	273	229	204	104	300	341	190	3,330
All other	2	3	......	16	17	3	2	2	2	11	12	12	82
Total	661	421	442	441	812	466	329	290	259	734	886	596	6,337

[1] Includes 115 cars, unsegregated.

TABLE 276.—*Cabbage: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920.*

1917.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York, Long Island									12	69	29	8	118
New York, other	328	51	8					9	606	2,164	1,267	566	4,999
Pennsylvania	2							1	12	41	37	1	94
Maryland	4	1	1			54	101	9	1				171
Virginia	8	1			152	875	103	222	342	178	10		1,891
South Carolina				1	266	396							663
Florida			77	156	34	1						4	272
Ohio						7	209	21	116	143	49	1	546
Indiana							2	15	91	103	38	1	250
Illinois						2	8	3	23	24	5		65
Michigan	1							3	76	266	170	8	524
Wisconsin	61	6						3	253	1,429	659	383	[1] 2,815
Minnesota							1	11	78	474	16	2	582
Iowa							72	234	92	29	26		453
Kentucky	9	1				19	46	3	1	7	6	4	96
Tennessee						38	10			1	2		51
Alabama				7	79	1							87
Mississippi				2	219	52	7					1	281
Louisiana	4	3		33	97	11						2	150
Texas	94	78	216	191	304	45	1					2	931
Colorado							52	465	791	1,051	107	19	2,485
Washington						7	28	5	1	9	15	9	74
California	39	76	42	67	478	573	99	8	1	5	11	13	1,412
All other					5	40	14	3	9	64	54	14	203
Total	550	217	344	457	1,634	2,121	753	1,015	2,505	6,057	2,501	1,038	[1] 19,213

1918.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Maine	7	4	2	3				5			3	26	50
New York, Long Island		1	1						28	68	8	5	111
New York, other	923	637	262	117			4	149	1,004	2,322	1,970	969	8,357
New Jersey			2			36	14			1	4	3	60
Pennsylvania	2	20	4	4			5	8	14	58	42	3	160
Maryland			1			61	1						63
Virginia	2	1			643	766	17	171	195	100	32		1,927
North Carolina				3	56					5	5		69
South Carolina		1	8	745	1,055	58							1,867
Florida	68	638	1,211	1,673	179	1						12	3,782
Ohio			2			28	246	154	77	55	13	3	578
Indiana						1		21	71	45	23		161
Illinois						6	8	65	84	60	43	1	267
Michigan	11	3	10	10				4	188	122	69	13	430
Wisconsin	197	217	100	16			1	68	471	1,263	736	265	3,334
Minnesota	5	4					18	56	375	362	177	13	1,010
Iowa		1				10	198	69	31	42	38		389
Missouri	1	2	2			40	4					1	50
Kentucky	9	3		1		101	7						121
Tennessee					2	115							117
Alabama		1		292	557	10							860
Mississippi				61	847	220							1,128
Louisiana	31	16		93	103	12						3	258
Texas	26	76	53	73	50	7	1					18	304
Colorado	29	3	8	1			93	414	544	507	103	5	[2] 1,960
Oregon	29	12								5	1	4	51
California	155	86	123	285	228	102	16	20	19	13	9	22	1,078
All other	3	9	1	2	14	20	12	1	7	23	22	5	119
Total	1,498	1,735	1,790	3,379	3,734	1,594	645	1,205	3,108	5,051	3,298	1,371	[2] 28,661

1919.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York	1,237	804	598	34				13	295	1,887	1,687	948	7,303
Pennsylvania	21	16	16				7	33	45	68	158	19	383
Maryland					11	241	1	1					254
Virginia				1	641	371	54	274	145	20	2		1,508
South Carolina	2	17	13	673	464	2	1						1,172
Florida	167	441	558	317	44							10	1,537
Ohio						82	89	2	33	70	7		283

[1] Includes 21 cars, unsegregated.
[2] Includes 253 cars, unsegregated.

TABLE 276.—*Cabbage: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920*—Continued.

1919—Continued.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Michigan	9	9	2						90	214	46	15	385
Wisconsin	354	201	50	2				24	578	1,730	338	231	3,508
Minnesota	13	2	2		1		5	59	242	606	30	1	961
Iowa						1	86	55	10	49	4		205
Alabama	4			44	358	15							421
Mississippi				14	431	121							566
Texas	115	266	308	494	222	7					2	23	1,437
Colorado	1	1	8				87	645	956	606	17	2	2,323
California	201	233	388	204	231	33	10	8	8	7	24	48	1,395
All other	58	27	34	48	97	534	217	40	63	80	96	50	1,344
Total	2,182	2,017	1,977	1,831	2,500	1,407	557	1,154	2,465	5,137	2,411	1,347	24,985

1920.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York	944	412	178	18	1		2	18	292	1,672	2,587	736	6,860
New Jersey	2	1				44	47	1	7	9			111
Pennsylvania	16	3					3	8	3	19	153	23	228
Maryland						158	102						260
Virginia	1				70	480	60	373	407	123	5		1,519
North Carolina				2	18	4			6	14	16		60
South Carolina				31	889	163	2					1	1,086
Florida	373	1,150	1,397	1,698	121							6	4,745
Ohio						35	127	8	9	48	47	1	275
Illinois						2	31	13	26	47	24		143
Michigan	9							1	66	168	61	2	307
Wisconsin	219	96	3				1	20	396	1,771	1,117	418	4,041
Minnesota	1						12	22	171	487	80	15	788
Iowa							92	118	70	69	22		371
Kentucky						80	47			1			128
Tennessee						138	3						141
Alabama	1	1	3	92	166	1							264
Mississippi				6	637	241							884
Louisiana	36	27	12	57	97	4							233
Texas	121	597	1,528	1,900	658	3						21	4,828
Colorado							13	406	262	742	140	9	1,572
Washington		1		1	1	11	12	1	3	9	22	9	70
California	190	221	205	129	283	127	22	19	2	1	40	4	1,243
All other	18	9	2	1		16	35	6	40	68	53	16	264
Total	1,931	2,518	3,328	3,935	2,941	1,507	611	1,014	1,760	5,248	4,367	1,261	30,421

TABLE 277.—*Cantaloupes: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920.*

1917.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New Jersey				67	32				99
Delaware			1	671	30				702
Maryland			4	841	10				855
North Carolina			878	150					[1] 1,106
South Carolina		2	154	1					157
Georgia		254	523	12					789
Indiana			8	590	66				664
Illinois			12	106	1				119
Michigan				1	41				42
Iowa				33	35				68
Tennessee				45	1				46
Arkansas			386	410	1				797
Colorado				115	1,511	268	4		1,898
New Mexico				144	83				227
Arizona			1,127	88					1,215
Nevada			114	25					139
Washington			1	88	47	9			145
California		2,975	2,383	1,839	299	29	19	3	7,547
All other		37	13	38	16				104
Total		3,268	5,604	5,264	2,173	306	23	3	[1] 16,719

[1] Includes 78 cars, unsegregated.

TABLE 277.—*Cantaloupes: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920*—Continued.

1918.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New Jersey				37	12	1			50
Delaware			19	314	96				429
Maryland			181	299	10				490
North Carolina			364	54					418
South Carolina		3	28						31
Georgia		181	227						[1] 551
Florida	1	25							26
Indiana			177	266					443
Illinois			59	44					103
Michigan				25	12				37
Iowa				41	2				43
Tennessee				26					26
Arkansas			678	21					699
Colorado				815	999	4			1,818
New Mexico				199	57				256
Arizona		52	1,110	7					1,169
Nevada			36						36
Washington				55	55				110
California	47	4,010	982	1,709	95	5			6,848
All other	3	7	15	10	1				36
Total	51	4,278	3,876	3,922	1,339	10			[1] 13,619

1919.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New Jersey				46	16				62
Delaware			5	560	25				590
Maryland			131	700	4				835
North Carolina			512	11					523
South Carolina		7	93						100
Georgia		153	161						314
Florida	8	74							82
Indiana			209	253					462
Illinois			42	43					85
Michigan				82	36				118
Iowa				26					26
Texas		13	29	80	1				123
Arkansas			1,064	42					1,106
Colorado				365	2,477	290			3,132
New Mexico			39	319	20				378
Arizona		61	1,771						1,832
Nevada			36						36
Washington				37	61	2			100
California	58	6,594	3,042	2,096	174	46			12,010
All other			10	29					39
Total	66	6,902	7,144	4,689	2,814	338			21,953

1920.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New Jersey				84	33				117
Delaware				501	80				581
Maryland			8	751	12				771
North Carolina			347	12					359
South Carolina			96	14					110
Georgia		35	343	11					389
Indiana			27	592	16				635
Illinois			6	75	4				85
Michigan				49	89	6			144
Iowa				38	2				40
Missouri			10	28					38
Arkansas			698	238					936
Colorado				264	2,086	102			2,452
New Mexico			14	863	60				937
Arizona			1,154	10					1,164
Nevada			46	2					48
California	475	6,726	2,565	3,136	165	33			13,100
Washington				134	187	8			329
All other		20	4	33	15	3			75
Total	475	6,781	5,318	6,835	2,749	152			22,310

[1] Includes 143 cars, unsegregated.

Table 278.—*Celery: Monthly and yearly carlot shipments, by States of origin, 1919 and 1920.*

1919.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York	64							20	30	399	547	463	1,523
New Jersey						5	11	43	73	15	21	9	177
Florida	52	416	652	400	507	24							2,051
Michigan							32	49	95	265	151	6	598
Colorado							1	28	52	128	3		212
California	500	130	70	12		3				7	466	608	1,796
All other								1	8	61	22		92
Total	616	546	722	412	507	32	44	141	258	875	1,210	1,086	6,449

1920.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York	145	71	6	1		1	2	16	105	782	931	583	2,643
New Jersey							16	26	26	5	20	11	104
Pennsylvania							2	28	79	60	6		175
Florida	155	853	981	683	320	15						3	3,010
Michigan							45	56	121	172	155	32	581
Colorado								20	67	161	21	6	275
California	516	123	219	24		5	3			17	555	830	2,292
All other								1	4	40	25	1	71
Total	816	1,047	1,206	708	320	21	68	147	402	1,237	1,713	1,466	9,151

Table 279.—*Citrus fruits: Monthly and yearly carlot shipments, by States of origin, 1919 and 1920.*

1919.

Fruit and State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Grapefruit:													
Florida	1,013	960	880	380	98	3			298	841	1,117	738	6,328
Arizona	1	2	1							2	7	4	17
California	27	17	28	49	62	23	8	17	2	12	26	8	279
Total	1,041	979	909	429	160	26	8	17	300	855	1,150	750	6,624
Lemons:													
California	568	622	836	1,071	1,381	1,460	1,004	410	348	507	432	184	8,823
Oranges:													
Florida	3,309	1,528	1,545	586	184	6				491	1,527	4,088	13,264
Alabama												5	5
Arizona	4	1	2								49	42	98
California	3,351	2,816	4,453	4,644	4,638	2,891	2,059	1,584	1,502	2,117	2,771	3,131	35,957
Total	6,664	4,345	6,000	5,230	4,822	2,897	2,059	1,584	1,502	2,608	4,347	7,266	49,324

1920.

Fruit and State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Grapefruit:													
Florida	1,250	1,263	1,953	1,104	1,763	459	34		94	1,146	1,519	837	11,422
Arizona	5	4	2	1						18	6	3	39
California	23	29	30	26	100	38	78	46	12	22	35	23	462
Total	1,278	1,296	1,985	1,131	1,863	497	112	46	106	1,186	1,560	863	11,923
Lemons:													
Florida					1		1						2
California	521	826	644	513	1,434	1,691	852	840	402	903	324	339	9,289
Total	521	826	644	513	1,435	1,691	853	840	402	903	324	339	9,291
Oranges:													
Florida	3,715	3,162	2,462	889	550	28				361	3,767	4,384	19,318
Alabama											37	39	76
Arizona	2									6	31	2	41
California	2,113	2,420	3,880	3,718	4,368	2,879	2,663	1,545	1,297	704	1,727	3,131	30,445
Total	5,830	5,582	6,342	4,607	4,918	2,907	2,663	1,545	1,297	1,071	5,562	7,556	49,880

TABLE 280.—*Grapes: Monthly and yearly carlot shipments, by States of origin, 1919 and 1920.*

1919.

State.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York			20	1,281	2,396	53	1	3,751
Pennsylvania				190	681	10		881
Ohio				29	58			87
Michigan			266	2,654	863			3,783
Iowa			45	62	1			108
Missouri			34	2				36
Washington				20	17			37
California	4	450	2,456	8,755	7,571	2,360	9	21,605
All other		10	16	30	5			61
Total	4	460	2,837	13,023	11,592	2,423	10	30,349

1920.

State.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York			6	522	4,988	464		5,980
Pennsylvania				1	1,055	179		1,235
Delaware			4	37	3			44
Ohio				2	48			50
Michigan			3	1,373	3,142	26		4,544
Iowa			20	86				106
Missouri			16	10				26
California	12	357	4,570	9,446	9,594	1,960	12	25,951
All other		9	24	36	4			73
Total	12	366	4,643	11,513	18,834	2,629	12	38,009

TABLE 281.—*Lettuce: Monthly and yearly carlot shipments, by States of origin, 1919 and 1920.*

1919.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York						50	293	653	607	156	2		1,761
New Jersey				1	5	17		1	8	100	113		245
Virginia					18					1	11	1	31
North Carolina				90	229								319
South Carolina			13	352	30								395
Florida	632	394	177	47	1						189	694	2,134
Ohio					26	25			1				52
Michigan							54	6	3				63
Minnesota							7	23	14	1			45
Louisiana				30	6								36
Texas	1	12	68	8								1	90
Arizona	2	16	20	2								1	41
California	132	295	551	555	491	69	25	11	17	96	249	240	2,731
All other				5	25	20	16	1	3	4	1		75
Total	767	717	829	1,090	831	181	395	695	653	358	565	937	8,018

1920.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York						18	706	697	568	154	1	2	2,146
New Jersey	1		1		10	69	20			172	240		513
Pennsylvania						1	12	4					17
North Carolina				35	226						4		265
South Carolina			1	307	48								356
Florida	1,218	441	237	64							240	896	3,096
Michigan						2	49	43	16				110
Minnesota							7	14	18	12			51
Texas	24	77	70	3								2	176
Colorado						8	11	16	80	9			124
Arizona	23	78	57									6	164
Idaho						8				8	8		24
Washington						30	98	90	93	33			344
California	757	1,025	985	653	870	226	74	69	52	199	851	568	6,329
All other	2	1	2	1	18	3			5		5	2	39
Total	2,025	1,622	1,353	1,063	1,172	365	977	933	832	587	1,349	1,476	13,754

TABLE 282.—*Onions: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920.*

1917.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Massachusetts	202	66	29	1			9	143	717	822	191	115	2,295
New York	74	27	33	15			3	159	436	501	218	91	1,557
New Jersey						5	215	192	116	26	5	2	561
Virginia							87	56	1	4	4	1	153
Ohio	498	181	96	12				29	300	341	156	51	1,664
Indiana	63	21	3	2	5			8	179	348	178	74	881
Illinois							3	35	30	82	11	3	164
Michigan	8	2	1						10	49	42	9	121
Wisconsin									14	93	22	21	150
Minnesota	3	1			1			1	65	418	41	15	545
Iowa							7	211	143	279	36		676
Kentucky	13	12	1				92	39	12	14	2		185
Louisiana				3	122	36	11	1				1	174
Texas			3	2,641	2,459	713	32	31	17				5,896
Colorado	4								31	109	38	3	185
Washington	3		1				45	189	27	26	13	4	308
Oregon	66	12	12		2		1	4	3	42	40	25	207
California	45	30	53	4	371	402	170	320	631	837	310	84	3,257
All other	7	3		1			3	16	8	77	41	17	173
Total	986	355	232	2,679	2,960	1,156	678	1,434	2,740	4,068	1,348	516	19,152

1918.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Massachusetts	151	225	254	127	12		20	87	576	1,124	199	87	2,862
New York	156	184	223	115	18		13	333	489	396	481	213	2,621
New Jersey	1	1	2	2		55	247	137	80	50	21	2	598
Pennsylvania		6	7	1	1		6	6	2	21	19	8	77
Virginia	2		3		1	16	74	3					99
Ohio	145	170	205	64	12	2	2	102	262	411	264	166	1,805
Indiana	144	155	82	33	3		1	86	465	494	257	109	1,829
Illinois	6	34	22	4			7	54	44	87	25	22	305
Michigan	12	45	66	17	3			3	57	110	206	71	590
Wisconsin	15	38	20	12	5				65	88	34	25	302
Minnesota	16	38	22	8	2			3	97	297	266	83	832
Iowa	4	15	8	5			87	316	144	251	96	45	971
Kentucky	6	2	10			46	140	7	2				213
Louisiana				2	55	117	68	54	59	67	15	13	450
Texas				1,344	1,789	373	57	10	2				3,575
Colorado	17	8	18	12	3				12	64	44	20	198
Washington	6	3		1	1		184	243	20	6	3		467
Oregon	25	30	13	6	7		1		8	15	14	19	138
California	181	98	55	42	355	529	268	476	690	726	454	134	4,008
All other	14	10	13	4	23	3	3	1	1	4	12		88
Total	901	1,062	1,023	1,799	2,290	1,141	1,178	1,921	3,075	4,211	2,410	1,017	22,028

1919.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Massachusetts	244	260	207	78	1		92	202	719	615	289	210	2,917
New York	288	215	192	156	8		54	227	277	411	504	254	2,586
New Jersey	1	1	3	1		84	355	70	71	27	22	3	638
Pennsylvania	6	7	4				25	30	7	26	12	1	118
Virginia	1					45	88						134
Ohio	337	281	168	15			28	77	323	267	206	188	1,890
Indiana	204	130	64	7			9	121	253	148	133	89	1,158
Illinois	48	29	14	2	1	1	8	13	35	34	5	5	195
Michigan	52	53	31	7				3	19	45	60	38	308
Wisconsin	44	28	19	6				1	29	16	7	5	155
Minnesota	51	15	8	2				16	215	147	21	14	489
Iowa	14	4	9	2			115	161	78	75	37	7	502
Kentucky						48	287	3	1				339
Louisiana				1	58	42							101
Texas				828	1,907	101	7	32	1				2,876
Colorado	47	23	19	1					24	46	21	17	198
Washington	5	9	6		1		249	297	26	14	3	1	611
Oregon	32	48	76	22	3			2	7	64	40	16	310
California	105	104	125	59	481	323	473	641	1,421	1,008	340	139	5,219
All other	9	6	4	2	2	2	54	13	16	18	2		128
Total	1,488	1,213	949	1,189	2,462	646	1,844	1,909	3,522	2,961	1,702	987	20,872

TABLE 282.—*Onions: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920*—Continued.

1920.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Massachusetts	242	200	223	43	......	......	3	189	618	1,025	560	162	3,265
New York	258	290	327	96	2	......	5	68	395	517	452	274	2,684
New Jersey	1	......	......	1	......	3	328	204	71	3	9	10	630
Pennsylvania	11	4	2	......	......	......	......	10	19	14	10	9	79
Maryland	......	......	......	......	......	......	7	50	30	2	......	......	89
Virginia	......	......	......	......	......	......	32	88	40	1	......	......	161
Florida	......	......	......	17	10	......	......	......	......	......	......	......	27
Ohio	390	252	165	17	......	......	......	14	547	804	410	177	2,776
Indiana	121	100	31	......	......	......	......	78	627	528	539	114	2,138
Illinois	6	5	5	7	......	......	1	26	33	175	37	2	297
Michigan	7	27	25	......	......	......	......	1	74	182	143	113	572
Wisconsin	11	11	15	......	......	......	......	......	45	127	41	7	257
Minnesota	16	7	3	......	......	......	......	......	25	109	53	1	214
Iowa	11	1	3	......	......	......	14	279	221	153	126	18	826
Kentucky	......	......	......	......	......	......	204	76	15	3	......	......	298
Louisiana	......	......	......	......	46	41	8	9	2	......	......	......	106
Texas	......	......	17	1,667	3,096	205	54	33	4	......	1	......	5,077
Colorado	49	38	12	......	......	......	1	......	5	51	18	9	183
Idaho	......	1	......	......	......	......	......	......	1	16	9	1	28
Washington	2	2	2	......	......	......	149	478	95	21	14	3	766
Oregon	32	12	25	4	......	......	......	1	1	2	5	3	85
California	211	208	143	86	1,088	358	222	283	753	787	268	119	4,526
All other	......	1	1	......	......	......	3	4	3	9	6	3	30
Total	1,368	1,159	999	1,938	4,242	607	1,031	1,891	3,624	4,529	2,701	1,025	25,114

TABLE 283.—*Peaches: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920.*

1917.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Total.
Connecticut	....	....	....	6	162	10	....	178
New York	....	....	....	....	4,292	3,008	8	7,308
New Jersey	....	....	9	1,690	590	....	....	1,218
Pennsylvania	....	....	1	328	521	29	....	879
Delaware	....	....	4	198	33	....	....	235
Maryland	....	....	8	432	541	....	....	981
Virginia	....	....	....	109	14	2	....	125
West Virginia	....	....	7	656	321	6	....	990
North Carolina	....	9	36	20	....	....	....	65
Georgia	37	942	2,983	2	....	....	....	[1] 4,098
Ohio	....	....	....	....	36	50	....	86
Michigan	....	....	....	10	340	93	2	445
Missouri	....	....	....	160	....	3	....	163
Texas	....	3	738	84	....	....	....	825
Oklahoma	....	20	33	223	2	....	....	278
Arkansas	....	10	1,099	485	3	....	....	1,597
Colorado	....	....	....	49	922	374	....	[2] 1,347
New Mexico	....	....	....	....	117	....	3	120
Utah	....	....	....	....	893	253	....	1,146
Idaho	....	....	....	2	153	41	1	197
Washington	....	....	....	180	1,690	50	....	1,920
Oregon	....	....	....	21	36	8	....	65
California	1	154	173	2,136	361	33	....	2,858
All other	3	22	58	21	4	5	....	113
Total	41	1,160	5,149	5,741	11,031	3,968	11	[3] 27,237

1918.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Total.
New York	....	....	....	18	999	40	....	1,057
New Jersey	....	....	69	556	123	....	....	748
Pennsylvania	....	....	11	159	82	5	....	257
Delaware	....	....	19	131	....	3	....	153
Maryland	....	....	18	135	67	2	....	222
Virginia	....	....	19	44	....	....	....	63
West Virginia	....	....	39	157	105	21	....	322
North Carolina	....	15	36	5	....	....	....	56
South Carolina	17	35	34	2	....	....	....	88

[1] Includes 134 cars, unsegregated. [2] Includes 2 cars, unsegregated. [3] Includes 136 cars, unsegregated.

TABLE 283.—*Peaches: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920*—Continued.

1918—Continued.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Total.
Georgia	1,036	3,511	3,438	10				7,995
Ohio			4	9	89	3		105
Illinois			8	13	2			23
Michigan			2	19	52	3		76
Tennessee			150	2				152
Alabama	55	92	25					171
Texas	4	109	1,432	32	2			1,579
Oklahoma		55	66	123				244
Arkansas			179	11				190
Colorado			5	670	434	2		1,111
Utah				136	441			577
Idaho				2	19			21
Washington			8	544	87	8		647
California	1	201	762	2,396	1,122	36		4,518
All other	7	3	12	11	1			34
Total	1,119	4,021	6,336	5,185	3,625	123		20,409

1919.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Total.
New York			5	97	1,289	43		1,434
New Jersey			184	854	110			1,148
Pennsylvania			8	248	106	4		366
Delaware			33	140				173
Maryland			41	428	146	2		617
Virginia			11	115	11			137
West Virginia			27	274	108	16		425
North Carolina	1	2	62	1				66
Georgia	295	3,073	3,863	5				7,236
Ohio				17	36	3		56
Illinois			8	287				295
Michigan				11	257	2		270
Missouri			3	207				210
Tennessee		1	82	32	1			116
Alabama		86	113					199
Texas		107	1,766	66	1			1,940
Oklahoma		27	88	750	1			866
Arkansas	2		1,375	956	2			2,335
Colorado				860	470	4		1,334
New Mexico			2	54	2			58
Utah				350	751	1		1,102
Idaho				101	163	1		265
Washington			6	994	1,198	21		2,219
Oregon				44	55	6		105
California	4	205	1,520	4,363	1,753	1		7,846
All other	26	12	19	23	25			105
Total	328	3,513	9,216	11,277	6,485	104		30,923

1920.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Total.
New York				22	3,450	1,233		4,705
New Jersey			41	745	520	1		1,307
Pennsylvania				64	237	14		315
Delaware				168	3			171
Maryland			4	249	143	29		425
Virginia			5	323	42			370
West Virginia				245	231	33		509
North Carolina		2	123	217	1			343
South Carolina		12	34	14				60
Georgia	41	1,315	4,157	150				5,663
Ohio				27	792	216		1,035
Indiana				94	3			97
Illinois			5	504	31			540
Michigan				19	2,098	131		2,248
Tennessee			38	111				149
Alabama		27	99					126
Texas			59	3				62
Colorado				62	708	3		773
Utah					373			373
Washington				14	188	2		204
California	2	222	2,314	3,160	1,594	6		7,298
All other	2	10	2	60	33	1		108
Total	45	1,588	6,881	6,251	10,447	1,669		26,881

TABLE 284.—*Pears: Monthly and yearly carlot shipments, by States of origin, 1919 and 1920.*

1919.

State.	Jan.	Feb.	Mar.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York	7			9	205	573	571	121	19	1,505
New Jersey					3	46	71	1		121
Delaware					2	38	15			55
Georgia				28	18	5				51
Illinois					18	259	47			324
Michigan					12	73	42			127
Missouri					2	24	47			73
Texas				46	27	24	3			100
Colorado					208	288	28			524
Washington	2			4	1,351	704	333	41	19	2,454
Oregon					433	411	82	3	1	930
California	2	1		1,857	1,480	211	88	24	1	3,664
All other				10	61	97	62			230
Total	11	1		1,954	3,820	2,753	1,389	190	40	10,158

1920.

State.	Mar.	Apr.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York	8	3			156	1,468	1,275	367	57	3,334
New Jersey						3	23	1		27
Delaware					4	177	83	5		269
Virginia						7	25	1		33
Ohio					7	13	24	6		50
Indiana						25	47	3		75
Illinois					27	669	409	27		1,132
Michigan					83	390	634	32		1,139
Texas				58	25	5				88
Colorado					231	248	124	1		604
New Mexico				6	29					35
Utah				1	20	49	3	1	1	75
Washington					507	857	337	130	56	1,887
Oregon					272	377	191	15		855
California			23	2,348	1,507	272	145	48	5	4,348
All other				4	14	37	88	3	2	148
Total	8	3	23	2,417	2,882	4,597	3,408	640	121	14,099

TABLE 285.—*Potatoes (sweet): Monthly and yearly carlot shipments, by States of origin, 1919 and 1920.*

1919.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New Jersey	287	221	162	41				18	243	261	226	422	1,881
Delaware	321	314	123	46						11	29	251	1,095
Maryland	51	57	20	12	1			24	151	234	179	201	930
Virginia	4		23	2	1			626	2,162	1,708	1,128	100	5,754
North Carolina	43	29	76	24			14	325	54	30	54	17	666
Georgia	96	86	105	30	6	5		3	1	13	18	37	400
Florida	12	27	28	2				6		3	6	1	85
Illinois	15	5	20	18						2	35	110	205
Tennessee	127	61	40	17				26	26	40	121	138	596
Alabama	10	20	33	7			29	176	45	26	13	5	364
Mississippi	7	4	7						18	26	24	17	103
Louisiana	14	9	29	8	1			5	28	21	66	13	194
Texas	20	18	23	8	1			7	42	107	195	30	451
Arkansas	39	28	16				1		1	9	78	21	193
California	66	53	19	3	2	1		10	131	217	130	86	718
All other	11	7	21	2				2	2	21	9	3	78
Total	1,123	939	745	220	12	6	44	1,228	2,904	2,729	2,311	1,452	13,713

TABLE 285.—*Potatoes (sweet): Monthly and yearly carlot shipments, by States of origin, 1919 and 1920*—Continued.

1920.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New Jersey	295	227	286	135	93	24	7	9	329	358	274	561	2,590
Delaware	315	181	223	132	69	1	......	......	6	58	78	368	1,431
Maryland	186	107	63	20	14	......	......	4	216	371	153	229	1,363
Virginia	5	4	1	......	6	......	......	27	1,715	1,909	1,411	120	5,198
North Carolina	37	22	45	63	88	1	......	304	180	51	47	21	859
Georgia	94	96	58	82	72	1	2	25	52	36	50	72	640
Florida	......	4	18	3	1	......	......	22	3	8	6	2	67
Illinois	72	32	27	24	15	......	......	......	......	......	18	20	208
Tennessee	152	163	270	213	46	17	......	16	53	48	50	125	1,153
Alabama	7	18	15	42	25	......	81	157	47	31	26	22	471
Mississippi	6	......	3	1	......	......	......	4	6	8	25	6	59
Louisiana	31	6	5	27	9	......	......	34	29	111	113	42	407
Texas	44	28	20	18	3	......	2	43	61	105	113	55	492
Arkansas	63	48	98	35	1	......	......	......	3	24	41	26	339
New Mexico	10	10	7	......	......	......	......	......	......	2	......	......	29
California	48	10	7	1	......	......	......	16	123	253	151	78	687
All other	3	3	4	21	12	......	......	......	14	15	11	11	94
Total	1,368	959	1,150	817	454	44	92	661	2,837	3,388	2,567	1,758	16,095

TABLE 286.—*Potatoes (white): Monthly and yearly carlot shipments, by States of origin, 1917 to 1920.*

1917.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Maine	3,397	2,914	2,666	2,693	1,464	473	......	71	1,599	1,886	1,231	1,294	19,688
New York, Long Island	......	......	11	171	36	......	36	732	962	1,038	424	172	3,582
New York, other	209	154	131	142	24	6	2	1	90	1,190	619	306	2,874
New Jersey	42	10	9	20	3	......	112	4,669	3,919	1,979	563	76	11,402
Pennsylvania	159	88	52	78	24	2	......	6	371	1,051	578	257	2,666
Maryland	......	......	......	3	......	30	1,179	856	122	86	99	55	[1] 2,536
Virginia	141	58	81	......	4	4,962	11,487	3,026	288	110	207	76	20,440
North Carolina	......	......	......	......	224	3,108	54	......	1	6	2	......	3,395
South Carolina	......	......	......	......	1,770	670	......	......	......	......	......	......	2,440
Florida	......	......	1	1,471	2,575	190	4	......	......	......	......	......	[2] 4,284
Michigan	403	312	116	281	193	11	1	16	388	1,572	1,296	598	5,187
Wisconsin	1,038	848	505	665	201	85	......	118	1,158	3,707	1,383	575	10,283
Minnesota	379	447	374	381	160	80	17	1,312	1,798	4,074	1,445	675	[3] 12,547
Iowa	......	......	......	......	......	......	......	1	43	336	59	1	440
Nebraska	33	24	......	4	......	......	......	38	25	652	668	74	1,518
Kansas	......	......	......	......	......	......	397	377	49	1	9	4	837
Kentucky	36	30	7	15	8	10	206	286	79	22	7	11	717
Alabama	......	......	......	1	397	235	......	......	......	......	......	......	633
Louisiana	2	......	......	......	494	548	......	......	2	......	9	8	1,063
Texas	......	1	......	10	1,028	632	1	......	4	11	2	......	1,689
Oklahoma	......	......	......	......	......	612	13	......	......	18	20	......	663
Arkansas	......	......	......	......	1	316	17	......	......	......	5	......	339
Colorado	1,409	1,297	219	472	137	18	2	230	1,764	2,165	1,254	824	9,791
Utah	......	......	......	......	......	......	......	40	96	314	204	13	667
Nevada	85	68	56	26	5	......	112	68	125	188	270	155	1,158
Idaho	613	302	568	683	162	16	3	100	284	909	1,291	899	5,830
Washington	382	442	187	386	122	33	61	98	110	372	343	161	[4] 2,762
Oregon	897	735	329	450	268	60	2	3	10	69	349	264	3,436
California	639	346	122	138	230	1,536	965	583	462	494	600	455	6,570
South Dakota	......	4	6	7	......	......	......	19	106	711	112	1	966
All other	87	60	26	71	173	278	213	220	265	481	465	70	2,409
Total	9,951	8,140	5,466	8,168	9,703	13,911	14,884	12,870	14,120	23,442	13,514	7,024	[5] 142,812

[1] Includes 106 cars, unsegregated.
[2] Includes 43 cars, unsegregated.
[3] Includes 1,405 cars, unsegregated.
[4] Includes 65 cars, unsegregated.
[5] Includes 1,619 cars, unsegregated.

TABLE 286.—*Potatoes (white): Monthly and yearly carlot shipments, by States of origin, 1917 to 1920*—Continued.

1918.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Maine	1,742	1,607	1,954	1,530	825	445	16	91	2,076	2,466	1,596	1,700	16,048
New York, Long Island	426	533	425	144	41	6	80	608	1,027	830	557	276	4,953
New York, other	487	612	679	747	372	68	......	......	142	1,237	708	599	5,651
New Jersey	57	84	105	111	27	9	303	3,075	1,641	368	223	110	6,113
Pennsylvania	347	299	286	377	125	20	......	14	264	489	309	161	2,691
Maryland	17	92	93	168	30	13	489	181	25	1	25	10	1,144
Virginia	22	63	65	101	17	2,483	7,570	936	124	16	410	135	11,942
North Carolina	......	......	3	......	33	4,063	1,421	12	3	4	......	15	5,554
South Carolina	......	......	......	......	800	1,927	85	......	......	......	......	......	2,812
Florida	3	5	7	1,259	2,950	584	36	......	2	......	......	......	4,846
Michigan	458	751	938	1,326	1,553	531	4	20	328	1,547	2,072	743	10,271
Wisconsin	887	1,461	1,643	1,452	1,011	447	11	134	2,768	4,630	2,464	1,545	18,453
Minnesota	1,261	1,510	2,119	1,328	625	179	112	3,099	4,573	4,623	1,733	758	21,920
Iowa	1	2	4	7	6	2	......	62	460	370	18	2	934
North Dakota	20	53	65	6	7	......	1	1	288	984	150	53	1,628
South Dakota	......	2	9	11	7	1	......	37	510	621	25	......	1,223
Nebraska	98	224	190	37	17	1	......	110	450	1,063	709	264	3,163
Kansas	6	......	1	......	......	......	424	380	13	......	......	......	824
Kentucky	24	99	25	29	9	3	304	184	5	5	1	3	691
Alabama	4	3	1	......	95	437	36	6	1	2	1	......	586
Louisiana	4	5	5	5	788	2,285	735	49	43	92	25	9	4,045
Texas	2	1	2	53	1,213	1,004	40	2	......	......	......	......	2,317
Colorado	1,065	980	1,674	1,537	790	177	12	850	2,673	2,676	1,259	452	14,145
Utah	17	32	63	13	21	3	10	115	117	74	96	6	567
Nevada	113	109	145	61	64	7	......	......	......	61	134	121	815
Idaho	856	603	911	513	615	136	9	458	1,049	1,076	944	446	7,616
Washington	354	375	232	193	196	119	18	33	43	112	363	219	2,257
Oregon	265	351	256	98	133	95	15	3	12	28	282	278	1,816
California	905	921	454	259	127	944	2,065	1,089	1,098	1,122	1,054	895	10,933
All other	48	166	204	163	223	986	360	256	106	405	284	91	3,292
Total	9,489	10,943	12,558	11,528	12,720	16,975	14,156	11,805	19,841	24,902	15,442	8,891	169,250

1919.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Maine	1,979	1,417	2,471	2,281	1,618	1,271	60	947	2,211	3,338	2,543	2,465	22,601
New York, Long Island	290	217	250	161	54	......	117	781	314	853	609	256	3,902
New York, other	612	470	762	766	320	116	7	1	202	2,067	1,448	726	7,497
New Jersey	27	32	48	41	13	6	618	4,971	3,292	970	410	56	10,484
Pennsylvania	175	158	192	240	116	1	......	80	549	743	964	320	3,538
Maryland	15	28	95	60	4	59	1,217	191	3	4	173	147	1,996
Virginia	83	43	74	54	13	3,955	7,311	330	22	13	419	82	12,399
North Carolina	3	3	16	11	11	2,415	812	59	6	1	2	7	3,346
South Carolina	......	......	......	......	341	838	38	......	......	......	......	......	1,217
Florida	3	......	5	729	1,499	42	......	......	......	......	......	......	2,278
Michigan	790	592	1,154	1,725	1,291	770	30	27	441	2,245	1,929	850	11,844
Wisconsin	2,460	1,598	2,122	1,608	963	362	......	105	2,592	5,614	2,239	1,260	20,923
Minnesota	1,839	1,359	2,365	1,612	1,018	434	89	2,438	5,359	5,817	1,324	693	24,347
North Dakota	125	109	211	381	191	36	......	10	847	904	84	19	2,917
South Dakota	6	28	4	31	24	5	......	......	258	396	5	......	757
Nebraska	370	204	320	235	87	11	1	96	182	712	257	59	2,534
Kansas	1	1	5	......	......	4	935	186	......	......	1	......	1,133
Kentucky	31	73	94	44	11	......	404	256	4	2	14	30	963
Louisiana	2	......	......	......	70	418	37	25	......	......	......	1	553
Texas	......	......	......	47	213	494	47	4	......	......	......	1	806
Oklahoma	......	......	......	1	......	531	125	2	......	......	17	2	678
Montana	60	26	105	230	88	8	......	2	39	192	70	8	828
Wyoming	22	28	20	45	35	3	......	......	128	108	12	......	401
Colorado	1,380	1,083	1,257	909	828	270	......	631	2,348	2,720	884	455	12,765
Utah	1	1	10	62	4	......	11	132	43	178	32	2	476
Nevada	135	96	113	57	8	1	......	......	1	121	258	85	875
Idaho	846	599	892	755	525	123	29	635	1,168	1,785	1,052	450	8,859
Washington	296	206	403	818	243	126	116	116	192	738	587	254	4,095
Oregon	230	179	217	266	98	29	1	......	1	31	100	124	1,276
California	917	417	471	176	122	544	1,557	1,336	1,110	971	813	647	9,081
All other	55	31	68	84	75	431	293	220	127	165	131	33	1,713
Total	12,753	8,998	13,744	13,429	9,883	13,303	13,855	13,581	21,439	30,688	16,377	9,032	177,082

Table 286.—*Potatoes (white): Monthly and yearly carlot shipments, by States of origin, 1917 to 1920*—Continued.

1920.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Maine	2,839	1,474	2,796	3,493	1,208	132		91	1,126	2,170	2,046	1,458	18,833
New York, Long Island	286	184	268	22	7	4	53	335	899	1,389	905	372	4,724
New York, other	1,012	969	1,661	795	207	11	3	1	97	955	1,622	586	7,919
New Jersey	32	2	50	3	5		1,567	4,695	5,152	2,390	766	103	14,765
Pennsylvania	351	236	274	151	71	3	1	7	331	1,270	1,677	388	4,760
Maryland	81	86	149	45	4	87	1,846	585	105	31	349	91	3,459
Virginia	19	12	11	20		4,813	8,220	1,801	178	97	655	158	15,984
North Carolina	1				30	3,288	152	2	2	12	12		3,499
South Carolina				2	852	2,209	6						3,069
Florida			1	47	2,335	924	42						3,349
Michigan	741	760	999	638	380	7	1	30	480	1,865	2,612	1,026	9,539
Wisconsin	1,742	1,403	1,528	674	300	125	3	16	410	3,147	2,574	1,050	12,972
Minnesota	1,875	1,162	1,900	1,027	262	117	65	1,344	2,736	6,852	3,244	927	21,511
Iowa	8	2	13	6	2		2	33	236	516	58	2	878
North Dakota	46	72	114	105	23	5			115	781	276	83	1,620
South Dakota		1		23	5	1			240	1,387	53	10	1,720
Nebraska	173	84	71	22	4		1	152	321	850	562	149	2,389
Kansas	5	1				37	1,215	655	24	14	7	2	1,960
Kentucky	82	34	27	4	7	13	447	196	27	22	35	10	904
Louisiana			4	4	436	433	15						892
Texas	2			37	113	548	19	11	1	1	1		733
Oklahoma						497	59				21	2	579
Montana	23	5	6	5		2		8	12	262	270	33	626
Wyoming	9	2	1	5				5	114	198	91	19	444
Colorado	687	512	431	92	47	3	15	628	1,716	2,639	1,493	694	8,957
Utah	4	5	9	4	6		88	157	91	30	76	10	480
Idaho	867	384	383	89	16		23	784	689	1,174	1,737	652	6,798
Washington	303	184	364	210	69	26	42	114	288	749	729	138	3,216
Oregon	151	96	187	55	34	7		7		30	351	167	1,085
California	656	374	282	97	163	824	1,784	1,002	1,074	1,185	1,016	839	9,296
All other	137	79	133	56	173	686	259	115	66	155	252	62	2,173
Total	12,132	8,123	11,662	7,731	6,759	14,802	15,928	12,774	16,530	30,171	23,490	9,031	169,133

Table 287.—*Strawberries: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920.*

1917.

State.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Total.
Massachusetts					3	52			55
New York					60	150			210
New Jersey					798	31			829
Delaware				112	2,228				2,340
Maryland				520	1,673				2,193
Virginia				1,189	163				1,352
North Carolina			187	504	5				696
Florida		65	128						193
Indiana					76				76
Illinois				176	171				347
Michigan					247	228			475
Missouri				399	274				673
Kentucky				315	361				676
Tennessee			2	1,694	85				1,781
Alabama			99	93	4				196
Mississippi			41	50					91
Louisiana		32	720	348					1,100
Texas			97	24					121
Arkansas			55	1,018	23				1,096
Washington					34	19			53
Oregon					82	24			106
California			47	52	73	73			245
All other			7	12	79	63			161
Total		97	1,383	6,506	6,436	640			15,065

TABLE 287.—*Strawberries: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920*—Continued.

1918.

State.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Total.
Massachusetts					60	15			75
New York					240	2			242
New Jersey				217	217	11			445
Delaware				646	176				822
Maryland				771	67				838
Virginia					342				342
North Carolina			384	201					585
Florida	11	66	2						79
Illinois				87	38				125
Michigan					262	10			272
Iowa				2	53				55
Missouri				586	34				620
Kentucky				399	11				410
Tennessee			27	1,204	3				1,234
Alabama		27	211	41					279
Mississippi		6	72	1					79
Louisiana		253	264	39					556
Arkansas			94	557					651
Oregon					71	2			73
California			34	174	120	132	31	18	509
All other		3	34	54	65	5			161
Total	11	355	1,122	5,321	1,417	177	31	18	8,452

1919.

State.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Total.
Massachusetts					76	8			84
New York					109	3			112
New Jersey				75	249	2			326
Delaware				126	304				430
Maryland				421	190				611
Virginia				201	7				208
North Carolina			39	419	26				484
Illinois				14	66				80
Michigan					375	16			391
Iowa					66				66
Missouri				796	285				1,081
Kentucky				35	97				132
Tennessee			1	1,032	66				1,099
Alabama			145	83	1				229
Mississippi			54	48					102
Louisiana		38	566	78					682
Arkansas			50	955	29				1,034
Oregon				5	83	5			93
California			40	295	130	104	100	34	703
All other		11	16	15	106	9	1		158
Total		49	911	4,598	2,265	147	101	34	8,105

1920.

State.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Total.
Massachusetts					30	57			87
New York					233	129			362
New Jersey				6	548	5			559
Delaware				62	578				640
Maryland				229	557	1			787
Virginia				263	86				349
North Carolina			32	402	12				446
Florida		44	109						153
Illinois				41	57				98
Michigan					422	17			439
Wisconsin					53	15			68
Missouri				183	135				318
Kentucky				56	183				239
Tennessee				954	221				1,175
Alabama			71	73	3				147
Louisiana			649	209					858
Arkansas			7	840	49				896
Oregon					85	35			120
California			3	176	98	120	112	58	[1] 569
All other			16	17	116	24			173
Total		44	887	3,511	3,466	403	112	58	[1] 8,483

[1] Includes 2 cars in October.

TABLE 288.—*Tomatoes: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920.*

1917.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York									59	84			143
New Jersey							589	773	607	252	18		2,239
Delaware							1	177	511	187	1		877
Maryland							113	62	27	35			237
Virginia							173						173
Florida				810	2,944	721	8					3	[1] 4,496
Ohio							51	349	139	89			628
Indiana								13	318	193			524
Illinois							123	329	11	24			487
Missouri							11	21	26	23			[2] 97
Kentucky							1	42	37	13			93
Tennessee						44	833	35	31	4			947
Mississippi					1	911	151						1,063
Texas					5	1,069	202			1	1		1,278
California	1		11	4	1	73	80	57	63	143	74	12	519
All other						20	8	36	39	8			[3] 115
Total	1		11	814	2,951	2,838	2,344	1,894	1,868	1,056	94	15	[4] 13,916

1918.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York								41	217	123			381
New Jersey						31	1,049	522	317	78	9		2,006
Pennsylvania								15	30	2	6		53
Delaware								314	670	146			1,130
Maryland						1	36	55	83	25			200
Virginia						10	77	8	2				97
Florida		13	486	1,447	1,387	351	1					15	3,700
Ohio							91	354	311	43			799
Indiana							7	359	608	171	5		1,150
Illinois							138	194	57	4			393
Michigan							3	70	10				83
Missouri							72	6	11				89
Tennessee						285	367	2					654
Mississippi					151	1,228							1,379
Texas					9	1,043	71						1,123
Utah								18	416	199			633
California			1	1	21	67	45	142	400	568	261	8	1,514
All other						12	10	24	39	2			87
Total		13	487	1,448	1,568	3,028	1,967	2,124	3,171	1,361	281	23	15,471

1919.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York								23	266	166	2		457
New Jersey							564	160	126	140	22		1,012
Pennsylvania								3	349	38			390
Delaware								54	375	71	2		502
Maryland						2	91	23	71	19			206
South Carolina						8	18						26
Florida	39	109	874	1,027	1,757	643	4					34	4,487
Ohio							123	139	150	67	10		489
Indiana							2	115	546	285			948
Illinois							61	107	57	9			234
Iowa								14	15				29
Missouri						2	76	53	15	1			147
Tennessee						25	342	1					368
Mississippi					7	1,315	66						1,388
Texas					106	1,027	72						1,205
Utah								22	274	42			338
California					54	46	42	102	526	1,059	353	4	2,186
All other						2	10	34	28	2	14	1	91
Total	39	109	874	1,027	1,924	3,070	1,471	850	2,798	1,899	403	39	14,503

[1] Includes 10 cars, unsegregated.
[2] Includes 16 cars, unsegregated.
[3] Includes 4 cars, unsegregated.
[4] Includes 30 cars, unsegregated.

TABLE 288.—*Tomatoes: Monthly and yearly carlot shipments, by States of origin, 1917 to 1920*—Continued.

1920.

State.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
New York								74	496	169	7		746
New Jersey							768	689	661	208	4		2,330
Pennsylvania								2	31	6			39
Delaware								25	121	7			153
Maryland							33	48	49	3			135
Florida	266	470	1,339	468	528	662	11					5	3,749
Ohio							55	153	72	9	10	3	302
Indiana								92	637	188			917
Illinois							137	72	103	29			341
Michigan							1	24	3				28
Kentucky							2	176	370	11			559
Tennessee						72	730	1	2				805
Mississippi					1	1,281	81						1,363
Texas		1			105	1,044	135	1					1,286
Arkansas						1	22	1					24
Utah								18	197	36			251
Washington							1	34	18	9			62
California		1			1	37	177	137	408	539	85	8	1,393
All other						8	23	42	38	5			116
Total	266	472	1,339	468	635	3,105	2,176	1,591	3,206	1,219	106	16	14,599

TABLE 289.—*Watermelons: Monthly and yearly carlot shipments, by States of origin, 1919 and 1920.*

1919.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Delaware				277	50				327
Maryland				469	46				515
Virginia			20	187	56				263
North Carolina			742	149					891
South Carolina		13	2,433	227					2,673
Georgia		857	7,545	581	1				8,984
Florida	291	2,833	754						3,878
Indiana				432	149				581
Illinois			7	99	83	1			190
Michigan				70	20				90
Iowa				202	119				321
Missouri			88	2,991	437				3,516
Alabama		18	479	209	2				708
Texas	2	390	1,305	1,200	110				3,007
Oklahoma			117	585	165	3			870
Arkansas			104	163	1				268
Colorado				87	120	4			211
Arizona		26	91	4					121
Washington				65	71	7			143
California	6	848	1,315	871	245	13	2		2,300
All other		1	11	54	22	1			89
Total	299	4,986	15,011	8,922	1,697	29	2		30,946

1920.

State.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Delaware				136	43				179
Maryland				341	82				423
Virginia				216	96				312
North Carolina		1	194	599	5				799
South Carolina			3,778	955	2				4,735
Georgia		86	9,579	1,417	21				11,103
Florida	5	4,906	1,878	18					6,807
Indiana				294	366	1			661
Illinois			3	117	98				218
Michigan				33	26				59
Iowa				146	163	3			312
Missouri			25	2,606	381				3,012
Alabama		7	580	489	80				1,156
Mississippi			59	20					79
Texas		643	3,081	990	114	1			4,829
Oklahoma			34	367	63				464
Arkansas			91	218	3				312
Colorado				17	52	2			71
Washington				99	91	5			195
California	13	774	871	1,132	347	52	7	46	3,242
All other			11	53	103				167
Total	18	6,417	20,184	10,263	2,136	64	7	46	39,135

TABLE 290.—*Monthly and yearly unloads of eight commodities at ten markets, in carlots, 1916 to 1920.*

NEW YORK.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples:													
1916	942	1,026	1,042	774	577	303	61	255	794	1,807	1,740	870	10,191
1917	[1] 4	[1] 4	[1] 103	638	595	224	342	975	1,067	1,496	1,468	1,080	[1] 7,996
1918	817	912	1,052	797	402	121	614	862	1,144	1,512	1,483	1,620	11,336
1919	1,156	1,326	1,009	604	305	97	254	441	947	1,506	1,547	1,409	10,601
1920	1,034	841	1,100	265	512	168	204	427	1,155	2,007	2,002	1,343	11,058
Average	[2] 987	[2] 1,026	[2] 1,051	616	478	183	295	592	1,021	1,666	1,648	1,264	[3] 10,236
Cabbage:													
1916	131	229	367	435	271	193	51	10	5	97	149	132	2,070
1917	(4)	[1] 1	[1] 19	102	244	591	122	3	63	371	292	219	[1] 2,027
1918	190	259	387	471	758	300	38	......	25	94	194	164	2,880
1919	207	227	308	291	571	393	26	2	7	51	104	114	2,301
1920	129	197	319	482	490	327	28	1	1	36	205	91	2,306
Average	[2] 164	[2] 228	[2] 345	356	467	361	53	3	20	130	189	144	[3] 2,317
Cantaloupes:													
1916	......	......	......	......	......	415	881	1,233	485	117	10	......	3,141
1917	......	......	......	......	3	176	1,121	1,175	619	237	34	......	3,365
1918	......	......	......	......	1	288	709	1,204	615	176	36	......	3,029
1919	......	......	......	......	4	462	1,044	1,185	714	350	108	......	3,867
1920	......	......	......	......	......	637	1,172	1,287	756	266	95	......	4,213
Average	......	......	......	......	2	396	985	1,217	638	229	57	......	3,523
Onions:													
1916	394	486	656	527	522	287	191	411	390	532	349	206	4,951
1917	(4)	(4)	[1] 25	244	783	465	316	356	645	1,160	487	185	[1] 4,666
1918	309	260	430	300	439	424	365	281	354	509	413	381	4,465
1919	279	415	467	319	393	323	408	439	491	425	469	370	4,801
1920	231	247	349	108	696	425	175	278	459	496	426	182	4,072
Average	[2] 303	[2] 352	[2] 476	300	567	385	291	353	468	624	429	265	[3] 4,591
Peaches:													
1916	......	......	......	......	3	220	1,090	724	860	498	......	......	3,395
1917	......	......	......	......	4	220	901	1,000	970	525	......	......	3,620
1918	......	......	......	......	327	771	1,361	749	433	42	......	......	3,683
1919	......	......	......	......	68	703	1,516	1,143	457	48	......	......	3,935
1920	......	......	......	......	......	402	1,095	942	706	361	......	......	3,506
Average	......	......	......	......	80	463	1,193	912	685	295	......	......	3,628
Potatoes (white):													
1916	1,533	1,020	1,428	1,531	1,411	2,535	2,332	1,579	1,872	1,964	1,578	1,846	20,629
1917	(4)	(4)	[1] 337	2,516	2,292	2,599	3,037	2,106	2,225	3,167	1,535	787	[1] 20,601
1918	949	1,177	1,258	1,812	1,684	2,701	2,498	1,476	1,654	1,494	1,396	1,231	19,330
1919	993	849	1,144	1,752	1,672	2,329	2,242	1,517	1,521	1,436	1,989	934	18,378
1920	803	624	1,034	674	1,324	3,273	2,430	1,168	1,570	1,569	1,669	1,286	17,424
Average	[2] 1,070	[2] 918	[2] 1,216	1,657	1,677	2,687	2,508	1,569	1,768	1,926	1,633	1,217	[3] 19,272
Strawberries:													
1916	5	34	4	158	776	1,243	478	82	......	......	......	......	2,780
1917	5	4	31	182	613	1,398	538	......	......	......	......	......	2,771
1918	......	2	41	186	692	265	20	......	......	......	......	......	1,206
1919	......	......	15	70	465	312	6	......	......	......	......	......	898
1920	......	9	33	113	368	593	86	......	......	......	......	......	1,202
Average	2	10	25	142	583	768	226	16	......	......	......	......	1,771
Tomatoes:													
1916	2	20	150	387	425	530	728	341	137	137	53	7	2,917
1917	[1] 2	[1] 1	[1] 5	90	628	608	736	757	273	134	55	21	[1] 3,310
1918	11	8	29	278	459	466	552	780	491	88	48	19	3,229
1919	36	43	226	220	502	666	513	326	99	143	162	50	2,986
1920	99	121	318	167	185	503	670	542	206	260	65	26	3,153
Average	[2] 35	[2] 48	[2] 181	228	440	555	640	549	241	152	77	25	[3] 3,119

CHICAGO.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples:													
1916	258	360	353	237	111	71	60	282	583	1,501	1,163	273	5,252
1917	88	99	127	43	71	53	241	319	634	1,186	1,003	471	4,335
1918	98	118	153	98	17	17	155	359	582	1,685	855	399	4,536
1919	141	120	120	68	70	32	108	353	1,001	2,358	1,231	467	6,069
1920	246	184	201	144	113	65	333	802	1,233	1,755	1,674	352	7,102
Average	166	176	191	118	76	48	179	423	807	1,697	1,185	392	5,459
Cabbage:													
1916	140	119	95	150	198	160	52	26	59	128	155	84	1,366
1917	57	47	89	49	163	205	146	1	11	111	189	73	1,141
1918	69	95	165	259	199	201	33	8	29	50	106	108	1,322
1919	151	167	141	163	214	195	124	35	115	188	187	157	1,837
1920	125	192	205	177	165	114	51	3	16	20	191	96	1,355
Average	108	124	139	160	188	175	81	15	46	99	166	104	1,404

[1] Reports incomplete.
[2] Average for four years.
[3] Including incomplete reports of 1917.
[4] No reports received.

TABLE 290.—*Monthly and yearly unloads of eight commodities at ten markets, in carlots, 1916 to 1920*—Continued.

CHICAGO—Continued.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Cantaloupes:													
1916	.....	.....	.....	.....	.....	347	465	522	245	45	4	.....	1,628
1917	.....	.....	.....	.....	.....	33	198	271	263	28	.....	.....	793
1918	.....	.....	.....	.....	.....	46	351	375	221	66	.....	.....	1,059
1919	.....	.....	.....	.....	.....	477	648	476	219	102	14	.....	1,936
1920	.....	.....	.....	.....	.....	476	541	573	342	109	17	3	2,061
Average	.....	.....	.....	.....	.....	276	441	443	258	70	7	1	1,495
Onions:													
1916	96	65	103	193	254	155	103	130	82	123	97	49	1,450
1917	57	53	56	139	232	171	69	35	62	101	137	34	1,146
1918	9	37	61	46	109	157	118	41	24	44	26	23	695
1919	47	48	115	38	229	147	129	130	125	150	199	46	1,403
1920	72	81	74	67	186	208	76	61	48	117	145	102	1,237
Average	56	57	82	97	202	168	99	79	68	107	121	51	1,186
Peaches:													
1916	.....	.....	.....	.....	.....	59	419	306	39	106	.....	.....	929
1917	.....	.....	.....	.....	.....	26	295	391	181	174	.....	.....	1,067
1918	.....	.....	.....	.....	.....	174	487	201	160	38	.....	.....	1,060
1919	.....	.....	.....	.....	.....	142	469	366	370	10	.....	.....	1,357
1920	.....	.....	.....	.....	.....	56	275	221	516	199	.....	.....	1,267
Average	.....	.....	.....	.....	.....	91	389	297	253	105	.....	.....	1,136
Potatoes (white):													
1916	785	776	839	930	898	1,444	1,239	1,253	1,141	1,206	1,042	572	12,125
1917	567	493	518	575	845	1,233	1,258	869	793	1,097	898	463	9,609
1918	586	657	873	858	711	1,856	1,681	1,084	1,019	1,217	1,150	785	12,477
1919	681	642	842	911	930	1,242	1,308	1,053	1,217	1,253	1,250	829	12,158
1920	619	689	735	807	890	1,133	1,149	788	824	1,250	1,665	753	11,302
Average	648	651	761	816	855	1,382	1,327	1,009	999	1,205	1,201	680	11,534
Strawberries:													
1916	.....	16	47	256	856	442	52	.....	.....	.....	.....	.....	1,669
1917	.....	2	2	2	286	381	237	.....	.....	.....	.....	.....	910
1918	11	4	17	149	388	306	1	.....	.....	.....	.....	.....	876
1919	14	6	12	137	383	593	87	14	.....	.....	.....	.....	1,246
1920	1	5	8	76	284	484	43	8	.....	.....	.....	.....	909
Average	5	7	17	124	439	441	84	4	.....	.....	.....	.....	1,122
Tomatoes:													
1916	28	50	126	191	180	221	297	124	33	71	75	29	1,425
1917	30	31	34	21	153	261	337	327	50	22	42	25	1,333
1918	22	15	45	103	82	192	228	193	33	20	51	24	1,008
1919	18	32	67	108	110	237	216	96	22	19	67	28	1,020
1920	49	78	147	63	49	155	397	211	7	4	18	21	1,199
Average	29	41	84	97	115	213	295	190	29	27	51	25	1,197

PHILADELPHIA.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples:													
1916	233	255	279	253	175	54	19	36	263	907	595	273	3,342
1917	192	166	262	150	125	49	3	8	147	563	429	249	2,343
1918	150	217	247	150	81	14	7	39	292	664	501	339	2,701
1919	213	177	170	111	59	21	5	18	261	738	611	480	2,864
1920	323	380	341	156	168	43	17	31	225	647	540	346	3,217
Average	222	239	260	164	122	36	10	26	238	704	535	337	2,893
Cabbage:													
1916	168	172	192	212	224	173	12	.....	27	137	143	105	1,565
1917	84	58	119	52	85	126	12	3	100	339	222	125	1,325
1918	119	137	197	275	315	106	6	3	112	188	324	154	1,936
1919	162	179	179	138	193	152	3	7	66	196	243	144	1,662
1920	106	162	218	319	245	174	11	.....	37	147	294	193	1,906
Average	128	142	181	199	212	146	9	3	68	201	245	144	1,679
Cantaloupes:													
1916	.....	.....	.....	.....	4	149	341	280	139	11	.....	.....	924
1917	.....	.....	.....	.....	.....	52	379	228	90	66	.....	.....	815
1918	.....	.....	.....	.....	.....	71	206	126	62	28	.....	.....	493
1919	.....	.....	.....	.....	.....	203	375	310	134	27	.....	.....	1,049
1920	.....	.....	.....	.....	.....	148	463	263	135	59	19	4	1,091
Average	.....	.....	.....	.....	1	125	353	241	112	38	4	1	874
Onions:													
1916	116	137	190	151	202	84	35	102	145	197	111	104	1,574
1917	154	110	88	94	172	122	81	74	167	262	178	104	1,606
1918	108	121	162	80	163	88	47	116	161	233	160	103	1,542
1919	162	112	158	66	117	80	50	77	176	149	146	105	1,398
1920	134	146	160	70	193	216	12	44	108	197	156	118	1,554
Average	135	125	152	92	169	118	45	83	151	208	150	107	1,535

TABLE 290.—*Monthly and yearly unloads of eight commodities at ten markets, in carlots, 1916 to 1920*—Continued.

PHILADELPHIA—Continued.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Peaches:													
1916	......	......	......	......	......	53	435	166	288	142	......	......	1,084
1917	......	......	......	......	......	66	436	111	45	169	......	......	827
1918	......	......	......	......	96	268	447	29	41	11	......	......	892
1919	......	......	......	......	22	250	509	74	62	27	......	......	944
1920	......	......	......	......	......	102	451	94	81	119	......	......	847
Average	......	......	......	......	24	148	456	95	103	94	......	......	919
Potatoes (white):													
1916	424	358	505	629	752	1,219	661	230	359	626	479	326	6,568
1917	368	311	373	313	882	1,054	717	305	571	727	527	293	6,441
1918	286	318	325	609	790	1,171	618	349	504	679	764	410	6,823
1919	493	368	555	684	848	1,269	644	433	484	711	732	447	7,668
1920	436	349	464	568	686	1,269	603	401	600	566	711	537	7,190
Average	401	341	444	561	792	1,196	649	344	504	662	643	403	6,938
Strawberries:													
1916	......	16	9	63	314	176	7	......	......	......	......	......	585
1917	1	11	23	56	285	303	......	......	......	......	......	......	679
1918	......	2	15	68	219	......	......	......	......	......	......	......	304
1919	......	......	4	40	180	18	1	......	......	......	......	......	243
1920	2	2	17	36	177	57	......	......	......	......	......	......	291
Average	1	6	14	53	235	111	2	......	......	......	......	......	420
Tomatoes:													
1916	14	65	151	240	231	281	25	2	10	11	10	9	1,049
1917	8	8	7	43	235	299	87	......	1	4	......	4	696
1918	8	5	57	156	228	237	4	1	......	......	......	2	698
1919	10	26	107	138	210	350	47	......	1	7	28	19	943
1920	34	69	177	119	68	245	101	......	......	1	6	6	826
Average	15	35	100	139	194	282	53	1	2	5	9	8	842

PITTSBURGH.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples:													
1916	264	280	329	410	344	127	125	211	191	493	375	296	3,445
1917	263	203	246	259	238	134	116	151	183	248	259	198	2,498
1918	191	278	313	325	186	76	128	152	173	371	441	317	2,951
1919	237	205	176	160	116	39	123	167	232	333	283	145	2,216
1920	249	373	350	219	216	73	119	192	221	280	220	280	2,792
Average	241	268	283	275	220	90	122	175	200	345	316	247	2,780
Cabbage:													
1916	104	91	134	118	165	161	117	46	79	156	225	65	1,461
1917	47	38	41	55	66	106	134	21	36	148	163	41	896
1918	59	60	119	147	202	120	50	21	135	303	331	123	1,670
1919	104	110	139	103	177	171	79	17	26	42	143	61	1,172
1920	87	129	206	72	133	98	110	50	17	133	199	63	1,297
Average	80	86	128	99	149	131	98	31	59	156	212	71	1,299
Cantaloupes:													
1916	......	......	......	......	......	259	455	522	294	......	......	......	1,530
1917	......	......	......	......	......	75	419	357	262	27	......	......	1,140
1918	......	......	......	......	......	134	317	357	197	63	......	......	1,068
1919	......	......	......	......	......	352	505	480	312	53	......	......	1,702
1920	......	......	......	......	......	234	393	351	241	56	......	......	1,275
Average	......	......	......	......	......	211	418	413	261	40	......	......	1,343
Onions:													
1916	121	106	104	158	214	68	116	110	126	188	80	50	1,441
1917	87	58	50	88	151	83	81	93	146	178	131	32	1,178
1918	33	66	76	71	152	60	118	133	151	188	105	55	1,208
1919	62	57	81	63	155	121	86	101	109	92	45	4	976
1920	60	84	75	48	149	204	24	51	127	160	84	49	1,115
Average	73	74	77	86	164	107	85	98	132	161	89	38	1,184
Peaches:													
1916	......	......	......	......	......	57	424	167	624	187	......	......	1,459
1917	......	......	......	......	......	65	251	268	364	219	......	......	1,167
1918	......	......	......	......	47	219	369	186	162	27	......	......	1,010
1919	......	......	......	......	12	189	424	345	236	15	......	......	1,221
1920	......	......	......	......	......	104	241	174	180	150	......	......	849
Average	......	......	......	......	12	127	342	228	313	120	......	......	1,141
Potatoes (white):													
1916	540	377	524	619	729	786	691	748	729	795	575	214	7,327
1917	281	210	194	293	557	630	581	566	551	628	499	195	5,185
1918	168	255	320	405	501	746	656	496	754	891	867	457	6,516
1919	340	352	423	602	683	896	801	840	776	650	618	345	7,326
1920	335	346	533	424	274	913	503	454	482	460	609	281	5,614
Average	333	308	399	469	549	794	646	621	658	685	634	298	6,394

TABLE 290.—*Monthly and yearly unloads of eight commodities at ten markets, in carlots, 1916 to 1920*—Continued.

PITTSBURGH—Continued.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Strawberries:													
1916		1	6	40	291	252	54						644
1917		1	1	14	185	216	18						435
1918			3	35	170	59	4						271
1919				22	77	66	1						166
1920			2	6	38	136	3						185
Average			2	23	152	146	16						340
Tomatoes:													
1916	5	25	120	228	160	286	279	215	13	21	11	1	1,364
1917	7	15	9	27	195	290	242	137	2	11	7	3	945
1918		2	20	124	205	280	258	96	18	8	4	1	1,016
1919	4	4	25	84	119	276	311	157	6	2	5		993
1920	1	19	72	111	46	192	204	120					765
Average	3	13	49	115	145	265	259	145	8	8	5	1	1,017

ST. LOUIS.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples:													
1916	17	34	41	36	31	7	25	112	773	1,739	347	63	3,225
1917	40	20	26	9	2	4	4	56	370	1,183	279	124	2,117
1918	35	21	18	28	10	10	2	73	247	680	299	117	1,540
1919	42	44	30	34	8	2	21	62	389	517	152	78	1,379
1920	19	49	109	68	54	13	37	104	221	503	324	111	1,612
Average	31	34	45	35	21	7	18	81	400	924	280	99	1,975
Cabbage:													
1916	81	78	111	103	74	10	7	45	120	171	145	42	987
1917	23	30	45	14	43	13	10	86	143	358	188	48	1,001
1918	18	17	35	88	86	18	17	99	17[illegible]	180	91	33	858
1919	68	52	65	50	60	5	4	57	97	157	80	51	746
1920	38	47	89	94	69	23	1	46	21	91	107	34	660
Average	46	45	69	70	66	14	8	67	111	191	122	42	850
Cantaloupes:													
1916						77	134	106	74	6			397
1917						16	128	89	42	10			285
1918						60	83	71	67	5			286
1919						46	131	60	58	10			305
1920						30	30	47	60	6	6		179
Average						46	101	75	60	7	1		290
Onions:													
1916	41	68	89	71	92	39	29	76	94	113	64	25	801
1917	52	23	26	64	138	93	18	43	65	120	102	9	753
1918	6	40	34	29	80	26	10	45	92	89	64	34	549
1919	26	49	40	7	51	22	5	39	72	72	40	15	438
1920	18	32	45	17	18	7	6	20	46	85	58	29	381
Average	29	42	47	38	76	37	14	45	74	96	66	22	584
Peaches:													
1916						25	138	63	76	45			347
1917						6	103	122	50	67			348
1918					3	47	37	81	20				188
1919						31	112	161	29	1			334
1920						22	56	47	35	22			182
Average					1	26	89	95	42	27			280
Potatoes (white):													
1916	206	213	331	308	382	310	19	50	172	366	304	206	2,867
1917	220	238	318	233	248	222	56	130	216	517	342	164	2,904
1918	117	142	294	225	242	363	6	76	301	363	432	178	2,739
1919	201	229	319	300	351	308	95	42	195	312	240	164	2,756
1920	163	169	209	108	57	115	26	117	240	315	305	195	2,019
Average	181	198	294	235	256	264	40	83	225	375	325	181	2,657
Strawberries:													
1916			6	32	141	2							181
1917			1	1	85	2							89
1918				18	43	16							77
1919					43	2							45
1920					40	3							43
Average			1	10	70	5							87
Tomatoes:													
1916		3	34	61	48	143	42	1	3	7	5	1	348
1917		2		4	52	92	75	1	4	4	3		237
1918			3	19	30	11				1			64
1919			17	13	16	94	38						178
1920	1	9	16	5	4	8	11	1				7	62
Average		3	14	20	30	70	33	1	1	2	2	2	178

TABLE 290.—*Monthly and yearly unloads of eight commodities at ten markets, in carlots, 1916 to 1920*—Continued.

CINCINNATI.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples:													
1916	61	88	87	64	46	31	51	71	139	343	231	126	1,338
1917	55	49	76	31	24	10	18	9	18	77	127	142	636
1918	18	46	76	61	46	19	19	43	116	294	259	133	1,130
1919	102	101	51	48	18	6	18	125	159	376	239	207	1,450
1920	99	143	120	97	79	35	29	43	130	263	346	233	1,617
Average	67	85	82	60	43	20	27	58	112	271	240	168	1,234
Cabbage:													
1916	32	41	57	44	39	32	2	10	44	84	46	21	452
1917	13	12	25	9	26	26	3	7	70	124	77	34	425
1918	30	34	43	51	78	28		3	66	119	86	39	577
1919	44	49	40	34	50	13	4	18	53	135	89	28	557
1920	28	54	57	79	73	43	3		10	89	113	47	596
Average	29	38	44	43	53	28	2	8	49	110	82	34	521
Cantaloupes:													
1916						70	122	134	102	14			442
1917						28	169	100	68	53			418
1918						60	99	116	91	23			389
1919						103	170	158	116	50			597
1920						103	156	149	114	32			554
Average						73	143	131	98	34			480
Onions:													
1916	20	25	28	43	30	18	3	7	34	41	19	16	284
1917	24	9	15	21	45	23	8	2	25	37	34	43	286
1918	9	22	20	14	44	17	4	10	38	51	34	13	276
1919	27	21	22	9	42	5	1	8	20	33	22	16	226
1920	35	20	20	17	54	27	1	5	25	34	28	17	283
Average	23	19	21	21	43	18	3	6	28	39	27	21	271
Peaches:													
1916						18	126	72	186	97			499
1917						21	108	127	88	151			495
1918						90	182	61	71	11			415
1919						78	225	198	122	8			631
1920						61	195	53	90	82			481
Average						54	167	102	111	70			504
Potatoes (white):													
1916	108	120	142	133	208	275	75	20	109	192	132	96	1,610
1917	107	108	105	170	196	293	81	52	113	148	83	117	1,573
1918	75	79	106	158	208	340	69	17	87	202	145	52	1,538
1919	88	83	182	210	217	231	93	117	171	293	246	116	2,047
1920	115	118	163	179	203	327	85	93	210	263	272	161	2,189
Average	99	102	140	170	206	293	81	60	138	220	176	108	1,791
Strawberries:													
1916				37	202	12							251
1917				17	166	76	28						287
1918			22	60	166	7							255
1919			4	69	148	11							232
1920				2	63	15							80
Average			5	37	149	24	6						221
Tomatoes:													
1916	2	15	53	101	80	81	107						439
1917	6	9	4	11	67	103	89	54	2	2			347
1918		4	8	37	42	63	37						191
1919	2	1	21	44	34	70	24	6					202
1920	2	16	32	55	11	49	51	2					218
Average	2	9	24	50	47	73	62	12					279

ST. PAUL.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples:													
1916	17	34	32	28	42	8		4	40	174	160	50	589
1917	10	20	29	6	3		2	9	15	85	75	30	284
1918	28	27	25	18	7	6	1		9	127	111	51	410
1919	12	10	12	4	1		1	5	6	97	62	17	227
1920	19	13	31	17	6	1	3	5	18	102	146	40	401
Average	17	21	26	15	12	3	1	5	18	117	111	38	382
Cabbage:													
1916	2		2	12	9	14	4	2	9	12	5	4	75
1917	1	4	7		3	13	4	1	2	9	2		46
1918	1	3		7	21	14				2	4	2	54
1919	3	1	4	2	12	13	2		3	4	7	2	53
1920	1	6	11	10	8	6				20	7	5	74
Average	2	3	5	6	11	12	2	1	3	9	5	3	60

TABLE 290.—*Monthly and yearly unloads of eight commodities at ten markets, in carlots, 1916 to 1920*—Continued.

ST. PAUL—Continued.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Cantaloupes:													
1916						21	22	38	9				90
1917						4	31	37	7	6			85
1918						3	11	20	3	1			38
1919						23	32	26	6	5			92
1920						21	15	9	12	3			60
Average						14	22	26	7	3			73
Onions:													
1916		1	10	3	15	6	12	5	8	17	5	1	83
1917	2		4	6	6	10	1	11		4	3	3	50
1918	2		1		4	3	6			3	5	1	25
1919	1		3		7	6	4	3	2	24	6	5	61
1920	2	3	4	4	3	5	2	1	3	4	6	3	40
Average	1	1	4	3	7	6	5	4	3	10	5	3	52
Peaches:													
1916					1	6	24	12	33	8			84
1917							10	21	16	22			69
1918						1	28	30	37	1			97
1919						5	21	43	56	3			128
1920						1	8	7	20				36
Average						3	18	23	32	7			83
Potatoes (white):													
1916	19	7	23	22	37	63	26	22	61	241	157	47	725
1917	67	31	31	51	49	66	25	3	9	48	23	7	410
1918	5	2	7	13	22	31	23		1	15	5	1	125
1919	1	2	2	13	17	13	29		6	39	18	10	150
1920	5	3	26	26	17	16	23	3	62	187	52	17	437
Average	19	9	18	25	28	38	25	6	28	106	51	16	369
Strawberries:													
1916			2	25	82	70	1						180
1917				8	31	42	1						82
1918					29	23							52
1919				6	36	16							58
1920				7	30	12							49
Average				9	42	33							84
Tomatoes:													
1916		1	4	8	6	14	17	7			3	1	61
1917				1	4	10	5	7					27
1918				5	6	8	18	1			1		39
1919			1	3		10	10						24
1920				2		3	9	1					15
Average			1	4	3	9	12	3			1		33

MINNEAPOLIS.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples:													
1916	27	51	47	37	27	8	13	38	113	273	189	46	869
1917	18	12	19	11	7	2	6	44	60	199	153	55	586
1918	25	17	20	17	12	4	14	8	37	203	177	34	568
1919	10	4	9	14	8	2	13	17	33	120	98	20	348
1920	21	16	28	18	1	3	11	11	26	93	198	38	464
Average	20	20	25	19	11	4	11	24	54	178	163	39	567
Cabbage:													
1916			1	7	21	28	4	2	3	3	3	3	75
1917		2	4	3	9	18	11	5	4	15	6	4	81
1918			5	15	20	14	3						57
1919		1	9	4	18	15	2						49
1920	3	3	21	21	50	11	3		1	4	3	1	121
Average	1	1	8	10	24	17	5	1	2	4	2	2	77
Cantaloupes:													
1916						45	57	60	12	1			175
1917						11	47	52	25	7			142
1918						27	39	36	8	8			118
1919						48	67	35	12	9			171
1920						10	37	28	15	3	1		94
Average						28	49	42	14	6			140
Onions:													
1916	4	3	8	19	23	9	21	13	14	21	8	3	146
1917	2	10	9	13	29	16	2	17	8	28	11	4	149
1918	2	1	5	1	20	10	20	5	4	6	1		75
1919	1	1	4	1	19	14	13	11	5	11	2	1	83
1920	3	9	9	4	44	5	3	11	8	2	7	2	107
Average	2	5	7	8	27	11	12	11	8	14	6	2	112

TABLE 290.—*Monthly and yearly unloads of eight commodities at ten markets, in carlots, 1916 to 1920*—Continued.

MINNEAPOLIS—Continued.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Peaches:													
1916	......	......	......	......	......	17	50	57	72	14	......	......	210
1917	......	......	......	......	......	10	28	41	72	39	......	......	190
1918	......	......	......	......	......	......	19	15	44	5	......	......	83
1919	......	......	......	......	......	1	8	27	71	5	......	......	112
1920	......	......	......	......	......	4	22	13	14	11	......	......	64
Average	......	......	......	......	......	6	25	31	55	15	......	......	132
Potatoes (white):													
1916	48	43	75	68	100	121	70	13	94	214	156	54	1,056
1917	108	93	101	131	128	138	57	10	18	236	157	19	1,196
1918	16	17	36	28	43	78	59	3	8	72	24	13	397
1919	27	19	38	53	56	61	70	......	15	83	58	18	498
1920	27	27	41	66	39	29	30	23	50	235	157	32	756
Average	45	40	58	69	73	85	57	10	37	168	110	27	781
Strawberries:													
1916	......	......	5	30	173	101	9	......	......	......	......	......	318
1917	......	......	1	31	92	48	22	4	1	......	......	......	199
1918	......	......	......	13	78	28	......	......	......	......	......	......	119
1919	......	......	......	5	58	36	2	......	......	......	......	......	101
1920	......	......	......	16	46	18	4	......	......	......	......	......	84
Average	......	......	1	19	89	46	7	1	......	......	......	......	164
Tomatoes:													
1916	......	1	12	21	18	23	31	8	1	4	6	......	125
1917	......	......	......	6	14	13	22	10	......	6	4	......	75
1918	......	......	1	2	10	16	26	3	......	2	3	1	64
1919	......	......	2	10	5	14	16	......	......	2	1	......	50
1920	......	......	6	6	7	8	16	2	......	2	1	1	49
Average	......	......	4	9	11	15	22	5	......	3	3	......	73

KANSAS CITY.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples:													
1916	20	17	31	26	9	2	20	31	138	383	203	73	953
1917	33	14	33	3	7	2	14	24	92	415	245	106	988
1918	11	15	17	14	10	2	13	23	70	249	164	121	709
1919	51	27	25	5	2	3	6	19	50	287	124	75	674
1920	38	34	30	26	9	5	16	34	123	302	254	135	1,006
Average	31	21	27	15	7	3	14	26	95	327	198	102	866
Cabbage:													
1916	41	35	36	41	35	7	2	38	47	48	37	21	388
1917	23	13	20	20	40	33	4	29	26	76	58	33	375
1918	19	37	41	48	65	28	23	50	70	90	75	34	580
1919	29	36	47	26	39	14	......	39	33	63	44	51	421
1920	24	39	33	43	41	10	3	9	27	70	68	32	399
Average	27	32	35	36	44	18	6	33	41	69	56	34	433
Cantaloupes:													
1916	......	......	......	......	......	57	88	75	47	3	......	......	270
1917	......	......	......	......	......	30	137	141	41	11	......	......	360
1918	......	......	......	......	......	......	......	63	57	8	......	......	128
1919	......	......	......	......	......	125	152	92	71	8	......	......	448
1920	......	......	......	......	......	96	128	104	66	2	......	......	396
Average	......	......	......	......	......	62	101	95	56	6	......	......	320
Onions:													
1916	30	20	30	20	22	19	17	18	44	64	21	25	330
1917	22	33	27	27	47	30	5	14	17	94	80	11	407
1918	7	20	29	13	36	8	11	20	46	75	109	15	389
1919	13	15	29	19	30	13	2	22	36	49	24	32	284
1920	34	34	32	23	32	22	6	16	54	97	49	27	426
Average	21	24	29	20	33	18	8	18	39	76	57	22	367
Peaches:													
1916	......	......	......	......	......	9	66	22	32	10	......	......	139
1917	......	......	......	......	......	11	58	92	42	89	......	......	292
1918	......	......	......	......	......	31	61	49	62	2	......	......	205
1919	......	......	......	......	......	25	51	97	109	3	......	......	285
1920	......	......	......	......	......	4	20	53	65	16	......	......	158
Average	......	......	......	......	......	16	51	63	62	24	......	......	216
Potatoes (white):													
1916	140	182	340	193	246	344	60	44	165	291	343	174	2,522
1917	108	208	244	107	173	237	98	131	138	498	419	185	2,546
1918	85	164	262	155	242	277	184	100	188	352	410	183	2,602
1919	170	160	250	257	273	280	87	90	137	335	290	192	2,521
1920	136	185	243	170	130	250	97	91	225	296	197	125	2,145
Average	128	180	268	176	213	278	105	91	171	354	332	172	2,467

TABLE 290.—*Monthly and yearly unloads of eight commodities at ten markets, in carlots, 1916 to 1920*—Continued.

KANSAS CITY—Continued.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Strawberries:													
1916			12	53	140	11	5						221
1917				39	88	34	10	2					173
1918			15	17	65	3							100
1919					43	7							50
1920			19	42	7								68
Average			9	30	69	11	3						122
Tomatoes:													
1916	6	13	26	41	40	96	46		4	11	13	4	300
1917	7	9	4	16	47	95	78	1		4	4	1	266
1918	3	3	9	29	32	50	31	3	4	13	4	4	185
1919	2	5	15	28	34	98	28		1	8	13	3	235
1920	6	15	24	19	28	74	33			10	2	3	214
Average	5	9	16	27	36	83	43	1	2	9	7	3	240

WASHINGTON.

Crop and year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples:													
1916	38	25	39	24	14	2		2	64	141	88	22	459
1917	10	14	16	16	9			2	58	118	71	19	333
1918	14	30	31	24	18		2	10	70	247	141	46	633
1919	22	11	12	7	4	3	1	5	49	114	98	61	387
1920	13	24	42	25	36	1	1	12	55	207	142	32	590
Average	19	21	28	19	16	1	1	6	59	165	108	36	480
Cabbage:													
1916	35	27	36	32	12			2	20	33	22	16	235
1917	9	6	7	1	7	12			30	54	42	18	186
1918	29	29	32	44	29	3	5	31	45	47	44	33	371
1919	33	30	33	24	33	8	1	14	17	38	32	24	287
1920	25	43	42	72	59	32		1	10	37	48	24	393
Average	26	27	30	35	28	11	1	10	24	42	38	23	294
Cantaloupes:													
1916						35	52	8	25	3			123
1917							62	9	19	9			99
1918						16	30	25	44	11			126
1919						55	91	25	38	21			230
1920						52	102	53	41	14	4		266
Average						32	67	24	33	12	1		169
Onions:													
1916	19	1	11	10	19	2	1	6	27	22	12	7	137
1917	9	3	3	2	14	7	7	3	8	33	14	5	108
1918	5	19	12	7	26	12	16	14	24	41	25	19	220
1919	12	16	10	2	16	13	9	12	22	23	20	19	174
1920	11	14	19	10	49	35	1	2	17	33	19	16	226
Average	11	11	11	6	25	14	7	7	20	30	18	13	173
Peaches:													
1916						4	36	3	60	20			123
1917						2	33	12	41	32			120
1918					6	37	55	18	21	1			138
1919					1	28	57	42	28	2			158
1920						18	50	72	93	30			263
Average					1	18	46	29	49	17			160
Potatoes (white):													
1916	38	25	65	50	58	26	21	20	59	44	9	2	417
1917	6	12	13	9	51	40	18	23	83	84	54	46	439
1918	53	83	80	71	95	140	114	153	125	108	98	93	1,213
1919	80	49	66	79	61	134	82	86	86	136	89	52	1,000
1920	71	45	49	43	81	145	66	95	91	67	82	50	885
Average	50	43	55	50	69	97	60	75	89	88	66	49	791
Strawberries:													
1916				1	6								7
1917		1			4	5							10
1918				2	7	9							18
1919				1	31	18							50
1920		3	3	13	51	5							75
Average		1	1	3	20	7							32
Tomatoes:													
1916		5	26	39	33	30						1	134
1917		3	1	3	45	37	8		3	4		1	105
1918	1	1	7	38	29	37			1			1	115
1919	1	4	15	37	38	55	6				1	1	158
1920	11	22	45	34	15	45	8						180
Average	3	7	19	30	32	41	4		1	1		1	138

TABLE 291.—*Apples: Yearly unloads at ten markets, by States of origin, in carlots, 1916 to 1920.*

Originating State.	New York.					Chicago.					Philadelphia.					Pittsburgh.					St. Louis.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
Boxed.																									
Montana	.....	1	23	83	124	.....	.....	.....	.....	1	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Colorado	6	3	5	2	20	95	107	41	162	82	.....	.....	.....	.....	.....	3	3	8	14	6	6	36	139	79	70
New Mexico	.....	.....	.....	.....	.....	3	6	.....	22	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Utah	.....	.....	.....	.....	1	1	17	16	10	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	14	2	4
Idaho	45	110	64	187	132	10	166	69	242	97	3	.....	.....	62	4	.....	53	55	32	22	2	138	28	62	46
Washington	1,010	[1] 1,170	2,243	2,257	2,210	676	785	490	1,366	1,539	334	234	139	645	847	88	125	450	225	588	133	150	162	80	202
Oregon	171	[1] 290	551	870	1,164	33	52	26	83	42	3	.....	3	54	104	4	9	33	20	43	6	56	6	17	5
California	150	[1] 147	124	539	200	39	116	27	66	39	3	5	2	21	5	4	3	.....	16	4	8	4	12	24	6
All other	.....	.....	2	11	.....	1	2	.....	2	.....	.....	.....	.....	3	.....	.....	.....	.....	1	.....	1	1	1	.....	.....
Total	1,382	[1] 1,721	3,012	3,949	3,851	858	1,251	669	1,953	1,813	343	239	144	785	961	99	193	546	308	663	156	391	362	264	333
Barreled.																									
Maine	6	[1] 40	233	122	40	118	82	46	141	1	19	1	3	48	40	35	34	13	2	7	.....	.....	.....	.....	.....
New Hampshire	.....	.....	.....	.....	2	10	.....	.....	19	.....	7	.....	3	48	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Vermont	196	54	121	97	73	.....	.....	.....	.....	.....	8	5	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Massachusetts	136	[1] 45	104	167	108	13	.....	1	11	1	12	13	9	152	29	.....	.....	.....	.....	6	.....	.....	.....	.....	.....
New York	6,981	[1] 3,305	7,634	4,449	4,378	972	436	1,555	559	1,031	1,423	1,065	1,127	733	940	1,637	996	1,565	1,067	1,350	98	1	241	68	291
New Jersey	440	1,401	1,140	513	454	.....	.....	.....	.....	13	64	7	35	35	13	14	5	4	7	6	.....	.....	.....	.....	1
Pennsylvania	204	[1] 45	87	83	64	134	48	105	37	34	551	290	368	255	579	296	335	143	119	230	4	.....	17	10	15
Delaware	13	468	351	110	137	.....	.....	.....	.....	.....	87	150	65	112	140	33	16	67	65	86	.....	.....	.....	.....	.....
Maryland	87	111	177	77	136	56	7	41	15	37	97	10	122	128	126	47	45	31	91	46	3	1	2	3	7
Virginia	613	[1] 468	853	688	1,487	233	45	39	33	20	373	371	435	338	261	193	181	410	176	97	139	2	48	4	19
West Virginia	.....	174	499	154	235	108	14	15	21	27	248	37	175	193	105	457	296	.....	207	159	141	.....	67	8	38
Ohio	.....	.....	.....	.....	1	25	5	27	6	18	.....	.....	.....	.....	2	379	148	67	63	29	.....	.....	.....	.....	.....
Indiana	34	5	15	20	28	135	25	12	15	32	.....	.....	.....	.....	5	79	8	2	2	3	.....	.....	.....	.....	2
Illinois	46	27	3	32	24	1,219	1,589	756	1,198	827	.....	.....	.....	.....	4	121	128	34	26	40	2,512	1,364	690	901	798
Michigan	8	1	4	6	1	1,076	401	1,105	1,295	3,063	.....	.....	.....	.....	.....	25	28	32	42	24	.....	3	18	1	18
Wisconsin	.....	.....	.....	.....	1	9	83	32	21	14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
Minnesota	7	.....	8	15	3	9	17	5	24	10	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Iowa	.....	.....	.....	.....	.....	45	33	3	23	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	9	.....	.....	.....	.....	2
Missouri	11	29	.....	18	.....	154	137	47	233	95	.....	.....	.....	.....	7	8	20	.....	.....	.....	130	245	64	80	57
Nebraska	.....	.....	.....	.....	2	11	7	5	21	7	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....
Tennessee	.....	.....	.....	.....	.....	1	5	10	.....	2	.....	.....	.....	.....	.....	6	19	23	10	1	.....	.....	.....	.....	5
Arkansas	.....	.....	.....	.....	.....	.....	17	1	395	11	.....	.....	.....	.....	.....	.....	34	.....	8	.....	3	11	4	22	14
All other	27	101	24	42	11	64	133	61	26	36	109	155	212	31	2	16	12	12	13	29	39	99	27	17	11
Imports	.....	1	11	59	22	2	.....	1	23	2	1	.....	3	4	1	.....	.....	2	10	6	.....	.....	.....	1	.....
Total	8,809	[1] 6,275	8,324	6,652	7,207	4,394	3,084	3,867	4,116	5,289	2,999	2,104	2,557	2,079	2,256	3,346	2,305	2,405	1,908	2,129	3,069	1,726	1,178	1,115	1,279
Total boxed and barreled	10,191	[1] 7,996	11,336	10,601	11,058	5,252	4,335	4,536	6,069	7,102	3,342	2,343	2,701	2,864	3,217	3,445	2,498	2,951	2,216	2,792	3,225	2,117	1,540	1,379	1,612

[1] Incomplete.

TABLE 291.—*Apples: Yearly unloads at ten markets, by States of origin, in carlots, 1916 to 1920*—Continued.

Originating State.	Cincinnati.					St. Paul.					Minneapolis.					Kansas City.					Washington.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
Boxed.																									
Colorado											4	1	10	4	1	31	110	40	44	132					
Idaho		20	6	61	17	8	7	5	5	8						8	49	23	73	100			2	1	3
Washington	79	104	167	132	369	214	97	211	142	201	158	183	160	145	228	280	188	265	238	239	41	83	157	158	133
Oregon					21	12		2	2	4	10	5	4	1		6	28	11	12	21	5	11	31	28	17
California		3	8	31	16		30					57	1	1		17	6	12	12	12					2
All other	2		4	18		6		2	4			12	1	4		4	6	4	2					1	
Total	81	127	185	242	423	240	134	220	153	213	172	258	176	155	229	346	387	355	381	504	46	94	190	188	155
Barreled.																									
Maine	65	54	32	135	19										1										
New Hampshire	1	1	4	21																					
New York	340	167	431	445	737	35	5	72	9	83	96	16	193	4	90					120	44	6	15	3	27
Pennsylvania	46	13	9	3	12															3	8	2	4	6	3
Maryland					18										1						26	17	16	15	34
Virginia	149	65	110	88	84					2					10						226	145	286	132	250
West Virginia	120	42	58	73	39		1	12	3	3			43		2					7	94	49	91	37	100
Ohio	153	21	141	14	78															2	11		1		
Indiana	38	9	25	4	9															5					
Illinois	55	34	23	37	27	140	35	43	10	11	183	75	39	41	24	20	12	39	20	32					3
Michigan	42	3	77	143	97	19	3	20	1	54	60	2	14		50					10					
Wisconsin					1					8	11	12	1	1											
Minnesota					1	23	28	6	6	1	23	38	14	11	5										
Iowa						9	6	2	4	1	28	14	4	4	1	4	26	1	6	4					
Missouri	1		1	23	8	60	41	18	13	16	168	85	45	62	33	502	489	191	183	126					2
Nebraska										1	15	30		3		9	19	4	1	7					
Kansas					2	6	11	2	1	6	76	34	19	16	5	55	25	38	42	110					
Tennessee	29	11	24		24																				
Arkansas				72			1		21	1	9	5	1	45	6	16	16	53	35	49					
All other	218	89	8	148	37	55	17	15	6	1	17	6	19	5	6	1	14	28	4	26	4	20	30	6	15
Imports			2	2	1	2	2				11	11		1	1				2	1					1
Total	1,257	509	945	1,208	1,194	349	150	190	74	188	697	328	392	193	235	607	601	354	293	502	413	239	443	199	435
Total boxed and barreled	1,338	636	1,130	1,450	1,617	589	284	410	227	401	869	586	568	348	464	953	988	709	674	1,006	459	333	633	387	590

TABLE 292.—*Cabbage: Yearly unloads at ten markets, by States of origin, in carlots, 1916 to 1920.*

Originating State.	New York.					Chicago.					Philadelphia.					Pittsburgh.					St. Louis.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
New York	950	[1]908	962	782	516	53	3	31	81	38	931	762	1,037	886	801	746	264	1,076	509	587	122	19	47	65	16
New Jersey	40	71	69	73	36	......	1	......	1	1	4	10	1	2	17	14	4	2	1	......	......	......	......	......	......
Pennsylvania	3	9	......	1	1	1	1	......	......	......	27	93	31	119	55	139	97	24	103	49	40	......	......	3	......
Maryland	52	58	4	72	5	10	......	......	......	......	1	4	4	40	2	71	33	23	10	9	......	7	......	......	......
Virginia	(2)	473	557	612	226	37	......	2	......	1	299	118	186	181	92	105	23	23	6	10	......	......	......	......	......
North Carolina	(2)	12	7	1	12	......	......	......	......	1	6	......	16	5	3	3	1	6	......	......	......	......	......	......	......
South Carolina	(2)	76	460	324	379	......	......	......	......	1	211	78	223	167	198	14	14	10	8	5	......	......	......	......	......
Florida	(2)	[1]179	817	398	1,007	18	107	269	23	157	70	241	432	239	662	5	58	174	45	100	4	24	69	9	9
Ohio	......	......	......	......	......	7	14	6	4	1	......	......	......	......	1	161	139	94	118	189	......	......	......	......	1
Indiana	......	......	......	......	2	5	24	15	13	8	......	......	......	......	......	6	8	......	......	6	10	......	18	2	2
Illinois	......	......	......	......	......	43	55	59	55	26	......	......	......	......	......	5	15	1	3	1	11	102	53	10	16
Michigan	......	......	......	......	......	46	6	27	10	1	......	......	......	......	......	21	17	3	4	16	14	31	16	13	4
Wisconsin	......	......	......	......	......	594	331	301	634	397	......	......	......	......	......	9	38	3	......	7	438	342	273	255	190
Minnesota	......	......	......	......	......	7	3	17	26	14	......	......	......	......	......	......	......	......	......	......	54	92	176	88	47
Iowa	......	......	......	......	......	26	......	1	30	6	......	......	......	......	......	8	......	......	9	......	20	127	55	65	67
Missouri	......	......	......	......	......	17	20	56	93	11	......	......	......	......	......	......	2	......	6	......	......	43	......	3	......
Kentucky	......	......	......	......	......	55	26	12	13	4	......	......	......	......	1	8	9	12	4	10	......	......	......	......	......
Tennessee	......	......	......	......	......	19	33	21	43	23	......	......	......	......	......	6	4	2	9	......	2	4	......	1	2
Alabama	1	1	......	2	28	46	3	73	59	6	......	......	......	......	6	74	6	67	57	9	47	......	55	8	1
Mississippi	......	8	......	4	17	127	48	249	97	59	......	......	2	1	41	35	43	139	123	73	25	4	40	3	20
Louisiana	(2)	194	3	7	44	100	86	76	43	11	......	......	1	......	1	5	5	7	......	......	21	1	4	4	5
Texas	6	2	......	......	2	6	99	......	164	428	......	1	......	......	10	8	37	......	91	192	9	104	46	145	269
Colorado	......	......	......	......	......	23	1	1	30	......	......	......	......	......	......	10	1	......	......	......	112	21	3	55	6
California	(2)	19	1	23	27	62	259	63	371	153	1	10	......	18	12	1	53	1	41	10	1	9	2	8	2
All other	1,018	17	......	2	4	64	21	43	47	8	15	8	3	4	4	7	25	3	25	24	57	71	1	9	3
Total	2,070	[1]2,027	2,880	2,301	2,306	1,366	1,141	1,322	1,837	1,355	1,565	1,325	1,936	1,662	1,906	1,461	896	1,670	1,172	1,297	987	1,001	858	746	660

[1] Incomplete.

[2] Included in "All other."

TABLE 292.—*Cabbage: Yearly unloads at ten markets, by States of origin, in carlots, 1916 to 1920*—Continued.

Originating State.	Cincinnati.					St. Paul.					Minneapolis.					Kansas City.					Washington.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
New York	183	95	287	231	205													7	5		154	120	218	168	139
Pennsylvania	14		7	29	2																	1	1	15	6
Virginia	27																				6		25	33	20
South Carolina																					44	18	44	21	57
Florida	16	54	126	42	107			6	1	1			11			3	2	5			20	17	64	41	154
Ohio	28	77	21	30	39																				
Indiana	12	2	6	2	4											3		1							
Illinois	11	50	6	4	19	4	1	1			2	1	2			5		3	1	1					
Michigan	17	28	30	60	38											1		1	1	2					1
Wisconsin	53	48	11	30	13	4	9	8	12	32	2	5	3	1	7	170	109	213	165	145					
Minnesota	5		3	38	1	11	9	3	8	8	2	18			4	8	23	91	33	39					
Iowa	6	1		10		2	1				2	2				11	25	38	2	12					
Missouri		1				7	1	1				6	1	2			3		3	2					
Kentucky	5		7	2	4																				
Tennessee	28	11	7		10										2										
Alabama	18	3	28	29	29	2		4	1							1	1	48	1						
Mississippi	4	12	30	21	26	2		15	4		3	1	6	4				21							8
Louisiana	2	1	7	3	8	3	1	2	3		23	2	1			33	14	21	1						
Texas		11		7	88				1	21	5	1	3	16	79	34	68	18	62	118					
Colorado	2	3		6							3					110	82	77	95	45					
California				5	1	16	21	13	21	12	26	40	28	23	26	7	36	21	36	28					
All other	21	28	1	8	2	24	3	1	2		7	5	2	3	3	2	11	15	16	7	11	30	18	6	8
Total	452	425	575	557	596	75	46	54	53	74	75	81	57	49	121	388	375	580	421	399	235	186	371	287	393

TABLE 293.—*Cantaloupes: Yearly unloads at ten markets, by States of origin, in carlots, 1916 to 1920.*

Originating State.	New York.					Chicago.					Philadelphia.					Pittsburgh.					St. Louis.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
New Jersey	146	132	170	70												2	3	1							
Delaware	460	383	544	236	254						79	40	25	82	46	105	48	17	35	21					
Maryland	414	389	445	304	325						146	36	18	105	81	72	18	13	58	22					
North Ca olina	321	342	96	190	138						199	210	72	122	95	85	37	6	19						
South Carolina	25	91	26	15	13						3			5	8	15	6	1	4	2					

Georgia	148	147	127	78	134	28	35	3	4	1	55	9	35	43	87	50	43	20	2	2	......	......	......	......	......
Florida	39	25	23	29	15	......	......	......	......	6	7	50	......	4	4	10	1	......	......	......	......	......	......	......	......
Indiana	3	......	2	1	......	125	28	62	58	38	......	......	......	......	......	61	50	34	20	30	......	......	......	......	1
Illinois	......	......	......	......	......	5	20	7	2	31	......	......	......	......	......	3	3	......	......	......	......	......	......	......	......
Michigan	......	......	......	......	......	18	14	26	72	149	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Missouri	......	......	......	......	......	1	29	1	......	1	......	......	......	......	......	9	6	9	2	17	18	19	9	......	3
Tennessee	10	5	9	5	2	1	5	1	1	1	......	......	......	......	......	2	1	......	......	......	......	......	......	......	......
Texas	......	......	2	41	21	4	2	1	1	3	......	......	......	......	1	......	......	1	34	16	8	2	......	2	......
Arkansas	1	9	40	18	22	95	76	61	113	101	8	......	1	9	2	44	23	46	113	42	74	74	12	60	7
Colorado	321	259	302	748	560	205	131	178	238	254	85	140	81	130	165	170	132	215	300	178	57	24	69	47	54
New Mexico	2	40	46	62	216	23	21	2	18	40	......	......	3	1	14	1	8	14	22	32	3	3	6	7	7
Arizona	140	158	177	242	174	157	78	99	100	108	17	28	41	73	48	77	108	133	133	131	5	13	13	27	7
Nevada	3	2	......	......	......	25	2	1	1	......	......	......	......	......	......	34	14	......	14	......	......	......	......	......	......
California	1,055	1,344	1,008	1,823	2,270	904	324	607	1,327	1,326	313	302	210	420	540	780	616	557	939	781	202	137	176	160	98
All other	53	39	12	5	69	37	28	10	1	2	12	......	7	55	......	10	23	1	7	1	30	13	1	2	2
Total	3,141	3,365	3,029	3,867	4,213	1,628	793	1,059	1,936	2,061	924	815	493	1,049	1,091	1,530	1,140	1,068	1,702	1,275	397	285	286	305	179

Originating State.	Cincinnati.					St. Paul.					Minneapolis.					Kansas City.					Washington.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
Delaware	......	1	1	5	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	4	2	12	5	5
Maryland	7	2	14	......	3	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	1	......	......
North Carolina	5	3	......	......	1	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	25	5	10	7	37
South Carolina	1	5	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	3	18	......	......	......
Georgia	28	19	1	......	2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	21	9	8	9	1
Florida	1	......	3	2	1	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	4	1	......	......	......
Indiana	28	46	72	46	40	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Missouri	1	6	......	2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Tennessee	6	3	1	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Texas	......	......	......	......	......	......	......	......	......	......	1	......	......	......	......	28	2	......	4	1	......	......	......	......	......
Arkansas	10	45	9	58	18	5	15	5	4	5	2	4	4	8	4	40	111	19	67	76	......	......	......	......	......
Colorado	89	47	91	134	95	8	1	9	7	12	12	6	10	20	10	42	37	74	86	56	18	13	34	45	39
New Mexico	......	......	12	20	33	......	......	......	......	1	......	......	2	2	4	......	......	3	11	6	......	1	5	......	8
Arizona	40	37	31	40	32	10	6	4	9	......	24	12	12	21	3	14	35	4	32	26	......	1	6	26	9
Nevada	......	......	......	......	......	......	......	......	......	......	......	7	1	3	......	4	1	......	......	......	......	......	......	......	......
California	194	182	152	279	314	60	52	19	72	41	135	86	87	115	72	134	135	28	248	230	48	45	41	122	165
All other	32	22	2	11	15	7	11	1	......	1	1	27	2	2	1	8	39	......	......	1	......	4	9	16	2
Total	442	418	389	597	554	90	85	38	92	60	175	142	118	171	94	270	360	128	448	396	123	99	126	230	266

TABLE 294.—*Onions: Yearly unloads at ten markets, by States of origin, in carlots, 1916 to 1920.*

Originating State.	New York.					Chicago.					Philadelphia.					Pittsburgh.					St. Louis.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
Massachusetts	668	[1] 248	447	685	466	......	......	......	......	......	226	157	207	257	210	45	51	2	8	45	......	......	......	......	......
New York	2,014	[1] 1,092	1,652	1,729	954	18	32	14	51	136	461	489	667	474	355	176	85	99	84	135	6	13	2	7	13
New Jersey	52	285	381	419	310	2	41	......	2	5	80	70	132	71	41	14	......	......	21	19	......	......	......	1	3
Pennsylvania	88	9	17	23	9	......	8	1	1	2	36	14	7	20	5	50	33	20	42	46	......	......	......	......	2
Maryland	1	1	13	19	2	......	......	......	......	......	14	15	9	28	21	36	9	8	16	5	......	......	......	......	1
Virginia	1	68	40	45	132	8	......	......	11	......	9	10	11	11	36	11	23	2	23	3	......	......	......	......	1
Ohio	478	[1] 263	538	597	439	40	31	4	25	18	97	139	106	129	127	335	243	287	199	154	103	25	33	36	60
Indiana	203	[1] 226	331	205	493	103	50	76	137	221	55	23	42	51	151	83	61	232	92	205	133	50	163	86	138
Illinois	9	96	19	61	18	47	43	68	91	34	7	1	......	12	8	19	61	28	30	11	29	66	17	40	21
Michigan	20	12	29	64	18	47	2	15	39	54	9	2	4	13	21	42	25	98	21	36	24	4	11	28	10
Wisconsin	3	20	10	15	7	26	55	23	21	65	1	......	......	1	......	1	5	4	......	1	48	58	17	7	11
Minnesota	12	83	19	11	......	7	19	5	4	4	......	......	......	3	3	......	1	1	......	1	61	65	52	49	5
Iowa	19	62	2	21	......	12	13	17	5	12	8	49	13	11	......	8	21	80	17	4	103	93	110	61	44
Kentucky	36	29	......	33	7	52	14	12	57	9	1	......	8	17	7	63	33	36	28	6	2	......	1	1	2
Louisiana	23	11	20	19	1	63	42	16	10	3	4	11	1	2	4	14	5	......	......	......	35	7	7	12	......
Texas	573	1,289	617	435	700	415	457	279	306	327	392	421	268	163	345	388	275	203	196	228	164	278	111	64	36
Colorado	9	1	4	......	1	59	15	7	9	7	15	......	2	......	1	......	7	......	......	1	6	18	5	1	2
Washington	5	......	14	46	1	60	21	26	88	40	12	3	12	20	5	21	5	8	43	26	14	3	7	5	13
Oregon	......	1	......	10	1	6	17	......	11	5	......	......	......	1	......	......	2	......	1	......	......	1	......	1	......
California	98	293	114	353	174	233	231	125	153	206	12	59	8	71	57	38	132	52	141	132	22	11	7	23	1
All other	371	47	37	11	10	42	49	4	23	9	9	......	11	18	11	22	14	6	14	9	24	51	6	11	7
Imports	258	530	161	......	329	210	3	3	53	80	126	143	34	25	146	75	84	42	......	48	27	7	......	2	11
Total	4,951	[1] 4,666	4,465	4,801	4,072	1,450	1,146	695	1,403	1,237	1,574	1,606	1,542	1,398	1,554	1,441	1,178	1,208	976	1,115	801	753	519	438	381

Originating State.	Cincinnati.					St. Paul.					Minneapolis.					Kansas City.					Washington.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
Massachusetts																					13	7	5	19	1
New York	28	9		7	16	2				5	12	2		1	4	41	8	2	10	42	9	6	16	13	15
New Jersey					2					3			2			3	2			9			1	3	10
Pennsylvania	1	1			1															2	14	6	3	3	2
Maryland					1																8	2			1
Virginia					1																1		3	2	3
Ohio	102	70	81	76	59					1	4					4	5	6	5	20	53	41	75	66	94
Indiana	31	35	89	48	57					1	1	1		2		1	1	7	4	4	5	4	27	17	3
Illinois	3	10	4	2	9	1	13		2	2	8	25	8	1	3	3	16	23	8	22			3	2	1
Michigan	5	2	23	16	9					2		1				2		1		2	4	8	17		1
Wisconsin	2	2				2			1	4	2	5	3			28	22	20	21	16	1	1			
Minnesota			1			21	14	10	27	6	19	25	4	1	2	49	49	47	29	23		2			
Iowa						3		1	1	1	6	8	5	3		42	71	166	46	66			3	4	
Kentucky	2	1	10	1	3				2		3			4									5	4	
Louisiana	13	5			3												7		1				1		
Texas	70	80	61	50	66	17	5	4	7	3	39	13	20	22	51	48	80	49	40	54	27	29	41	28	78
Colorado		1	1											2	2	39	18	22	14	21					
Washington				3	2	3	2	3	4	1	14	13	9	21	19	14	11	15	14	36			2		
Oregon				1	1		1		1		3			2	2	1	1		7						
California	7	23		16	16	20	8	7	15	9	31	23	23	19	11	39	40	25	71	92		1	3	3	10
All other	11	33	2	1		12	6		1	2	4	18		2	1	14	30	2	14	13	1	1	15	10	7
Imports	9	14	4	5	37	2	1					15	1	3	12	2	46	4		4	1				
Total	284	286	276	226	283	83	50	25	61	40[1]	146	149	75	83	107	330	407	389	284	426	137	108	220	174	226

[1] Incomplete.

TABLE 295.—*Peaches: Yearly unloads at ten markets, by States of origin, in carlots, 1916 to 1920.*

Originating State.	New York.					Chicago.					Philadelphia.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
New York	997	916	138	349	611	69	19	53	8	164	347	186	38	31	188
New Jersey	493	1,107	895	881	930						1		5	3	1
Pennsylvania	10	11	40	27	17		2		2		59	19	12	14	18
Delaware	32	106	85	62	36		3				39	16	10	64	10
Maryland	48	128	35	57	21		16			9	22	4	2	9	2
Virginia	58	41	36	56	129	1	12	8		2	27		5	6	8
West Virginia	101	58	18	11	1	4	36	2	2		30	2	2	8	1
North Carolina	3	55	29	24	52						17	37	16	20	66
South Carolina		9	27	16	25					1	1		5		2
Georgia	819	1,101	2,114	2,059	1,560	20	169	372	353	362	420	486	788	748	542
Illinois	2					49	15	6	111	147				1	
Michigan						62	61	5	14	479					
Missouri	15	11		9		47	21		15	3				1	
Tennessee		4	5	3	1		3	30					6	5	
Alabama			1					40	16	1			1		
Texas	14	6	5	12		194	86	235	196	1	7		2	3	
Oklahoma				2		10	53	25	22					7	
Arkansas	58	65	7	48		229	135	63	200		40	40		12	
Colorado	16		19	15	1	40	87	69	202	2				1	
Utah			3	11			22	40	31						
Idaho				1			5	2	11						
Washington	3		4	29	5	11	60	9	67						
California	351		214	256	99	178	211	72	90	67	50	27		8	
All other	375	2	8	7	18	15	51	29	17	29	24	10		3	9
Total	3,395	3,620	3,683	3,935	3,506	929	1,067	1,060	1,357	1,267	1,084	827	892	944	847

Originating State.	Pittsburgh.					St. Louis.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	192
New York	635	409	89	140	223	26	21	3		15
New Jersey	16	14	15	8	9					
Pennsylvania	40	115	30	46	28					
Delaware	1	14	13	6	10					
Maryland	27	46	1	29	12		2			
Virginia	20	19	13	7	17					
West Virginia	50	59	66	28	29		1	4		
North Carolina			10		27					
South Carolina		5	6		1					
Georgia	162	234	498	573	378	1	49	22	32	91
Illinois	14			5	3	15			2	25
Michigan	32		1			44				17
Missouri	22	6		9		4	13		4	1
Tennessee	3		8	8	4	1		1	1	13
Alabama	3		11	6			1	12	21	
Texas	157	43	96	44		76	25	41	95	
Oklahoma	5	3	2	32		22	18	41	108	
Arkansas	137	109	14	142		94	110	22	25	
Colorado	7		8	14		12	21	11	13	10
Utah			36	28			18	3	9	
Idaho				2					5	
Washington	1	1	3	13		8	3			
California	56	79	85	75	87	13	57	26	4	1
All other	71	11	5	6	21	31	9	2	15	6
Total	1,459	1,167	1,010	1,221	849	347	348	188	334	182

Originating State.	Cincinnati.					St. Paul.					Minneapolis.					Kansas City.					Washington.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
New York	130	140	28	24	112															1	42	18	6	3	16
New Jersey																					1	2	3	3	2
Pennsylvania		35	3	2																	2	2	1	9	1
Delaware		1																			1		6	8	4
Maryland		14	16	25	13																6	20	7	17	15
Virginia	3	9	2																		6	2	3	10	67
West Virginia	11	29	29	34	11																25	36	5	11	61
North Carolina					1																2	6	5	8	33
South Carolina					3																	2	8	1	
Georgia	77	100	234	224	251	3		18	9	2	4		14	5	2		8	16	8	19	37	29	81	81	55
Illinois	11			11			3					5								16					
Michigan	76	1	3	2	7	1						1			7	4				12					
Missouri	21			5			3				1	1				2	1	1	3	2					
Tennessee	5	2	11	17	24															1				2	
Alabama		1	8	55	9				1				2							1					
Texas	30	25	20	42		8	3	1	2		24	5	1			35	26	54	51	4					
Oklahoma	4	14	3	18					2					2		2	25	25	33						
Arkansas	40	53		71		10	4	1	3			7		3		42	66	34	55	4				1	
Colorado	4		12	19		3	6	14	11	13	6	3	23	10	30	20	83	7	32	41			1	1	
Utah			19	29								2				5	15	24	51	14					
Idaho				18								1					10	1	20						
Washington		2	2	8		33	8	25	35		94	69	27	71	1	11	9	1	13					2	
California	11	33	22	10	4	23	37	38	63	21	79	86	16	20	24	15	30	41	8	40	1			1	
All other	76	36	3	17	46	3	5		2		2	10		1		3	19	1	11	3		3	12		9
Total	499	495	415	631	481	84	69	97	128	36	210	190	83	112	64	139	292	205	285	158	123	120	138	158	263

TABLE 296.—*Potatoes (white): Yearly unloads at ten markets, by States of origin, in carlots, 1916 to 1920.*

Originating State.	New York.					Chicago.					Philadelphia.					Pittsburgh.					St. Louis.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
Maine	5,348	[1]3,071	1,308	3,617	1,896	216	1		59	255	439	225	143	486	771	317	120	37	90	178					1
Massachusetts	78	232	13	24												5	42	7	2						
New York	5,740	[1]4,972	7,646	6,063	5,210	89	9	10	23	60	755	384	779	1,203	587	667	251	126	486	1,027					3
New Jersey	1,744	[1]2,699	1,765	1,771	2,259	1,105	187	51	54	212	416	731	814	747	1,012	884	389	698	1,129	797	36	16	6	2	67
Pennsylvania	73	[1]130	144	206	103	121	63	3	1	1	1,775	1,610	1,876	1,890	2,062	364	391	121	479	471					1
Delaware	43	29	44	20	6	1	2		3	1	64	47	34	79	27	26	13	2	3	14					
Maryland	75	[1]120	241	185	174	105	152	15	18	12	160	78	117	276	270	210	199	68	186	308					3
Virginia	4,060	[1]5,304	2,662	3,034	3,676	1,411	1,223	581	682	917	1,456	1,697	704	939	997	1,062	972	713	969	727	2	72	6	29	41
North Carolina	468	759	1,106	746	502	11	22	133	52	91	229	220	403	357	224	277	436	358	186	289					
South Carolina	433	1,081	1,095	697	1,026	4	13	15		74	164	399	447	277	428	56	144	108	41	179					3
Georgia	6	30	36	17	7	24	27	28		1	19		74	13	3	3	21	66	1	2					3
Florida	187	1,236	1,734	828	1,051	117	389	245	152	249	350	744	908	443	569	64	310	353	136	208	4	60	28	22	20
Ohio	11		3	2		12	9	1		47	111		9			239	244	29	70	42					
Indiana	34	8	1	2	3	25	21	5	14	14	6	7	2			55	13	4	3	1	9	3	2		
Illinois	16	28	3	5	2	317	166	288	177	73	10	5		10	1	38	51	11	1	2	75	109	28	36	25
Michigan	869	[1]179	874	413	4	1,155	274	543	950	1,553	438	26	267	402	10	2,242	877	1,874	2,510	1,216	31	20	7	79	79
Wisconsin	29	[1]152	366	145	10	3,510	2,463	3,901	4,956	4,205	114	60	187	386	3	651	482	1,488	822	69	617	367	468	642	408
Minnesota	49	17	26	7		1,264	1,194	1,906	1,805	1,092	5		41	19		56	49	209	45	5	940	682	1,058	1,057	757
Iowa						37	34	95	25	37						3	10	8			19	59	28	82	26
Missouri						74	24	26	64	44						1	5				32	74	9	4	6
North Dakota						233	49	217	265	46							1	2			124	21	22	47	6
South Dakota						427	197	390	72	277						5	15	3	1		11	10	6	5	13
Nebraska						77	23	85	67	3						2		8	7		40	45	77	19	7
Kansas						30	30	15	147	296											2	23	3	2	15
Kentucky						84	114	115	134	123						4	26	7			7	6	1		5
Tennessee						6	52	13	5	27												37	8	4	2
Alabama	1	22	1		1	5	86	69	16	112							22	4	3		6	20	25	2	3
Mississippi						23	59	131	90	33	1			1		7	2	7	1	2	13	18	16	8	15
Louisiana			27	1		115	315	967	159	237						41	27	123	3		125	60	107	55	66
Texas						294	379	567	308	71						9	4	27	14		118	107	162	60	17
Oklahoma						191	105	34	207	141											44	22	16	44	16
Arkansas						225	143	101	128	68											42	64	6	18	5
Montana						38	21	13	38	7											14	9	1	5	6
Wyoming						16	6	34	3	1											4	32		1	
Colorado					1	144	302	643	241	40	2	18	4			2	19	21	2		189	312	350	239	270
Utah							6	6	5	14											1	9	1		
Idaho			1	18	3	165	550	508	761	568	2	3	1			13	21	28	6		275	318	278	235	123
Washington	1		2			284	384	117	99	8				11		2	2	3			54	119	10	5	1
California		5		3		15	241	157	152	46												34	3	2	1
All other	956	21	16	100	5	122	202	447	121	17	41	183	13	11	3	16	27	3	73	8	24	176	6	46	4
Imports	408	506	216	474	1,485	33	72	2	105	223	11	4		118	223	6			57	69	9	9	1	6	1
Total	20,629	[1]20,601	19,330	18,378	17,424	12,125	9,609	12,477	12,158	11,302	6,568	6,441	6,823	7,668	7,190	7,327	5,185	6,516	7,326	5,614	2,867	2,904	2,739	2,756	2,019

Originating State.	Cincinnati.					St. Paul.					Minneapolis.					Kansas City.					Washington.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
Maine	4	1	1		146																7	6	8	25	55
New York	19	2	3	27	54																24	10	21	156	175
New Jersey	93	66	1	27	160																91	130	223	193	235
Pennsylvania	21	3		3	1																6		1	9	6
Delaware	16	9		1																					
Maryland	24	2	3	2	5																7	14	7	19	32
Virginia	225	116	3	34	94					3					2					2	22	41	102	97	109
North Carolina	56	108	51	89	58					1										2	15	17	124	104	90
South Carolina		3	4		52					1										1	11	28	57	28	46
Georgia	2	5	30	2	20																		6	1	
Florida	56	165	106	93	216					2	1	2	6	1		10	22	12	5	12	21	48	89	22	58
Ohio	53	13	13	11	28																	1	3	2	13
Indiana	33	8	8	5	11	3	3															6	8		1
Illinois	43		15	11	23	3	8	1				19	1			16	3		3	3					
Michigan	404	176	278	519	629															10	202	116	338	217	26
Wisconsin	153	326	475	680	230		14	20	30	14	4	35	18	17	10	26	17	9	45	134	4	5	160	101	22
Minnesota	114	112	202	256	191	430	202	64	58	348	589	428	241	245	640	582	578	504	779	772		1	20		
Iowa	1	1			3							8				10	17	23	8	36			3		
Missouri	6	2				11	7				12	33	4	4		31	74	19	11	18					
North Dakota	31	10	29	54	25	33	9	7	10	7	39	37	6	21	5	100	100	202	209	95					
South Dakota			3	1	2	3	1				30	34	2	3		29	132	48	30	79					
Nebraska											5	7				460	220	204	302	171					
Kansas						9	4		10	17	30	5		26	13	43	99	118	93	141					
Kentucky	27	14	11	34	71																				
Tennessee	65	14	5	26	8					1							2	1							
Alabama	58	130	124	3	57												3	2		31					
Mississippi	7	37	51	20	8						2	1	9							5					
Louisiana	49	57	89	22	8			17	1		4	4	19			80	59	149	37	52					
Texas	18	3	13	17		11	6	3	3	4	48	5	36	12	8	106	110	96	111	61					
Oklahoma	4			24		31	13		6	1	69	15	3	34	10	154	98	66	83	86					
Arkansas	3	1	1			3	2			2		1	2	5	3	70	48	61	26	32					
Montana					2	21	16		8		6	29	3	55		247	75	63	78	23					
Wyoming																3	59	99	126	24					
Colorado																190	338	457	257	237			2	2	
Utah																1	22	42	7	13					
Idaho	6	16	17	14	10	4	1		1		2	16		2		124	138	322	249	102			3	1	2
Washington	6	14			4	114	25		1		144	203	5	40	2	152	216	46	47	8					
California							30	13	11	1	3	62	39	18	5	1	39	50	10	8					
All other	12	156	2	39	7	12	16		2		14	28	3	1	1	82	60	9		3	6	16	35	21	14
Imports	1	3		33	66	37	53		9	35	54	224		14	57	5	17		5	14	1		3	2	1
Total	1,610	1,573	1,538	2,047	2,189	725	410	125	150	437	1,056	1,196	397	498	756	2,522	2,546	2,602	2,521	2,145	417	439	1,213	1,000	885

[1] Incomplete.

TABLE 297.—*Strawberries: Yearly unloads at ten markets, by States of origin, in carlots, 1916 to 1920.*

Originating State.	New York.					Chicago.					Philadelphia.					Pittsburgh.					St. Louis.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
New York	353	302	79	84	146				5		5			3		11									
New Jersey	739	724	254	223	301						19					25		3							
Delaware	249	404	143	53	96						65	44	13	5	19	84	148	54	5	37					
Maryland	49	587	232	164	132		2				70	93	34	24	2	63	53	22	7	24					
Virginia	185	246	94	48	132	1	2				161	178	72	86	89	20	20	11	2	1					
North Carolina	275	308	247	227	206						98	155	114	72	97	12	14	17	5	8					
South Carolina	32		7								21		6		4		1								
Florida	172	158	56	26	132	29	14	26	37	12	59	64	23	18	50	9	3	2		2	1	6			
Ohio							2		1							34	20	8	8	23					
Indiana					1		1	9	87	25						2									
Illinois						314	70	42	104	73						4	3								
Michigan						278	484	252	380	309															
Iowa						3		9	51	24															
Missouri			2	10	4	65	4	59	45	1						14	2		18		4				
Kentucky	2	14	10			30	52	49	10	41	5	22	41	1	17	68	62	65	25	39					
Tennessee		8	40	7	14	295	192	226	187	131	10	12		3	3	130	61	23	31	18	13		1	4	18
Alabama			8	5			3	7	11	16						33	3	45	28	22					
Mississippi			1	6		25	6	5	12	2	2	2		8		10	1		2						
Louisiana	1	13	23	37	36	594	47	39	202	207	12	3		17	10	58	19	11	23	3	49		20		
Arkansas				6	1	23	20	10	100	54				5		40	11	9	2	2	109	83	56	37	25
All other	723	7	10	2	1	12	11	143	14	14	58	106	1	1		27	14	1	10	4	5			4	
Total	2,780	2,771	1,206	898	1,202	1,669	910	876	1,246	909	585	679	304	243	291	644	435	271	166	185	181	89	77	45	43

Originating State.	Cincinnati.					St. Paul.					Minneapolis.					Kansas City.					Washington.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
North Carolina		1																			4	3	13	35	46
Florida		23	10	32	2																	3			18
Ohio		9	1																						
Iowa						4	1	11	1	2	17	17	7	5	3										
Missouri				3		60	57	23	29	10	87	75	45	46	14	10	31	27	10	4					
Tennessee	159	153	157	102	72							4	1		7	2	5								
Alabama	86	78	78	90	1																				
Louisiana						29	8		8	10	54	45	10	9	22	46	12	26	2	26					
Arkansas	2					58	6	15	19	18	133	4	52	34	25	138	81	46	38	38					
All other	4	23	9	5	5	29	10	3	1	9	27	54	4	7	13	25	44	1			3	4	5	15	11
Total	251	287	255	232	80	180	82	52	58	49	318	199	119	101	84	221	173	100	50	68	7	10	18	50	75

TABLE 298.—*Tomatoes: Yearly unloads at ten markets, by States of origin, in carlots, 1916 to 1920.*

Originating State.	New York.					Chicago.					Philadelphia.					Pittsburgh.					St. Louis.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
New York	14	26	17	51	45	......	2	......	......	1	1	......	......	1	......	6	3	14	9	......	......	......	......	......	......
New Jersey	1,138	1,559	1,821	789	1,270	1	......	......	......	......	......	1	1	......	......	38	9	50	11	3	......	......	......	......	......
Pennsylvania	5	15	12	19	8	1	......	......	......	1	......	......	......	......	......	2	3	6	1	......	......	......	......	......	......
Delaware	23	8	3	5	2	1	......	......	......	......	21	2	......	1	......	......	......	......	......	......	......	......	......	......	......
Maryland	103	89	61	81	51	2	......	......	......	......	1	......	......	......	......	15	8	......	1	4	......	......	......	......	......
Virginia	......	10	6	6	4	2	3	......	......	1	2	......	......	1	7	1	5	......	1	......	......	......	......	......	......
South Carolina	22	7	4	18	8	......	......	......	......	......	......	......	......	......	......	1	1	......	......	......	......	......	......	......	......
Georgia	4	4	......	2	......	24	20	3	1	......	1	......	......	2	1	4	6	......	......	......	......	2	......	......	......
Florida	1,214	[1] 1,232	1,030	1,486	1,246	547	385	238	387	393	793	524	568	682	611	552	352	381	337	286	148	68	40	44	32
Ohio	......	......	1	5	2	14	8	15	5	3	3	......	......	3	......	315	156	183	319	163	......	4	......	......	......
Indiana	1	......	1	1	4	2	5	2	4	2	2	......	......	......	......	2	3	......	......	......	......	......	......	......	......
Illinois	3	......	......	......	......	44	303	165	93	314	......	......	......	......	......	1	8	2	1	1	1	1	......	......	......
Michigan	......	......	......	......	......	12	5	76	5	26	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Missouri	......	......	......	3	......	127	50	63	64	2	......	......	......	......	......	13	20	1	6	......	......	......	......	......	7
Tennessee	......	17	3	1	29	218	229	141	120	160	3	......	1	......	1	140	144	129	62	80	......	8	4	1	4
Mississippi	331	278	231	230	253	24	26	22	76	40	194	149	122	196	204	187	100	150	126	94	6	5	6	......	2
Louisiana	......	......	......	1	......	7	11	6	2	6	......	......	......	......	......	7	1	......	......	......	6	1	......	......	1
Texas	5	14	3	60	54	187	197	171	113	179	14	15	5	15	1	41	113	91	116	92	170	133	4	120	3
California	16	48	27	215	119	171	64	42	102	33	13	5	1	41	1	21	6	6	1	5	15	4	1	......	7
All other	38	3	2	3	2	13	24	14	7	6	1	......	......	......	......	15	7	2	1	......	2	11	6	3	1
Imports	......	......	7	10	56	28	1	50	41	32	......	......	......	1	......	3	......	1	1	37	......	......	3	10	5
Total	2,917	[1] 3,310	3,229	2,986	3,153	1,425	1,333	1,008	1,020	1,199	1,049	696	698	943	826	1,364	945	1,016	993	765	348	237	64	178	62

Originating State.	Cincinnati.					St. Paul.					Minneapolis.					Kansas City.					Washington.				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
Florida	268	147	98	126	132	19	1	11	4	1	55	2	13	19	5	135	93	60	36	26	115	79	83	128	156
Missouri	......	......	......	......	......	12	......	4	......	......	9	24	7	1	1	1	......	3	......	......	......	......	......	......	......
Tennessee	107	60	32	1	24	2	1	6	5	2	......	3	19	14	5	......	38	6	......	......	......	......	5	......	1
Mississippi	31	8	29	12	24	6	......	3	10	......	12	......	8	6	3	13	......	4	......	1	19	10	17	20	15
Texas	30	73	31	50	21	5	7	12	4	9	36	5	10	2	12	107	107	71	135	107	......	1	......	6	......
California	1	1	......	4	1	3	1	1	......	......	13	12	7	5	4	35	14	25	25	21	......	......	......	2	......
All other	2	54	......	4	12	13	17	2	1	2	......	21	......	......	3	9	1	4	......	10	......	14	9	2	8
Imports	......	4	1	5	4	1	......	......	......	1	......	8	......	3	16	......	13	12	39	49	......	1	1	......	......
Total	439	347	191	202	218	61	27	39	24	15	125	75	64	50	49	300	266	185	235	214	134	105	115	158	180

[1] Incomplete.

TABLE 299.—*Yearly unloads of eight commodities at ten markets, in carlots, 1916 to 1920.*

Crop and year.	New York.	Chicago.	Philadelphia.	Pittsburgh.	St. Louis.	Cincinnati.	St. Paul.	Minneapolis.	Kansas City.	Washington.	Total.
Apples:											
1916	10,191	5,252	3,342	3,445	3,225	1,338	589	869	953	459	29,663
1917	[1] 7,996	4,335	2,343	2,498	2,117	636	284	586	988	333	[1] 22,116
1918	11,336	4,536	2,701	2,951	1,540	1,130	410	568	709	633	26,514
1919	10,601	6,069	2,864	2,216	1,379	1,450	227	348	674	387	26,215
1920	11,058	7,102	3,217	2,792	1,612	1,617	401	464	1,006	590	29,859
Average	[2] 10,236	5,459	2,893	2,780	1,975	1,234	382	567	866	480	[2] 26,873
Cabbage:											
1916	2,070	1,366	1,565	1,461	987	452	75	75	388	235	8,674
1917	[1] 2,027	1,141	1,325	896	1,001	425	46	81	375	186	[1] 7,503
1918	2,880	1,322	1,936	1,670	858	577	54	57	580	371	10,305
1919	2,301	1,837	1,662	1,172	746	557	53	49	421	287	9,085
1920	2,306	1,355	1,906	1,297	660	596	74	121	399	393	9,107
Average	[2] 2,317	1,404	1,679	1,299	850	521	60	77	433	294	[2] 8,935
Cantaloupes:											
1916	3,141	1,628	924	1,530	397	442	90	175	270	123	8,720
1917	3,365	793	815	1,140	285	418	85	142	360	99	7,502
1918	3,029	1,059	493	1,068	286	389	38	118	128	126	6,734
1919	3,867	1,936	1,049	1,702	305	597	92	171	448	230	10,397
1920	4,213	2,061	1,091	1,275	179	554	60	94	396	266	10,189
Average	3,523	1,495	874	1,343	290	480	73	140	320	169	8,708
Onions:											
1916	4,951	1,450	1,574	1,441	801	284	83	146	330	137	11,197
1917	[1] 4,666	1,146	1,606	1,178	753	286	50	149	407	108	[1] 10,349
1918	4,465	695	1,542	1,208	549	276	25	75	389	220	9,444
1919	4,801	1,403	1,398	976	438	226	61	83	284	174	9,844
1920	4,072	1,237	1,554	1,115	381	283	40	107	426	226	9,441
Average	[2] 4,591	1,186	1,535	1,184	584	271	52	112	367	173	[2] 10,055
Peaches:											
1916	3,395	929	1,084	1,459	347	499	84	210	139	123	8,269
1917	3,620	1,067	827	1,167	348	495	69	190	292	120	8,195
1918	3,683	1,060	892	1,010	188	415	97	83	205	138	7,771
1919	3,935	1,357	944	1,221	334	631	128	112	285	158	9,105
1920	3,506	1,267	847	849	182	481	36	64	158	263	7,653
Average	3,628	1,136	919	1,141	280	504	83	132	216	160	8,199
Potatoes (white):											
1916	20,629	12,125	6,568	7,327	2,867	1,610	725	1,056	2,522	417	55,846
1917	[1] 20,601	9,609	6,441	5,185	2,904	1,573	410	1,196	2,546	439	[1] 50,904
1918	19,330	12,477	6,823	6,516	2,739	1,538	125	397	2,602	1,213	53,760
1919	18,378	12,158	7,668	7,326	2,756	2,047	150	498	2,521	1,000	54,502
1920	17,424	11,302	7,190	5,614	2,019	2,189	437	756	2,145	885	49,961
Average	[2] 19,272	11,534	6,938	6,394	2,657	1,791	369	781	2,467	791	[2] 52,995
Strawberries:											
1916	2,780	1,669	585	644	181	251	180	318	221	7	6,836
1917	2,771	910	679	435	89	287	82	199	173	10	5,635
1918	1,206	876	304	271	77	255	52	119	100	18	3,278
1919	898	1,246	243	166	45	232	58	101	50	50	3,089
1920	1,202	909	291	185	43	80	49	84	68	75	2,986
Average	1,771	1,122	420	340	87	221	84	164	122	32	4,365
Tomatoes:											
1916	2,917	1,425	1,049	1,364	348	439	61	125	300	134	8,162
1917	[1] 3,310	1,333	696	945	237	347	27	75	266	105	[1] 7,341
1918	3,229	1,008	698	1,016	64	191	39	64	185	115	6,609
1919	2,986	1,020	943	993	178	202	24	50	235	158	6,789
1920	3,153	1,199	826	765	62	218	15	49	214	180	6,681
Average	[2] 3,119	1,197	842	1,017	178	279	33	73	240	138	[2] 7,116
Total:											
1916	50,074	25,844	16,691	18,671	9,153	5,315	1,887	2,974	5,123	1,635	137,367
1917	[1] 48,356	20,334	14,732	13,444	7,734	4,467	1,053	2,618	5,407	1,400	[1] 119,545
1918	49,158	23,033	15,389	15,710	6,301	4,771	840	1,481	4,898	2,834	124,415
1919	47,767	27,026	16,771	15,772	6,181	5,942	793	1,412	4,918	2,444	129,026
1920	46,934	26,869	16,922	13,892	5,138	6,018	1,112	1,739	4,812	2,878	126,314
Average	[2] 48,458	24,621	16,101	15,498	6,901	5,303	1,137	2,045	5,032	2,238	[2] 127,333

[1] Reports incomplete.

[2] Including incomplete reports of 1917.

TABLE 300.—*Potatoes (including sweet): Imports into the United States, by countries, years ending June 30, 1916 and 1917, and calendar years 1918 to 1920.*[1]

Imported from—	Year ending June 30—		Calendar year—		
	1916	1917	1918	1919	1920
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Bermuda	161,260	186,775	193,093	225,745	159,963
Canada	27,576	2,844,364	1,004,798	5,307,724	5,052,212
Mexico	14,214	24,888	3,348	10,083	10,935
Australia		22,563			11,573
Other countries	6,482	435	255	134	827,312
Total	209,532	3,079,025	1,201,494	5,543,686	6,061,995

[1] Compiled from Foreign Commerce and Navigation of the United States.

TABLE 301.—*Potatoes (except sweet): Exports from the United States, by countries of destination, years ending June 30, 1916 and 1917, and calendar years 1918 to 1920.*[1]

Exported to—	Year ending June 30—		Calendar year—		
	1916	1917	1918	1919	1920
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Bermuda	56,077	41,733	23,433	20,163	32,151
Canada	230,115	574,190	781,574	610,622	856,430
Guatemala	13,139	16,013	7,701	11,127	9,193
Honduras	11,355	8,406	7,931	9,558	10,194
Panama	280,725	154,268	76,287	60,647	77,247
Mexico	101,776	179,731	352,274	315,523	287,191
Newfoundland and Labrador	12,474	2,418	10,382	1,646	2,211
British West Indies	76,007	45,176	46,936	46,933	38,621
Cuba	2,324,882	1,278,148	2,396,550	2,325,097	2,679,684
Dominican Republic	15,641	17,318	22,359	19,524	35,976
Other West Indies	26,010	23,871	33,578	42,956	27,345
Argentina	472,983	6,750	2,970	2,200	1,108
Brazil	182,277	69,789	10,994	23,723	7,071
Colombia	28,080	11,524	1,653	3,330	3,184
British Guiana	39,007	16,133	35,337	34,204	21,622
Uruguay	74,716	550	272		500
Venezuela	16,434	12,061	11,008	9,986	18,456
Other countries	53,062	30,922	31,948	105,083	45,381
Total	4,017,760	2,489,001	3,853,187	3,642,322	4,153,565

[1] Compiled from Foreign Commerce and Navigation of the United States.

TABLE 302.—*Onions: Imports into the United States, by countries, years ending June 30, 1916 and 1917, and calendar years 1918 to 1920.*[1]

Imported from—	Year ending June 30—		Calendar year—		
	1916	1917	1918	1919	1920
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Spain	590,717	1,422,572	153,558	568,540	1,414,910
United Kingdom	35,118	12,874		13,264	54,749
Canada	4,367	56,421	8,475	26,328	8,712
Cuba	7,150	28,337	7,084	1,270	
Australia	23,553	63,730	5,280	4,431	24,414
New Zealand	5,212	2,282			176
Canary Islands	29,457	48,609	2,440	8,949	27,571
Italy	3,763	9,765	487	7,492	19,894
Bermuda	112,544	89,975	83,121	94,796	74,345
Egypt				10,486	189,108
Other countries	3,991	23,383	584	5,130	5,279
Total	815,872	1,757,948	261,029	740,686	1,819,158

[1] Compiled from Foreign Commerce and Navigation of the United States.

TABLE 303.—*Onions: Exports from the United States, by countries of destination, years ending June 30, 1916 and 1917, and calendar years 1918 to 1920.*[1]

Exported to—	Year ending June 30—		Calendar year—		
	1916	1917	1918	1919	1920
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Canada	257,632	207,852	190,216	218,129	264,262
Honduras	5,818	4,315	4,693	4,864	5,322
Panama	60,890	43,237	43,999	31,649	41,003
Mexico	21,898	36,893	54,206	46,207	52,133
Newfoundland and Labrador	8,111	3,027	15,537	10,268	2,924
Jamaica	7,237	3,960	3,528	3,349	4,095
Cuba	106,163	77,012	299,800	400,560	485,266
Dominican Republic	9,698	7,906	11,171	12,056	20,601
Australia	26,166	1	632	6,242	10,589
New Zealand	20,218	2,456	6,628	10,919	17,841
Trinidad and Tobago	3,734	236	17,349	9,757	5,470
British Guiana	1,685	64	13,055	12,321	7,188
Other countries	34,489	22,342	32,041	50,638	29,084
Total	563,739	409,301	692,855	816,959	945,778

[1] Compiled from Foreign Commerce and Navigation of the United States.

TABLE 304.—*Apples (green or ripe): Exports from the United States, by countries of destination, years ending June 30, 1916 and 1917, and calendar years 1918 to 1920.*[1]

Exported to—	Year ending June 30—		Calendar year—		
	1916	1917	1918	1919	1920
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
Denmark	56,520	11,989	2,201	33,281	12,982
Norway	25,323	20,410	667	147,586	67,434
Sweden	8,787	3,573	....	34,950	14,432
United Kingdom	874,587	1,147,412	125,987	1,209,855	1,250,033
Canada	301,986	314,955	331,453	158,859	274,358
Panama	9,341	10,118	2,161	3,567	7,701
Mexico	10,365	36,686	50,261	23,565	37,925
Cuba	28,210	30,093	29,345	26,548	32,263
Argentina	44,003	58,453	4,704	15,159	32,688
Brazil	28,486	25,297	5,573	16,880	24,656
Australia	34,809	25,343	33	....	3,766
New Zealand	5,273	6,812	1,237	2,242	1,402
Philippine Islands	8,283	12,479	11,596	15,682	11,026
Other countries	30,348	36,377	14,698	24,193	27,045
Total	1,466,321	1,739,997	579,916	1,712,367	1,797,711

[1] Compiled from Foreign Commerce and Navigation of the United States.

TABLE 305.—*Lemons and oranges: Exports from the United States, by countries of destination, years ending June 30, 1916 and 1917, and calendar years 1918 to 1920.*[1]

Exported to—	Year ending June 30—		Calendar year—		
	1916	1917	1918	1919	1920
Lemons:	*Boxes.*	*Boxes.*	*Boxes.*	*Boxes.*	*Boxes.*
Canada	135,183	143,709	176,982	270,758	254,695
Panama	2,475	2,255	398	999	2,333
Mexico	1,073	1,814	1,235	1,062	1,681
China	4,967	6,216	4,526	11,950	10,817
Russia in Asia	7,434	656	....	31	40
Australia	9,799	5,800	....	3,380	1,630
New Zealand	6,370	8,482	4,450	10,466	12,306
Philippine Islands	3,517	2,993	2,607	4,240	4,956
Other countries	4,252	3,013	3,149	4,030	4,592
Total	175,070	174,938	193,347	306,916	293,050
Oranges:					
England	12,682	14,787	2,493	45,267	5,732
Scotland	10,664	6,329	....	6,175	3,975
Bermuda	1,925	3,082	1,201	1,205	2,821
Canada	1,489,746	1,726,394	827,529	1,633,421	1,417,001
Panama	4,411	4,026	174	5,356	6,077
Mexico	6,207	27,408	2,988	5,562	6,583
Newfoundland and Labrador	4,285	7,673	7,378	12,483	9,324
China	1,300	2,031	1,277	6,280	9,870
Australia	9,301	16,416	....	2,500	860
New Zealand	27,021	27,991	4,564	27,381	22,496
Philippine Islands	5,302	7,432	6,059	14,635	18,496
Cuba	479	2,174	456	5,466	9,475
Other countries	1,719	4,629	3,040	11,737	5,284
Total	1,575,042	1,850,372	857,159	1,777,468	1,517,994

[1] Compiled from Foreign Commerce and Navigation of the United States.

PART VI.—COTTON.

TABLE 306.—*Cotton, middling: Monthly average price, in cents per pound, at New Orleans.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	14.92	11.97	12.08	12.02	....	8.94	14.26	25.10	30.23	31.17	34.03	17.85
September	13.53	11.29	11.37	13.11	8.42	10.40	15.27	21.68	33.28	30.38	27.35	16.87
October	14.22	9.61	10.98	13.76	7.02	11.95	17.24	26.76	31.19	35.27	20.97	17.80
November	14.50	9.35	12.15	13.26	7.43	11.50	19.45	28.08	29.75	39.58	17.65	18.51
December	14.85	9.17	12.81	12.98	7.18	11.89	18.34	29.07	29.44	39.89	14.64	18.56
January	14.95	9.52	12.58	12.93	7.87	12.04	17.33	31.07	28.84	40.28	....	18.74
February	14.62	10.31	12.51	12.90	8.01	11.45	17.14	30.91	26.97	39.32	....	18.41
March	14.54	10.65	12.45	12.95	8.34	11.73	17.94	32.76	26.84	40.69	....	18.89
April	14.70	11.61	12.44	13.10	9.43	11.88	19.52	33.05	26.70	41.41	....	19.38
May	15.46	11.71	12.29	13.36	9.04	12.61	20.06	28.94	29.36	40.32	....	19.32
June	15.27	12.07	12.44	13.79	9.12	12.80	24.17	30.70	32.09	40.52	....	20.30
July	14.30	12.93	12.31	13.34	8.71	13.03	25.41	29.50	33.93	39.41	....	20.29
Average	14.66	10.85	12.20	13.13	8.23	11.69	18.84	28.97	29.89	38.19	....	18.67

[1] Figures prior to 1915, compiled from New York Cotton Exchange reports.

TABLE 307.—*Cotton, middling: Monthly average price, in cents per pound, at New Orleans.*

(Prices reduced to the 1913 basis.)

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	15.07	12.73	12.08	11.90	....	8.94	11.59	13.64	14.96	13.79	13.61	12.73
September	13.67	12.01	11.37	12.85	8.17	10.61	12.02	11.91	16.08	13.81	11.30	12.25
October	14.36	10.22	10.98	13.62	7.09	11.83	12.96	14.87	15.29	15.82	9.32	12.70
November	14.65	9.95	12.15	13.13	7.58	11.27	13.60	15.43	14.44	17.21	8.53	12.94
December	15.00	9.76	12.81	13.11	7.40	11.32	12.56	16.06	14.29	16.76	7.75	12.91
January	15.90	9.52	12.71	12.93	8.03	10.95	11.55	16.79	14.21	16.24	....	12.88
February	15.55	10.31	12.51	13.03	8.01	10.31	11.06	16.62	13.69	15.79	....	12.69
March	15.47	10.65	12.58	13.08	8.42	10.29	11.21	17.52	13.35	16.08	....	12.87
April	15.64	11.61	12.69	13.37	9.53	10.24	11.42	17.39	13.15	15.63	....	13.07
May	16.45	11.71	12.54	13.63	9.04	10.69	11.08	15.23	14.18	14.82	....	12.94
June	16.24	12.07	12.44	14.07	9.21	10.85	13.14	15.91	15.50	15.06	....	13.45
July	15.21	12.93	12.19	13.47	8.61	10.95	13.74	14.90	15.56	15.04	....	13.26
Average	15.27	11.12	12.25	13.18	8.28	10.69	12.16	15.52	14.56	15.50	....	12.85

TABLE 308.—*Cotton: Estimated average price at first of month, in cents per pound, paid to producers.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	14.3	13.2	12.0	11.5	12.4	8.1	12.6	24.3	27.8	32.5	36.8	16.9
September	14.4	11.8	11.3	11.8	8.7	8.5	14.6	23.4	32.2	30.3	31.1	16.7
October	13.3	10.2	11.2	13.3	7.8	11.2	15.5	23.3	31.8	31.3	25.5	16.9
November	14.0	8.9	10.9	13.0	6.3	11.6	18.0	27.3	29.3	36.5	19.4	17.6
December	14.1	8.8	11.9	12.2	6.8	11.3	19.6	27.7	27.6	35.6	14.0	17.6
January	14.4	8.4	12.2	11.7	6.6	11.4	17.1	28.9	28.7	35.9	....	17.5
February	14.3	9.0	11.9	11.9	7.4	11.5	16.8	29.7	24.9	36.2	....	17.4
March	13.9	9.8	11.8	12.6	7.4	11.1	15.9	30.2	24.0	36.2	....	17.3
April	13.9	10.1	11.8	11.9	8.1	11.5	18.0	31.8	24.5	37.3	....	17.9
May	14.2	10.9	11.6	12.2	9.1	11.5	18.9	28.5	26.0	37.7	....	18.1
June	14.6	11.0	11.5	12.4	8.6	12.2	20.2	27.4	29.5	37.2	....	18.5
July	14.4	11.2	11.6	12.4	8.6	12.5	24.7	28.6	31.1	37.4	....	19.3
Average	14.2	10.3	11.6	12.2	8.2	11.0	17.7	27.6	28.1	35.4	....	17.6

TABLE 309.—*Cotton: Monthly exports of unmanufactured cotton.*[1]

[In millions of pounds; i. e., 000,000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	128	128	110	137	11	83	217	234	149	243	75	144
September	399	530	391	491	67	263	284	236	188	119	119	297
October	642	739	795	792	262	354	420	275	200	181	306	466
November	598	700	906	782	400	274	386	214	183	478	358	492
December	697	815	726	636	629	291	401	243	307	451	414	520
January	522	729	471	543	719	281	312	236	341	478	....	463
February	410	643	277	388	786	357	185	183	234	329	....	379
March	211	573	193	360	631	239	181	159	259	407	....	321
April	130	364	278	206	347	270	139	111	211	278	....	233
May	158	191	241	203	320	262	194	149	228	186	....	213
June	80	85	114	152	168	284	124	141	351	123	....	162
July	38	61	71	64	126	245	139	112	271	107	....	123
Total	4,013	5,558	4,573	4,754	4,466	3,203	2,982	2,293	2,922	3,380	....	3,814

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 310.—*Cotton seed: Estimated average price per ton paid to producers.*

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	....	$20.45	$18.02	$20.24	$20.16	$20.14	$35.22	$56.61	$61.34	$66.23	$43.22	$35.38
September	$26.23	18.09	17.61	21.07	13.88	20.98	41.13	57.58	67.90	62.13	29.96	34.66
October	26.86	16.73	18.04	22.01	15.28	33.73	47.19	65.02	65.85	66.95	28.94	37.77
November	25.36	16.69	18.57	22.46	14.01	34.01	55.82	69.38	64.97	72.65	26.00	39.39
December	25.65	16.70	21.42	23.48	17.73	35.54	56.35	68.29	65.05	69.07	19.83	39.93
January	26.35	16.57	21.98	22.70	19.14	36.85	52.53	67.51	64.93	69.88	....	39.84
February	25.61	16.81	22.01	23.37	23.33	36.75	51.43	66.95	64.65	69.34	....	40.03
March	25.49	18.21	21.55	23.60	22.32	36.56	53.18	68.27	64.00	67.18	....	40.04
April	26.12	18.62	21.89	24.17	22.69	38.13	55.94	68.08	64.28	68.71	....	40.86
May	25.46	19.21	21.88	23.56	22.07	37.91	55.61	68.16	63.83	68.88	....	40.66
June	23.38	19.24	21.54	23.62	20.82	35.79	57.19	66.03	63.80	66.16	....	39.76
July	22.70	19.04	21.37	22.78	20.05	36.06	56.90	64.11	64.24	61.64	....	38.89
Average	25.38	18.03	20.49	22.77	19.29	33.54	51.54	65.50	64.57	67.40	....	38.86

TABLE 311.—*Cottonseed oil: Monthly average price per hundredweight of spot prime summer yellow.*[1]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	$10.84	$5.85	$6.47	$8.88	$6.67	$5.78	$9.27	$14.84	$20.25	$25.88	$12.22	11.5
September	10.12	6.96	6.38	7.67	5.87	6.30	10.17	16.44	20.25	21.33	13.49	11.1
October	8.11	5.97	6.22	7.00	5.22	7.71	11.75	17.99	20.25	23.00	11.20	11.3
November	7.29	5.73	6.01	7.05	5.55	7.93	12.53	18.59	20.25	22.75	10.40	11.4
December	7.24	5.37	6.30	6.86	5.83	8.38	12.38	18.65	20.25	21.50	9.12	11.3
January	7.32	5.39	6.25	6.98	6.56	8.59	12.32	20.09	20.25	21.75	....	11.6
February	7.03	5.54	6.35	7.12	7.08	9.59	12.51	20.33	20.25	19.38	....	11.5
March	6.60	5.69	6.44	7.38	6.70	10.53	13.62	19.84	20.25	19.26	....	11.6
April	6.19	6.46	6.96	7.51	6.61	10.73	15.30	19.75	21.25	18.52	....	11.9
May	6.55	7.18	7.01	7.18	6.40	10.91	16.23	20.00	21.25	18.91	....	12.2
June	6.43	6.86	7.70	7.30	6.17	10.91	16.26	20.25	25.03	17.01	....	13.4
July	5.89	6.67	9.11	7.18	6.06	10.04	14.52	20.25	27.37	13.35	....	12.0
Average	7.47	6.14	6.77	7.34	6.23	8.95	13.07	18.91	21.41	20.25	....	11.7

[1] Compiled from New York Produce Exchange reports and Oil Paint and Drug Reporter.

TABLE 312.—*Cottonseed oil: Monthly exports from the United States.*[1]

[In millions of pounds; i. e., 000,000 omitted.]

Month.	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21	10-yr. av.
August	5	12	13	6	5	25	8	4	3	9	3	9
September	3	11	12	2	9	23	8	4	2	6	5	8
October	6	26	16	12	17	20	11	4	4	12	7	13
November	26	41	40	25	29	20	13	2	7	10	23	21
December	29	68	39	27	38	28	14	4	12	11	41	27
January	25	66	41	30	38	28	18	4	26	17	......	29
February	26	39	38	17	42	22	9	10	32	20	......	26
March	25	49	36	27	29	32	16	11	20	22	......	27
April	30	35	36	18	46	20	28	16	14	19	......	26
May	23	24	21	14	33	16	17	16	13	12	......	19
June	20	13	13	7	27	11	12	19	31	11	......	16
July	15	10	8	6	21	6	6	15	10	4	......	10
Total	233	394	313	191	334	251	160	109	174	153	......	231

[1] Compiled from Monthly Summary of Foreign Commerce.

TABLE 313.—*Cotton: New York prices, in cents per pound, for cotton for future delivery on contract; range for each month during season 1919–20.*

During month.	Delivery in—											
	August.		September.		October.		November.		December.		January.	
	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.
1919.												
August	32.70	29.60	34.38	29.70	35.50	29.75	34.70	31.50	35.35	29.89	35.20	29.86
September	32.20	28.90	31.39	28.60	32.60	27.95	......	......	32.95	28.11	33.02	28.08
October	33.08	31.65	32.80	31.00	37.25	30.40	36.90	32.35	37.00	30.60	36.22	30.65
November	35.00	28.00	33.75	28.00	32.00	27.60	......	......	38.50	35.00	37.80	33.00
December	31.30	29.00	30.50	28.00	29.85	27.03	......	......	40.00	35.95	38.10	34.02
1920.												
January	32.25	30.93	31.60	30.40	31.40	29.30	31.00	29.45	30.90	28.90	38.86	37.00
February	32.00	29.00	31.10	28.80	30.78	27.62	29.40	29.00	30.20	27.25	29.90	27.25
March	34.85	31.10	34.25	30.40	33.80	29.70	29.93	29.93	33.05	29.12	32.48	28.76
April	38.50	35.92	37.50	35.50	37.25	33.77	35.34	34.28	36.20	33.00	35.28	32.50
May	38.70	36.00	36.85	34.80	36.85	34.15	35.95	33.50	35.98	33.05	35.48	32.38
June	37.90	34.45	35.40	33.43	36.70	32.70	35.80	33.30	35.64	31.61	34.93	30.96
July	38.50	34.95	36.60	33.97	35.31	31.27	32.75	31.55	33.60	30.00	32.78	29.18
Season	38.70	28.00	37.50	28.00	37.25	27.03	36.90	29.00	40.00	27.25	38.86	27.25

During month.	Delivery in—											
	February.		March.		April.		May.		June.		July.	
	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.
1919.												
August	34.41	34.41	35.28	29.96	31.48	31.48	35.20	29.90	......	......	32.07	31.00
September	29.50	29.50	33.21	28.25	......	......	33.28	28.45	31.60	31.60	33.00	28.50
October	35.15	33.97	35.66	30.75	34.72	32.00	35.35	30.85	33.18	33.18	34.80	31.25
November	36.20	36.20	37.26	31.15	36.00	33.80	36.73	30.20	......	......	36.34	29.35
December	34.66	34.66	36.32	31.84	32.80	32.10	34.60	30.50	32.00	31.85	32.95	29.20
1920.												
January	37.50	37.15	37.21	35.55	35.30	34.95	35.65	33.55	32.60	32.60	33.96	31.59
February	37.60	36.54	38.25	33.75	......	......	35.32	31.50	......	......	32.96	29.49
March	31.70	28.75	42.18	37.25	40.00	36.00	39.80	34.60	37.45	37.15	36.90	32.05
April	34.85	32.25	34.35	32.00	41.90	40.00	42.50	39.60	41.68	39.30	40.25	36.80
May	34.79	32.35	34.88	32.00	33.20	31.95	42.98	38.80	40.70	37.90	39.41	36.95
June	32.00	31.75	34.43	30.43	33.37	32.00	34.08	29.95	......	......	38.90	35.25
July	32.00	30.90	31.99	28.90	30.25	29.60	31.25	28.40	30.72	28.50	43.75	38.00
Season	37.60	28.75	43.18	28.25	41.90	29.60	42.98	28.40	41.68	28.50	43.75	28.50

TABLE 314.—*Cotton: New Orleans prices, in cents per pound, for cotton for future delivery on contract; range for each month during season 1919–20.*

During month.	Delivery in—											
	August.		September.		October.		November.		December.		January.	
	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.
1919.												
August	......	......	......	......	35.50	29.60	......	......	35.20	29.41	35.10	29.45
September	......	......	......	......	33.00	28.00	......	......	32.91	27.90	32.92	27.88
October	......	......	......	......	37.52	31.00	......	......	37.30	30.63	36.30	30.52
November	......	......	29.85	27.45	33.00	28.00	......	......	38.95	35.20	38.07	33.20
December	......	......	......	......	29.60	27.10	......	......	40.80	38.00	39.45	34.85
1920.												
January	......	......	......	......	31.50	29.58	......	......	30.55	29.24	40.45	38.50
February	......	......	......	......	30.80	27.59	......	......	30.00	27.30	29.50	28.34
March	......	......	32.00	32.00	33.58	29.72	......	......	32.87	29.07	31.15	28.45
April	......	......	......	......	37.15	33.50	......	......	36.07	32.80	35.12	32.45
May	......	......	......	......	36.86	34.13	......	......	35.92	33.05	35.40	32.40
June	......	......	......	......	36.50	32.55	......	......	35.47	31.51	34.84	31.00
July	......	......	......	......	34.83	31.00	......	......	33.50	29.35	32.70	28.90
Season	......	......	32.00	27.45	37.52	27.10	......	......	40.80	27.30	40.45	27.88

During month.	Delivery in—											
	February.		March.		April.		May.		June.		July.	
	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.
1919.												
August	......	......	35.08	29.45	......	......	35.35	29.50	......	......	......	......
September	......	......	32.96	27.96	......	......	33.00	28.00	......	......	31.50	30.98
October	......	......	35.62	30.50	......	......	35.22	30.49	......	......	34.70	33.07
November	......	......	37.22	31.50	......	......	36.56	30.45	......	......	36.15	29.51
December	......	......	37.06	32.06	......	......	34.90	30.60	......	......	33.10	29.09
1920.												
January	......	......	38.40	36.61	......	......	36.48	34.45	......	......	34.64	32.45
February	......	......	39.00	34.70	......	......	35.80	32.33	......	......	33.45	30.24
March	......	......	40.10	38.26	......	......	39.10	35.50	......	......	36.60	32.72
April	......	......	34.23	31.94	40.18	40.18	41.69	38.74	......	......	40.16	36.50
May	......	......	34.94	31.86	......	......	40.74	39.20	......	......	39.00	37.10
June	......	......	34.25	30.45	......	......	32.50	29.85	......	......	38.90	35.50
July	......	......	31.86	28.50	......	......	31.10	27.86	......	......	37.63	35.40
Season	......	......	40.10	27.96	40.18	40.18	41.69	27.86	......	......	40.16	29.09

TABLE 315.—*Cotton (including linters): Production in principal countries, crop years 1913 to 1920.*

(In thousands of bales; i. e., 000 omitted; bales of 500 pounds gross weight.)

Country.	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21
North America:								
United States—								
Ginned	14,156	16,135	11,192	11,450	11,302	12,041	11,421	13,366
Linters	639	857	931	1,331	1,126	929	718	487
Total	14,795	16,992	12,123	12,781	12,428	12,970	12,139	13,853
West Indies (British)	6	5	5	3	3	4	(1)	(1)
Mexico	150	125	125	140	125	366	209	[2] 165
South America:								
Brazil	320	385	440	420	449	563	561	[3] 100
Peru	[2] 110	[2] 106	[2] 97	[2] 113	[2] 80	114	173	157
Asia:								
British India	4,239	4,359	3,128	3,767	3,756	3,347	4,515	2,845
Japan	4	5	5	4	4	(1)	(1)	(1)
Korea	33	33	42	29	52	[3] 140	(1)	(1)
Russia—								
Transcaucasia	120	132	133	(1)	} 578	550	439	[3] 180
Turkestan	953	1,176	1,526	1,101				
China	....	....	....	....	....	....	1,151	[3] 1,000
Africa:								
Lagos	(1)	11	5	8	7	3	(1)	(1)
Nyasaland	[2] 5	[4] 7	6	7	5	4	(1)	(1)
Uganda	24	35	21	21	20	19	(1)	(1)
Union of South Africa	....	....	....	....	1	1	(1)	(1)
Egypt	1,588	1,337	989	1,062	1,322	1,088	1,191	1,251
Sudan (Anglo-Egyptian)	[2] 11	8	20	14	19	10	(1)	(1)
German Africa—								
East Africa	[2] 10	[5] 10	(1)	(1)	(1)	(1)	(1)	(1)
Togo	[2] 2	[5] 2	(1)	(1)	(1)	(1)	(1)	(1)
All other countries	....	....	....	....	....	....	[3] 481	450

[1] Not available.
[2] Exports.
[3] Unofficial estimate.
[4] Includes Rhodesia.
[5] 1913 export figures.

TABLE 316.—*Cotton (including linters): Exports from the United States, 1910 to 1920.*[1]

(In thousands of bales; i. e., 000 omitted; running bales.)

Exported to—	Average for years ending Aug. 31, 1910–1914.	Year ending July 31—					
		1915	1916	1917	1918	1919	1920
Austria-Hungary	(2)	....	....	....	....	55	42
Belgium	175	1	....	....	....	90	189
France	1,029	683	922	994	616	735	576
Germany	2,436	243	....	....	....	....	443
Italy	480	1,109	789	644	374	589	579
Netherlands	(3)	(3)	15	54	....	77	168
Russia in Europe	83	104	157	33	15	....	....
Spain	257	444	319	376	233	301	239
United Kingdom	3,386	3,772	2,852	2,682	2,276	2,635	3,069
Canada	150	183	193	194	252	197	222
Mexico	18	40	20	5	10	1	1
Japan	283	433	491	481	604	784	873
Other countries	207	1,533	433	276	96	200	197
Total exports, including linters	8,504	8,545	6,191	5,739	4,476	5,664	6,598
Linters	(4)	222	295	439	188	72	53
Cotton	(4)	8,323	5,896	5,300	4,288	5,592	6,545
Total crop, including linters	13,433	16,738	12,013	12,664	12,345	12,817	11,921
Linters	500	832	915	1,300	1,097	910	595
Cotton	12,933	15,906	11,068	11,364	11,248	11,907	11,326
Percentage of crop exported	63	51	52	45	36	44	55

[1] Compiled from Monthly Summary of Foreign Commerce.
[2] Data for cotton years not available separately, but are included in "Other countries." Average for fiscal years ending June 30, 92,924 running bales.
[3] Data for cotton years not available separately, but are included in "Other countries." For the fiscal year 1915 our exports to Netherlands were 509,105 running bales, while the average, 1910–1914, was 23,964 running bales.
[4] Separate statistics not available.

TABLE 317.—*Cotton (including linters): Exports by countries, calendar years 1909–1920.*

[Thousands of bales; i. e., 000 omitted; bales of 500 pounds gross weight.]

Exported by—	Average, 1909–1913	1914	1915	1916	1917	1918	1919	1920
Belgium	159	....	....	....	....	....	51	221
Brazil	83	140	24	5	3	1	56	....
British India	1,966	2,791	2,103	2,118	1,588	781	1,528	[1] 2,041
China	240	188	202	237	232	360	299	
Egypt	1,442	1,225	1,430	1,122	844	1,040	1,390	....
France	316	209	40	116	89	29	82	....
Germany	232	....	....	....	....	....	....	....
Netherlands	145	111	181	2	....	....	4	8
Persia [2]	118	105	....	....	....	....	....	....
Peru	87	106	97	112	80	99	183	....
United States	[3] 8,731	[4] 8,931	[4] 6,406	[4] 5,964	[4] 4,587	[4] 5,664	7,045	6,651
Other countries	169	111	183	....	....	....	2	1
Total	13,688	13,917	10,666	[1] 9,676	[1] 7,423	[1] 7,974	[1] 10,640	[1] 8,922

[1] Incomplete.
[2] Year beginning Mar. 21.
[3] Year beginning Sept. 1.
[4] Year beginning Aug. 1.

TABLE 318.—*Cotton: Imports, by countries, for calendar years 1909–1920.*

[Thousands of bales; i. e., 000 omitted; bales of 500 pounds gross weight.]

Imported by—	Average, 1909–1913.	1914	1915	1916	1917	1918	1919	1920
Austria-Hungary	906	....	....	....	....	....	....	....
Belgium	496	....	....	....	....	....	289	506
Canada	137	152	197	205	178	230	179	241
France	1,435	949	1,052	1,192	1,260	656	1,007	....
Germany	2,258	....	....	....	....	....	....	....
Italy	896	879	1,344	1,170	828	601	826	1,438
Japan	1,405	1,705	2,015	2,299	1,947	1,886	2,190	....
Netherlands	277	245	365	177	....	....	114	124
Russia	886	801	641	57	....	....	....	....
Spain	382	389	660	471	447	277	341	....
Sweden	93	107	580	130	32	....	80	....
Switzerland	113	101	147	123	94	38	115	....
United Kingdom	4,164	3,447	4,820	4,045	3,163	3,114	3,846	3,458
United States	[1] 220	[2] 364	[2] 421	[2] 288	[2] 217	[2] 197	367	628
Other countries	342	287	297	....	....	....	82	....
Total	14,010	9,426	12,539	[3] 10,157	[3] 8,166	[3] 6,999	[3] 9,436	[3] 6,395

[1] Year beginning Sept. 1.
[2] Year beginning Aug. 1.
[3] Incomplete.

TABLE 319.—*Index numbers, United States Bureau of Labor Statistics, all commodities.*[1]

Month.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
January	......	......	......	99	100	98	110	150	185	203	248
February	......	......	......	100	99	100	111	155	186	197	249
March	......	......	......	99	99	99	114	160	187	201	253
April	......	......	......	98	98	99	116	171	190	203	265
May	......	......	......	98	98	100	118	181	190	207	272
June	......	......	......	100	98	99	118	184	193	207	269
July	......	......	......	101	99	101	119	185	198	218	262
August	......	......	......	101	102	100	123	184	202	226	250
September	......	......	......	102	103	98	127	182	207	220	242
October	......	......	......	101	99	101	133	180	204	223	225
November	......	......	......	101	98	102	143	182	206	230	207
December	......	......	......	99	97	105	146	181	206	238	189
Year	99	94	100	100	99	100	123	175	196	212	243

[1] Source: Bureau of Labor Statistics.

INDEX.

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WILLIAM B. GREELEY, Forester
Forest Products Laboratory, Madison, Wisconsin
In cooperation with the University of Wisconsin

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THE MANUFACTURE OF ETHYL ALCOHOL FROM WOOD WASTE.[1]

By F. W. KRESSMANN, *formerly chemist in Forest Products.*[1]

CONTENTS.

SOURCES OF ETHYL ALCOHOL AND COMPARATIVE COSTS OF PRODUCTION.

The production of fermentable sugars and ethyl alcohol from cellulosic materials, such as straw, linen, cotton, peat, wood, and in fact, all plant fibers, has engaged the attention of chemists and technologists for nearly a century. It is only within the last two decades, however, that serious attempts have been made to utilize wood waste for this purpose. The principal sources of fermentable sugars from which alcohol is at present derived are the hydrolytic products of starch and the sugars obtained from fruits and such sugar-factory residues as molasses.

Corn yields about 2.4 gallons of 188-proof spirit a bushel; and, although the price of corn and other grains used varies with the

[1] The author acknowledges with pleasure his indebtedness to Messrs. Homer Cloukey and H. N. Calderwood, of the Forest Products Laboratory, whose aid in making the hundreds of analyses necessary to the research was invaluable. Acknowledgment is made also to Drs. S. F. Acree and E. C. Sherrard for helpful criticism and review. For help rendered by men from outside the Forest Service, the author acknowledges his obligations to Messrs. Boyt and Groves, of Georgetown, S. C., to Dr. R. C. Gravenburg, distillery superintendent, at Fullerton, La., and to Dr. T. B. Wagner, of New York. Many others have assisted in the production of this work, and to all of them the author is grateful.

season and from year to year, before the war the average cost of the materials for making grain alcohol, fuel excluded, was about $27\frac{1}{2}$ cents a 188-proof gallon. Manufacturing costs, including coal, interest, repairs, depreciation, taxes, labor, etc., range from 10 to 17 cents a gallon of 188-proof alcohol, depending upon the location and efficiency of the plant.

One gallon of molasses yields from 0.45 to 0.48 of a gallon of 188-proof spirit. The price of molasses before the war averaged from 5 to 7.5 cents a gallon, and, therefore, the approximate cost of raw material in a gallon of molasses spirit was from 10 to 15 cents. The cost of production of molasses spirit is slightly less than that of grain spirit, but in either case the cost of raw material is comparatively high.

One ton of dry sawdust or other wood waste (or its equivalent on an air-dry or green basis) will yield from 12 to 20 gallons of 188-proof spirit. The disposal of this waste in the vicinity of a sawmill or other large woodworking plant is specifically an item of loss, because most sawmills produce waste in excess of their own power requirements. Sometimes the waste is not worth more than 30 to 50 cents a ton, and this makes the cost of raw material in a gallon of ethyl alcohol from sawdust about 2 cents. This includes also the fuel charge, for the residue after conversion and extraction is available for fuel, whereas in grain distilleries about 7 tons of coal and in molasses distilleries about 4 tons are required in producing 1,000 gallons of 188-proof spirit.

If the manufacturing cost of producing ethyl alcohol from wood can be reduced to the same figure or nearly the same as that for making it from grain or molasses, there will be a large margin in favor of producing the alcohol from wood waste. Of course, with a yield of 12 to 20 gallons from a ton of wood and 80 gallons from a ton of corn, the amount of material handled in certain parts of the plant producing alcohol from wood will be four or five times as great as in a grain distillery of equal producing capacity, and this will require a larger-sized plant and an increased operating cost.

In recent years the production of ethyl alcohol from sawdust has received a great deal of attention, and a large amount of money has been spent in the technical development of the process. A number of plants have been built in this country, but only two have been considered commercial successes.

Because of the importance to the lumber industry of the problem of waste disposal, and because this process is practically the only one applicable to the disposal of wood waste, the Forest Service has investigated the different processes and, so far as possible, the plants that have been built, in order to learn the causes of former failures and to aid in the commercial development and success of the processes.

AMOUNT OF WOOD WASTE AVAILABLE.

The amount of wood waste produced by converting a tree or a sawlog into lumber is, of course, variable and depends upon the diameter of the tree, the quality of the timber, and the efficiency and equipment of the sawmill. The following tabulation shows that more than half of the cubic contents of the tree is wasted:

	Per cent.
Entire tree	100
Stump	2
Top	18
Sawdust	12
Bark	10
Slabs	8
Edgings	8
Shavings	4
	62

This includes limbs, top, and stump—the parts of the tree left in the woods—in addition to the waste at the mill or factory. The mill waste, particularly the part available without extra transportation charges, is of great interest in connection with the manufacture of ethyl alcohol.

The annual cut of lumber in the United States for the five or six years preceding the World War was approximately 40,000,000,000 feet board measure.[2] The mill waste from this cut has been estimated by Margolin [3] as follows:

	Per cent.
Sawlog	100
Bark	13
Sawdust	13.5
Edgings and trimmings	8.7
Slabs	8.7
Careless manufacturing and accidents	3.5
Loss in cutting to standard widths and lengths	1.7
Total waste	49.1
Lumber	50.9

For each thousand board feet of lumber produced from sawlogs (which is equivalent to 83.3 cubic feet of solid wood) there is, according to the above table, 80 cubic feet of waste, distributed as follows:

	Cu. ft.
Bark	21.3
Sawdust	22
Edgings and trimmings	14.2
Slabs	14.2
Careless manufacturing and accidents	5.6
Loss in cutting to standards	2.7
Total	80

[2] The Lumber Industry, Part IV, Bureau of Corporations, U. S. Dept. of Commerce; The Production of Lumber in 1913, Bulletin No. 232, U. S. Dept. of Agriculture.
[3] Report of the National Conservation Commission, vol. 2.

After the amount of the bark is deducted there remains in the form of waste 58 cubic feet of solid wood to 1,000 board feet of lumber cut, or 2,320,000,000 cubic feet annually. As the average weight of a cubic foot of air-dry wood is about 35 pounds,[4] this is a total annual waste of 40,000,000 tons. Some of this total annual waste is used for fuel at the mills, or may have a fair market value if the mills are located in centers of population; but it is estimated that over one-half, or 20,000,000 tons, is absolute waste, and that about 15,000,000 tons of this is from coniferous woods.

According to data for 1907 submitted to the Forest Service by the lumber manufacturers, 650 mills were reported to be cutting between 10,000,000 and 25,000,000 feet a year; 161 mills between 25,000,000 and 50,000,000 feet; 39 mills between 50,000,000 and 100,000,000 feet; and 2 mills over 100,000,000 feet annually. This is a total of 852 mills, each of which cuts 10,000,000 or more board feet a year. For 1913, each of 974 mills was reported as cutting this amount. This shows that the number of large operators is increasing instead of decreasing, and that the supply of raw materials is so concentrated as to be available for any use to which it can be put.

THE PRESENT VALUE OF WOOD WASTE.

Most of the wood waste produced to-day is valuable only for fuel for the production of power at the mill. In some places methods of closer utilization have been worked out; but, compared with the total amount of wood waste produced, the quantity of material so utilized is negligible unless the mills are located in or very near large cities.

Most mills produce waste in excess of their own power requirements, and in large mills equipped with especially efficient power plants this excess is from 50 to 65 per cent of the total amount produced. A waste burner, therefore, is almost invariably necessary, and its use involves not only a loss of large quantities of wood, but also a fixed charge for its operation. The cost of burning waste varies widely with the size and efficiency of the mill, but figures gathered by the Forest Products Laboratory indicate that it ranges from 30 to 66 cents a cord. Assuming that 37 cubic feet are burned for each thousand feet board measure of lumber cut, this is a charge of from 11 to 22 cents a thousand feet on all of the lumber cut, and means that the present cost of waste disposal amounts to about $6,000,000 annually, in addition to the value of the wood.

The wood waste available has great potential value, but its utilization has not as yet reached the stage where the waste has much more than a nominal value.

---

[4] The green weight, log scale, of yellow pine will range from 9,000 to 10,000 pounds to the thousand feet, and the green weight of the lumber produced will range from 4,200 to 4,600 pounds. Allowing for the usual 15 to 20 per cent overrun, we ordinarily get about 4,500 pounds of waste to 1,000 feet of yellow pine cut. The waste from other species will vary in the proportion of their respective weights to the cubic feet or to the thousand feet, log scale.

As will be shown, the production of ethyl alcohol is so far the only process that is applicable to the utilization of average mill-run refuse from the coniferous woods and from a few of the hardwoods. It affords a means of converting waste material into marketable commodities at a profit, provided sufficient quantities of waste material are available in the proper locality and at the proper price. The process is not applicable to the commercial conversion into alcohol of lumber, merchantable timber, or other expensive forms of wood. It, therefore, rests largely with the lumbermen themselves whether they will accept a price for their waste which will make it commercially available, or whether they will demand a price that will make its utilization prohibitive. Cooperation between the sawmill and the distiller is absolutely necessary, for the distiller is dependent upon the mill for his raw material, and the lumberman is dependent upon the distiller for the successful disposal of his waste. During the war, the return of 50 cents a cord for waste was not attactive to many of the lumbermen, with the exception of some in Mississippi, where, however, State laws prohibit the manufacture of ethyl alcohol.

Some sawmill owners have not been willing to tie up their waste on a 10-year contract at the price mentioned, but have preferred to continue for a time to burn it in the speculative hope that some better method of disposal might be found. Such action is, of course, perfectly legitimate and may possibly be the proper one. The alcohol plant costs about as much as the sawmill and its auxiliaries; so that a considerable supply of raw material—enough for at least 10 years—is necessary to justify the initial investment. As the life of the saw mill is continually decreasing, each year that passes reduces materially the prospect of utilizing the sawmill waste.

LIMITATIONS TO THE UTILIZATION OF WOOD WASTE.

The utilization of wood waste, particularly sawmill waste, is limited in a number of ways. The bulkiness of the waste material makes a minimum amount of handling imperative and practically prohibits its transportation, except for short distances and by means of mechanical conveyors, such as belts and fans. The form of the waste is one of the greatest difficulties in the way of its more complete utilization. In sawdust and shavings not only has the length of the wood fiber been reduced, but the fibers have been lacerated to such an extent as to destroy their value for pulp and paper production.

The destructive distillation of sawdust and shavings has not so far been found practicable. There have been two reasons for this: First, the small size of the material makes it so poor a conductor of heat that it can not be charred completely in the forms of retort and kiln in ordinary use; and, second, the charcoal produced is so finely divided that it is difficult to cool and handle and there is no ready market for it. In addition, the waste as it comes from the mill is usually a mixture of all forms, and any attempt at separation, except perhaps a simple blowing or screening to remove the very fine stuff, will increase the cost of the raw material to a prohibitive figure. Therefore, in any satisfactory process for the utilization of mill waste, it must be possible to handle any and all forms of waste as it comes from the mill.

Except in factories using only one or two species of wood, or in mills cutting only a few similar species, such as the "yellow pine" (longleaf, shortleaf, and loblolly) of the South, the differences in quality and form of the waste have operated against its efficient utilization. This is because many processes, such as pulp and paper making or destructive distillation, require a particular species in order to give a yield and quality of product that will make the processes commercially feasible.

Woods of all species and forms, however, have one point in common—they all contain more or less cellulose, which makes up the fibers of the wood, along with an incrusting substance called lignin. A chemical utilization of this cellulose would overcome the objections stated above as to the form of the material, length of the fiber, and species, provided the amount of cellulose present was sufficient to give a yield of alcohol that could be handled profitably on a commercial scale.

PROCESSES FOR THE MANUFACTURE OF ALCOHOL FROM WOOD.

The processes used for the production of ethyl alcohol from wood may be grouped into two general classes: Hydrolysis of wood into fermentable sugars by the use of dilute acid (preferably mineral acid) as a catalyzer, and solution processes, in which the wood is dissolved in concentrated acid and the diluted solution is then subjected to hydrolysis.

The first process consists, in general, of digesting sawdust or hogged and shredded wood with a dilute mineral acid under 60 pounds or more of steam pressure. This converts part of the wood into a mixture of pentose and hexose sugars. The latter are then fermented into ethyl alcohol.

Processes of the second class, involving the use of concentrated sulphuric acid and in which the wood is actually dissolved by the acid, as in the Ekstrom [5] process, have not received commercial attention, notwithstanding the fact that Flechsig [6] many years ago showed that cotton cellulose could thereby be converted into dextrose and alcohol almost quantitatively. The more recent work of

[5] French Patent No. 380358; German Patents Nos. 193112 and 207354.

[6] Zeit. für Physiol. chemie., 1882.

Willstatter and Feichmeister [7] with fuming hydrochloric acid on cotton and wood has confirmed these results; but in all those experiments the amounts of acid required have been so large that the initial and recovery costs for acid have prevented commercial development.

Whether the source of the fermentable sugars is the cellulose or the lignin of the wood has long been a subject for debate and has also been the occasion of considerable investigation; but the fact remains that a wood cellulose like soda or sulphite pulp has been found to produce about twice as much fermentable sugar and alcohol as the same amount of the original wood, the yields being in proportion to the cellulose content.[a]

HISTORY OF THE PROCESSES.

The first recorded attempts to produce sugars and alcohol from vegetable fiber were those of Braconnot [8] in 1819. From that time until the publication of Simonsen's [9] paper in 1898 little work of value was done.[10] Simonsen's review of the problem is well worth quoting here, because it tersely describes the situation at that time:

> The literature of this problem is imperfect and faulty to a high degree. It contains many inaccurate and impossible statements and contradictions. There is no record of any systematic investigation as to the effect of a variation of the different factors, such as amount of water, pressure, amount of acid, and time in high-pressure inversions. Parallel and comparative experiments on cellulose and wood are also lacking, so no information on the relation of the incrusting substances to the inversion processes is at hand. That these investigations may have been made and their results kept secret is not impossible, since factories have been established. Such researches could hardly have dealt with high-pressure inversion, which has only been carried out practically on a large scale for the last 20 years. Yet the manufacture of spirit from cellulose material by means of inversion under such unfavorable conditions as that over 100 per cent of sulphuric acid was required for the dry wood and the corresponding quantity of calcium carbonate or lime (and taking into account the high price of the material at that time and the length of time required for the process) seems to point to the fact that the inversion of wood will be the method of the future if only a satisfactory process can be found.

Simonsen carried out a long and painstaking research on the subject, in which he investigated both cellulose (sulphite cellulose) and sawdust in a systematic way. As an inverting agent he used sulphuric acid, and from his results concluded that the best conditions for the inversion of sawdust were as follows:

Time of inversion	15 minutes.
Acidity	0.5 per cent H_2SO_4.
Proportion of wood to liquid	1 to 4.
Pressure about	9 atmospheres.

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[7] Berichte, 1913, 2401.

[a] Koerner, Zeit. Ang. Chem., 1908, 2353.

[8] Gilbert's Annalen der Physik, 1819, 63, 348.

[9] Zeit. für ang. Chemie, 1898, 195, 962, 1007.

[10] The references to the original literature from 1819 to 1898 will be found in the bibliography at the end of this bulletin.

These conditions gave him a yield of alcohol equal to about 6 per cent of the dry weight of sawdust used, although few fermentation experiments were made.

As was shown later by Neumann,[11] Simonsen's work is contradictory in some respects, because of the fact that only a single experiment was made under each set of conditions. In his work on a large scale,[12] he was generally unable to duplicate the results obtained in the small autoclave cooks. The yields of alcohol varied considerably, although under the most favorable conditions and in a few exceptional cases he obtained yields which were slightly higher than those secured on the small scale. Simonsen's process was patented July 12, 1898.[13] Korner[14] later substantiated Simonsen's yield of 6 per cent and showed further that the yield of alcohol and sugar was in proportion to the cellulose content of the sawdust, straw, and sulphite cellulose used as raw material.

A. C. Classen developed a new process in which sulphur dioxide was the inverting agent, although his first patent[15] covered a mixture of sawdust and concentrated sulphuric acid (50° to 60° B.) in which the mixture was subjected to great pressure in a hydraulic press. In the original Classen process[16] an aqueous solution of sulphurous acid was used, though later Classen obtained three patents[17] in which chlorine, air, or oxygen were used as the oxidizing agents to convert the sulphurous acid to sulphuric acid. Still later he obtained a patent[18] covering the process of treating the wood with sulphuric anhydride, and an additional patent[19] covering the process of heating this mixture to 123° to 135° C.

He also patented[20] the use of a smaller amount of a more concentrated solution of sulphurous acid, claiming that the acid recovery was more efficient when the sawdust in the digester was only slightly moist. In 1914 he patented[21] the use of platinum, ferric oxide, etc., as catalytic agents to convert the sulphurous acid into sulphuric acid in the digester.

The French rights to the Classen process were sold to a M. Taffin, who had experimented for several months at Tolques before the purchase. After satisfying himself that the process was practical, he organized in August, 1904, the Compagnie Industrielle des Alcools

[11] Neumann, Dissertation, Dresden, 1910.
[12] Zeit. für ang. Chemie, 1898, 962.
[13] United States Patent No. 607091. It was also patented in Norway, Austria, England, France, Canada, Hungary, and Germany.
[14] Zeit. für ang. Chemie, 1908, 2353.
[15] German Patent No. 111868.
[16] German Patent No. 118540.
[17] German patents Nos. 118542, 118543, and 118544.
[18] German Patent No. 121869.
[19] German Patent No. 123911.
[20] German Patent No. 130980.
[21] United States Patent No. 1101061.

de l'Ardèche, and built an experimental plant at d'Aubervilliers, in which he planned to determine the most suitable forms of apparatus. After some time the company interested M. André Bernhard, of Lille, one of the largest distillers in France. The capital stock of the company was materially increased, M. Bernhard became manager and director, and the company decided to increase the capacity of the old plant and erect a still larger one in the Vosges. The chemists of the company were meanwhile perfecting a process whereby the acetic acid formed during the cooking of the wood with the sulphurous acid could be recovered along with the major part of the sulphurous acid. In addition, a special type of digester known as a "saccarafi-cateur" [22] was developed. This consisted of a steel cylinder $2\frac{1}{2}$ meters in internal diameter by $2\frac{1}{3}$ meters long, through which were spaced 22 tubes 160 mm. in diameter. Outside of each end of the tube heads were flanged boiler-steel jackets, one to receive the live steam from the boiler and the other to take off the condensed steam, the heating being indirect. This type of apparatus will be discussed further in connection with the plant built at Port Hadlock, Wash. Instead of the sugars being extracted in diffusion batteries, water and calcium carbonate were added to the digested sawdust, the whole mass was fermented directly, and afterwards was distilled in the usual type of beer still. Higher yields were claimed for this method than for the extraction method. This plant operated intermittently for a time, a number of runs being made in 1908 on American woods, primarily for the purpose of interesting American capital; but apparently no continued commercial operation resulted on French material.

In 1903, Classen sold the patent rights for America to the Classen Lignum Co. of Chicago, a corporation organized under the laws of the State of New Jersey. This company erected an experimental plant at Highland Park, Chicago, which had a capacity of about 2 tons of dry sawdust a day of 24 hours. Later the company erected a plant at Hattiesburg, Miss., at a cost of about $250,000, to operate on sawmill waste of longleaf pine. A number of mechanical and technical reasons for the failure of this plant have been outlined by Ruttan.[23] The disadvantages of this process were as follows: (1) The great length of time (from 4 to 6 hours) necessary to convert from $1\frac{1}{2}$ to 2 tons of wood; (2) the large quantity of acid required; (3) the prolonged action of so much acid and water in the rotating digester reduced the wood to a very fine powder and formed much sulphuric acid, which, acting on the sugars and other substances present, produced gums and caramels and made the complete extraction of the sugars from the residue very tedious and expensive; (4) the digester was lead lined, and the repair of the buckling and breaking of the

[22] This apparatus is described in detail in French Patent No. 358696.

[23] Jour. of the Soc. of Chem. Ind. 1909, 1290.

lining after every two or three operations proved a source of great delay and expense.

Ewen and Tomlinson, who were associated with the Classen process, began experimenting along new lines to overcome the difficulties that prevented the old process from becoming a commercial success. The results of their researches (United States Patent No. 763472) were: (1) The time of hydrolysis was shortened from 6 hours to 45 minutes; (2) the treated wood waste was obtained in a form which could be quickly and efficiently extracted; (3) a digester was devised which was not affected by the process; (4) the quantity of acid employed was reduced; (5) a large and uniform yield of fermentable sugars was obtained from the wood.

In general, these results were accomplished in the following way: Instead of adding an aqueous solution of sulphur dioxide to the sawdust and afterwards heating this large volume of water, steam was used as a source of both heat and moisture, and the sulphur dioxide was introduced into the digester in a gaseous form. This method shortened the heating period and also decreased the amount of wood that was reduced to a powdered condition, thereby permitting a more complete extraction.

On October 26, 1909, Ewen and Tomlinson were granted a patent protecting the process of producing fermentable sugars from lignocellulose (United States Patent No. 938308). This patent shows that they had given up the use of sulphur dioxide, both gaseous and in solution, and were employing sulphuric acid as the inverting or catalytic agent. A study of the patent reveals the fact that the ratio of water and acid to dry wood which they used was practically the same as in the method patented by Simonsen and referred to above. Ewen and Tomlinson, who were then the engineers and technical advisers of the Standard Alcohol Co., erected a plant at Georgetown, S. C.,[24] for the production of ethyl alcohol from sawmill waste. This plant was later acquired by the E. I. du Pont de Nemours Powder Co., which operated it intermittently until the early part of 1913. A fire then destroyed the main sawmill of the Atlantic Coast Lumber Corporation, and the alcohol plant was not operated until the summer of 1914, when the sawmill had been rebuilt. The alcohol plant has been operated successfully since that time under the Ewen and Tomlinson patents.

Several years ago the Classen Chemical Co. interested western capital in the erection of a plant at Port Hadlock, Wash., on Puget Sound, for the production of ethyl alcohol and cattle food from sawdust obtained from mills at Seattle, Tacoma, Everett, Anacortes, and Port Blakely. The plant was equipped with six digesters of the

[24] For a description, see R. von Demuth, Zeit. für ang. Chemie, 26, 786; also G. Foth, Chemiker Zeitung, 37, 1221, 1297.

same size and shape as those used in the French plant, the idea being to save steam by means of indirect heating. Sawdust and enough water were added through a manhole into the space between the tubes to raise the moisture content to about 45 per cent. Anhydrous sulphur dioxide was then added, and the mixture was cooked at 75 to 100 pounds pressure. The cost of conversion was excessively high, because the corrosion of the digesters was very rapid; the time necessary to heat them by indirect heat was very long; and it was necessary to replace the low-pressure steam with high-pressure steam in the outside jacket in order to prevent the sulphurous-acid gas from leaking out of the digester into the jacket. The extraction equipment was very inefficient, as the modern type of diffusion battery was not used. The plant was very well built, and much of the equipment was imported from France at a high cost. The extracted sawdust was mixed with Hawaiian molasses and was put on the market as a cattle food.[25] It was necessary to dry the extracted material to about 12 per cent moisture, in order to prevent decay, and this gave great difficulty because of explosions of dust in the driers. In addition, the plant was located 80 miles from a railroad, and this distance greatly increased all transportation charges both to and from the plant. This and the very poor design of the digester and extraction equipment were, no doubt, the chief reasons for the failure of the plant.

In the process covered by United States Patents Nos. 985725 and 985728, granted to W. P. Cohoe, of Toronto, Canada, hydrochloric acid is used and preferred as a catalytic agent because of its volatility. A yield of 25 to 28 per cent of fermentable sugars is claimed. It is also stated that the acid can be completely removed from the wood by blowing it out with steam. If this is true, the cost of neutralization is removed. It is also claimed that 1 to 2 per cent of acetic acid can be obtained from the preliminary steaming of hardwood sawdust. In addition, the preliminary steaming is claimed to be of value, because, after the blowing off, the sawdust is of a constant moisture content, irrespective of its initial moisture content. In a later paper Cohoe [26] further describes his work in which hydrochloric acid is used. The following quotations are of particular inter-

[25] The production of cattle food from sawdust has been attempted at another plant in this country, situated at Marinette, Wis. This plant, however, was unsuccessful in marketing the product obtained, since the chief value of hydrolyzed sawdust as a cattle food lies in the carbohydrates that it contains. Carbohydrate foods, as a rule, are the cheapest that the farmer can grow for himself, and usually the only foods purchased are nitrogenous concentrates. The Marinette company was finally forced to add oil cake and similar materials to its product. In addition, the Port Hadlock plant had a great deal of difficulty from spoilage due to the absorption of water and the consequent growth of mold in their product. The material was put on the market under the trade name of "Bastol." A similar material has recently been produced in London by Zimmermann (see article in Jour. Soc. of Arts, 1912, p. 68).

[26] Jour. of the Soc. of Chem. Ind., 1912, 513.

est in the light of more recent work of the Forest Products Laboratory.

1. In view of the fact that the reducing sugars produced by this reaction do not all ferment and also by the fact that the total amount of conversion was not by any means represented by reducing sugar, it occurred to the author that the presence of the hydrolyzing agent during the heating stage might exert a harmful effect upon the final result. To overcome this the digester was filled and heated to the reacting temperatures and then the reacting agent was introduced. This method is the one finally adopted.

2. Given proper preparation of the materials by the preheating and a proper adjustment of phases in the digester, all the time necessary for a successful reaction is that required by a proper mixing of materials. In other words, with proper preparation the reaction itself is practically instantaneous.

3. Throughout all runs the observation made of results on the laboratory scale with regard to the fact that this reaction runs to an equilibrium was confirmed. It has been found by repeated experiment that by a proper adjustment of the phases the concentration at which the equilibrium occurs may be varied.

The yields given in Cohoe's paper, however, do not bear out the claims in his patents, for the paper reports a maximum of 20 per cent of sugars, and the patents claim 25 to 29 per cent of sugars.

After the Georgetown plant was disposed of to the Du Pont Co., the Standard Alcohol Co. underwent a reorganization, some foreign capital was introduced, and a plant designed to produce 5,000 gallons of 188-proof alcohol a day was erected at Fullerton, La. This plant was never operated successfully by the Standard Alcohol Co. because of certain internal financial difficulties caused by the war. Since the introduction of additional foreign capital was out of the question, new American interests acquired a lease of the plant to demonstrate to their own satisfaction the commercial feasibility of the process. These interests, under the name of the Standard Lessee Corporation, operated the plant from July, 1916, until June, 1917. They then purchased the plant and patents under the name of the International Alcohol Corporation. The plant has been operated successfully since the latter part of 1916 up to tbe present time (December, 1918).

The most recent series of patents by Tomlinson, assigned to the Standard Alcohol Co. (United States Patents Nos. 1032440 to 1032450, inclusive) cover the forms of digester, the various processes for feeding the material to the digester, the methods of mixing the acid and wood, and the processes of digestion. The chief points of these patents may be summed up as follows: Patents Nos. 1032441 and 1032442 cover the thorough mixture of the sawdust and dilute acid as they are being fed to the digesters. Patent No. 1032440 is a process patent relating to the method by which the acid liquid is introduced into the digester with the steam after the temperature has been brought to 212° F. but before it has reached 235° F. Patent No. 1032443 covers the recovery of turpentine as well as sugar, and

Patent No. 1032444 the apparatus used in the process. Patent No. 1032445 covers the apparatus for mixing the sawdust and liquid acid (acid in a liquid form) as it is being fed to the digester. Patent No. 1032446 covers other apparatus for this purpose that employs acid in a gaseous form, and Patent No. 1032447 covers the process for the same. Patent No. 1032448 is a continuation of No. 938308. Patents Nos. 1032449 and 1032450 cover the apparatus and process whereby the acid liquor is introduced after the charge has first been steamed, and whereby, it is claimed, a more thorough mixing and greater yields are obtained. This idea of introducing the acid after the steaming is one of the features of Cohoe's earlier patents.

Recently another series of United States patents was taken out by Gallagher and Mork and assigned to the Standard Alcohol Co. Patent No. 1037185 covers the relief of pressure during cooking and claims thereby to eliminate products that inhibit fermentation. Patent No. 1056161 covers the process of cooking at high pressure—at 135 pounds for 15 minutes, then at 70 pounds for 30 minutes—whereby, it is stated, the wood dextrins are converted into dextrose. The claim is made that wood dextrin is converted into dextrose faster than the wood dextrin is produced from lignocellulose under the ordinary conditions of cooking. This is along the same line as the work published three years previously by Neumann, who called the wood dextrins hydrocellulose. Patent No. 1056162 covers the use of waste sulphite liquors as diluting agents for the sulphuric acid used as the hydrolyzing agent. Patent No. 1056163 relates to the use of chlorine either alone or in conjunction with sulphuric acid. The chlorine must be removed before fermentation because of its inhibiting action on yeast. Patent No. 1091327 relates to the use of "beer slop," the residue from the beer still, as a material for diluting the acid used as the hydrolyzing agent. Patent No. 1096030 covers the use of sulphuric acid and hydrochloric acid, or chloride salts with sulphuric acid, as the hydrolyzing agent.

As has been mentioned before, the work of Neumann confirmed that of Simonsen, involving sulphuric acid as a catalytic agent; but Neumann's main work was with gaseous hydrochloric acid. Girard [27] has shown that hydrocellulose is produced from cellulose by the action of gaseous hydrochloric acid, and Neumann has found that sawdust yields some dextrose in addition to the hydrocellulose. Some of the residue of hydrocellulose and sawdust left after the extraction of the dextrose can be converted further into dextrose. Neumann's yields are comparable to those of Simonsen, although by repeated inversions of the residue Neumann obtains a decided increase of total sugars. The individual inversions of the residue, however, do not yield sufficient sugar or alcohol to be of technical

[27] Annales de Chimie et Physique, I, 24, 5 ser., 344.

value. The work of Korner [28] and of Reiferscheidt [29] also substantiates in the main that of Simonsen. Korner attempted to duplicate Classen's work with sulphur dioxide, but could not. Reiferscheidt obtained Classen's yields by using a longer cooking period than that specified by Classen. In addition, several other investigations have been made in which hydrofluoric [30] and other similar acids were used. These investigations are of scientific rather than technical interest, and reference to them may be found in the bibliography.

Different from the processes mentioned above, in which the inversion of the wood is brought about only by heating with mineral acids, is that class of processes in which the cellulose or wood substance is changed to oxycellulose, acid cellulose, cellose,[31] soluble cellulose, or hydrocellulose before the real inversion takes place. Mention has already been made of Girard's work and Neumann's adaptation thereof. Gentzen and Roth [32] patented the use of ozone [33] as an oxidizing agent in conjunction with sulphuric acid. A yield of 34 per cent of dextrose is claimed in the patent, but Korner, in repeating the work, could not obtain any increase in yield over that obtained by sulphuric acid alone.

Korner further investigated the effects of hydrogen peroxide, potassium dichromate, and potassium persulphate in conjunction with sulphuric acid. Hydrogen peroxide increased the yields about 50 per cent above those obtained with sulphuric acid alone, whereas potassium dichromate, potassium persulphate, and ozone all decrease the yields. The use of salts, such as the dichromate and persulphate, may be criticized in that their presence may facilitate the production of secondary compounds.

By prolonged treatment of spruce with concentrated nitric acid, Lindsey and Tollens [34] prepared an oxycellulose which could not be hydrolyzed to a sugar under any condition. If we consider that the salts present in Kroner's experiments exerted no deleterious action and were inert during the inversion, then the results of Lindsey and Tollens seem to be in accord with those of Kroner, in that the oxycellulose prepared by them was the final product of oxidation, and the product obtained by Kroner with potassium dichromate or persulphate was an intermediate product, some of which could be hydrolyzed. Perhaps only a part of the wood was completely oxidized, and the yields of sugar obtained were on the remaining material which had not been acted upon by the oxidizing agent.

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[28] Zeit. für ang. Chemie, 1908, 2353.

[29] *Ibid.*, 1905, 44.

[30] J. J. D'Orlowski, French Patent No. 405187; also L. Spassky, French Patent No. 451268.

[31] G. Ekstrom, United States Patents Nos. 1087743 and 1087744.

[32] United States Patent No. 745676.

[33] See also Charles Doree and M. Cunningham, "The action of ozone on cellulose III action on beech wood (Lignocellulose)"; Jour. Chem. Soc. 103, 677–686; Jour. Chem. Soc. 101, 497–512.

[34] Liebig's Annalen, vol. 267, 341.

The action of hydrogen peroxide would then necessarily be one of pure hydration, in which the production of hydrocellulose was facilitated; for, according to Neumann, since the final yield of dextrose is dependent upon the amount of hydrocellulose originally present or upon the speed of its formation, the production of dextrose from hydrocellulose proceeds at a greater rate than the production of hydrocellulose from cellulose.

From the foregoing it is apparent that, since the publication of Simonsen's work and the obtaining of patents on his process, the production of ethyl alcohol from sawdust has received a very large degree of attention practically all over the world, and large sums have been spent on its technical development. Of the four plants which have been built in this country only two have achieved commercial success, but the failure of the others was due apparently to other things than the process itself.

OUTLINE OF INVESTIGATIONS.

The greatest fault common to all of the work that has been done heretofore is that it was aimed chiefly at an increase in the total yield of sugars, whereas, as will be shown later, such an increase does not necessarily mean a proportionate increase in alcohol yield. Most of the fermentation work done was haphazard and not of the same scientific character as the chemical work. Without accurate fermentations, and, consequently, without complete data, the interpretation of results led to difficulty, because oftentimes total sugar yields might not vary and yet might give different alcohol yields because of variations in the proportion of fermentable and nonfermentable sugars. Since we have no good quantitative chemical means for separating these two classes of sugars and must depend on fermentation, which is a biological process, carefully standardized fermentation experiments are an absolute necessity. The importance of this point, as will be shown later, can not be too strongly emphasized. Simonsen and others after him have contented themselves with an occasional fermentation (usually under conditions that made accurate duplication impossible) to show that some of the sugar obtained was actually fermentable. A careful study of sugar and alcohol relations, especially of the effect of the different variables on that portion of the total sugar that is fermentable, has not, to the knowledge of the writer, been made public heretofore.

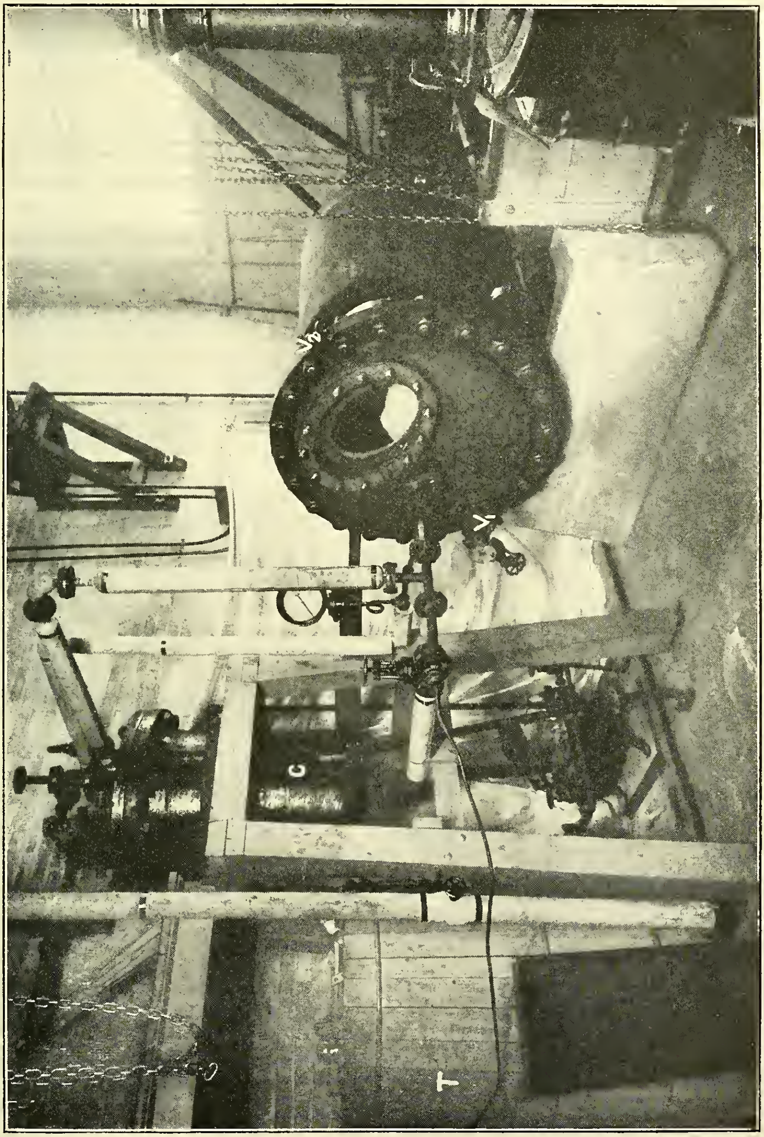
Simonsen, Neumann, and other investigators obtained contradictory data because they used as a variable different amounts of an acid solution of constant strength, thereby simultaneously varying both the ratio of water to wood and that of acid to wood. As will be shown in a study of these variables, these ratios are not mutually dependent, and the "acidity" of the solution used for hydrolysis is of little or no importance, except where it varies the actual ratio of acid to wood; the concentration of the catalytic agent expressed in per cent, or other terms, of the dry wood is the decisive factor.

In view of these facts, it was decided to reinvestigate certain of the variables studied heretofore, in addition to such others as might be considered necessary to the technical solution of this problem. This bulletin presents the results of the first part of such a systematic study.

The variables under investigation were: (1) Influence of the temperature and pressure of digestion; (2) length of the time of digestion; (3) ratio of the water to the dry sawdust; (4) ratio of the catalyzing agent to the dry sawdust; (5) concentration of the catalyzing agent in water; (6) size of the sawdust, hogged slabs, etc.; (7) effect of adding the catalyzing agent (acid) after the preliminary heating of the wood; (8) effect of varying the amount of bark in the sawdust; or, more specifically, the tannin and other ingredients in the bark; (9) special chemical treatments other than or in addition to acid catalysis; (10) yields from different species and mixtures; (11) the fermentation variables; (12) steam consumption for each ton of sawdust digested.

APPARATUS AND PROCEDURE.

The apparatus used and the method of procedure in each experiment were as follows: The hydrolysis of the wood was carried on in a rotary digester consisting of a thin cast-iron inner shell lined with acid-proof enamel and an outer shell of steel, the two being separated by several inches. The inside length of the inner shell was about 5 feet, the diameter about 2½ feet, and the total capacity about 22 cubic feet. Steam was admitted simultaneously to the inner shell and to the space between the inner and outer shells, the digester being similar to a steam-jacketed apparatus, except that the inner shell could be readily taken out and replaced. After a cook had been completed, the digester was blown off, the blow-off vapors being condensed in a quartz coil. A cast-iron tank, also lined with acid-proof enamel, was connected with the digester in such a way that its contents might be introduced into the digester when the latter was under pressure. The steam flowed to the inner shell and to the space between the two shells through separate pipes. The one leading to the inner shell connected with the acid tank. All pipes in contact with acid liquor or acid vapor were enamel-lined, and the valves were of special bronze, so as to reduce corrosion to a minimum and avoid as much as possible those complications in fermentation that arise from the presence of iron, copper, and zinc salts. The pressure was



FRONT VIEW OF DIGESTER SHOWING MANHOLE COVERS OFF AND SAWDUST IN INTERIOR.

measured by means of a gauge protected from the acid vapors, and the temperature was shown by a recording thermometer, the bulb of which projected into the sawdust. The digester was filled and emptied through a pair of concentric manholes in the inner and outer shells. The usual procedure was to make the charge of sawdust equivalent to about 100 pounds dry weight. The exact weight and moisture-content were recorded. The dilute acid was then added, the manhole covers were bolted on, steam was admitted, and rotation was begun. Before the temperature reached 100° C., the air in the inner shell and in the space between the two shells was vented to get a more accurate gauge reading. The admission of steam was continued until the desired pressure was reached and then regulated so that the heating period was always 20 minutes, or as near that length of time as possible. The steam was then throttled to maintain the desired pressure for the necessary time.

At the completion of the reaction (or in cooks of 15 minutes or more, 2 or 3 minutes before the time was up) the rotation was stopped and the vapors were blown off and condensed as rapidly as possible. The time of blow-off varied somewhat, depending on the pressure at which the cook was made and the amount of material in the digester. The condensing and cooling capacity of the coil, however, was not equal to the demands made upon it, so that blowing-off the digester took much longer than it should have done—about $1\frac{1}{4}$ hours from 7 or 8 atmospheres to atmospheric pressure.

The condensed blow-off was weighed and analyzed for volatile acid. The condensation from the steam between the two shells was drained out and weighed. It was also tested qualitatively for dextrose to detect any leakage through stuffing boxes or flanges from the inner shell. Whenever liquor was present in the inner shell, it was drained out through the blow-off valve, after which the digester was rotated so that the manholes were at the bottom, and the sawdust was raked out. After the preliminary series of experiments, this material was centrifuged. The digester liquor, centrifugal liquor, and treated sawdust were first weighed and then analyzed for acidity, total solids, dextrose, etc.

METHODS OF ANALYSIS.

The following methods of analysis were used:

MOISTURE.

About 15 grams of air-dry sawdust or 80 grams of digested or extracted sawdust were weighed into tared crystallizing dishes of glass and dried over night in an oven at 105° C. Although the digested sawdust samples at times charred somewhat, a comparative series in which the acid was neutralized before drying show no difference between neutralized and unneutralized material.

LEACHED TREATED SAWDUST.

Duplicate 100-gram samples of digested sawdust were weighed into Jena beakers holding 600 c. c., approximately 300 c. c. of water was added, and the beakers were placed on the steam bath. After 30 minutes the solution was filtered, and the filtrate was collected in a 2-liter volumetric flask. More water to the amount of 300 c. c. was then added to the sawdust, and the heating was repeated, a longer time being allowed for each extraction. The total time of extraction was 2 days, two of the extractions extending over night. The filtrate was made up to 2,000 c. c., and the latter was used for analysis.

SUGARS.

Allihn's method of determining the reducing sugars, by means of Fehling's solution, as given in Bureau of Chemistry Bulletin 107 Revised, was followed. The copper oxide was filtered in an asbestos Gooch crucible, washed with hot distilled water, and dissolved with 7 c. c. of concentrated nitric acid. It was then diluted and filtered into a 300 c. c. beaker and electrolyzed after the addition of 5 c. c. of a saturated sodium acetate solution. Hollard's stationary electrodes, consisting of a gauze cathode and a wire-frame anode, were used with a current density of 7.5 amperes at 2.4 volts. After all the copper was deposited, the electrodes were washed in water, alcohol, and ether, dried and weighed, and the dextrose was calculated from the copper numbers in the above-mentioned bulletin.

TOTAL SOLIDS.

One hundred cubic centimeters of the extract was evaporated to dryness in a tared crystallizing dish (in a tannin oven or on the steam bath), then placed in the 105° C. oven one hour, and finally cooled in desiccator and weighed.

VOLATILE ACIDS.

A 100 c. c. sample of the extract was distilled to heavy frothing with 10 c. c. of 85 per cent phosphoric acid. Distilled water to the amount of 100 c. c. was then gradually added from a separatory funnel, as fast as distilled, until the volume of distillate approximated 200 c. c. The distillate was then made up to 250 c. c. A 100 c. c. sample of this distillate was treated in a covered beaker with about 2 grams of mercuric oxide for three hours on the steam bath. After removal from the steam bath, 10 or 15 c. c. of phosphoric acid was added, and the sample was redistilled. Three titrations were then made, as follows: On the original sample, which gave the total acid, fixed and volatile; on the first distillate, which gave acetic and formic acid; and on the second distillate, which gave acetic acid only.

After the proper samples had been taken, the digested sawdust was placed in the leaching tank, where the sugar was extracted from it with a number of portions of warm water. The liquor from the digester and centrifugal (whenever there was any) and the leach liquors were then combined, neutralized with calcium carbonate and allowed to settle. After settling, the clear liquor was decanted and concentrated to a heavy sirup in a single-effect vacuum evaporator. These sirups were saved until the concentrates from two or three runs were obtained, and then they were diluted to proper strength for fermentation.

YEASTING AND FERMENTATION.

The yeast used was a pure-culture strain of *Saccharomyces cerevisiæ* isolated from a yeast used in a Hungarian distillery producing alcohol from beet-sugar molasses. This yeast is well adapted to the fermentation of sugar solutions obtained from the hydrolysis of wood and is considered to be the best strain available for this purpose.

The yeast was propagated in a beer wort, which was made up as follows: To 100 parts of water, 3 parts of hops were added, and the mixture was boiled vigorously for 15 minutes. The hops were filtered off while hot and from 25 to 35 parts of ground barley malt were added. The mixture was kept at 70° C. for four or five hours until the starch had all been converted, as shown by the iodine test. The malt was then pressed off and the liquid filtered. The filtrate polarized 18° to 20° in a saccharimeter. One liter was then put into a 2 or 5 liter cotton-plugged Erlenmeyer flask and sterilized in an Arnold sterilizer on three successive days. A small drop of the culture yeast kept in sterile sugar solution was added, and the fermentation was allowed to go to completion in about four or five days at 30° C., after which the resulting beer was poured off the yeast, and a 10 per cent sterile sucrose solution was added. About 10 c. c. of the yeast solution was then placed in a 50 c. c. sterile Florence flask, and these samples were used for starting the yeast. All transfers were made and similar work was done in a Hansen culture cabinet under sterile conditions.

The more recent practice for control work at the Forest Products Laboratory has been to propagate the yeast in a Pasteur flask in beer wort made as above, from which it is transferred to Freudenreich flasks which have side necks. Under these conditions it has been possible to propagate a yeast of strict purity, and all possible sources of contamination have been eliminated. The yeast will keep for long periods in the sugar solution, and, therefore, a three or four months' stock can usually be made up at one time.

When a series of fermentations was ready to be run, the small yeast sample in either the 50 c. c. Florence flask or the side-neck Freudenreich flask was added to 50 c. c. of 12° Brix sterile molasses, which was kept at 30° C. ±0.5° C.[35] for about 24 hours. Of this solution 10 c. c. was then added to 250 c. c. of 18° Brix molasses after about 18 hours at 30° C. Of this sample 50 c. c. was transformed to 1,500 c. c. of 18° Brix molasses, which was allowed to work off to about 12° Brix in 15 to 18 hours, when it was ready for use as the starting yeast.

Meanwhile a sprout mash was made up of 8.5 grams of malt sprouts and 2.5 grams of ammonium sulphate, boiled for 15 minutes in 250 c. c. of the wood-sugar solution to be fermented. This was cooled to 30° C., and 75 c. c. of the starting yeast (in 12° Brix molasses) was added. After 6 hours the mash was washed into a 20-liter bottle (a half carboy) with 100 c. c. of the wood-sugar solution. The latter varied in concentration from about 10° to 13.5° Brix, the average being 12° to 12.5°. The exact concentrations for each fermentation are shown on the fermentation sheet. After 3 hours 100 c. c. of wood-sugar solution was added; after 3 hours, 200 c. c.; after 3 hours, 200 c. c.; after 2.5 hours, 400 c. c.; and each hour thereafter, 400 c. c., until a final volume of 2 gallons (7,570 c. c.) was made up. The general plan of starting and filling the fermenters is shown in the following table:

Fermentation No. 2. Cooks 29, 33, 34, 35, 36, 37, 38, and 39. Starting yeast, 12° Brix.

		Volume added.	Total volume.			Volume added.	Total volume.
		C. c.	*C. c.*			*C. c.*	*C. c.*
Sept. 24	9.30 a. m.[1]	250	250	Sept. 25	9.00 a. m.	400	3,650
	3.30 p. m.	100	350		10.00 a. m.	400	4,050
	6.30 p. m.	100	450		11.00 a. m.	400	4,450
	9.30 p. m.	200	650		12.00 m.	400	4,850
Sept. 25	12.30 a. m.	200	850		1.00 p. m.	400	5,250
	3.00 a. m.	400	1,250		2.00 p. m.	400	5,650
	4.00 a. m.	400	1,650		3.00 p. m.	400	6,050
	5.00 a. m.	400	2,050		4.00 p. m.	400	6,450
	6.00 a. m.	400	2,450		5.00 p. m.	400	6,850
	7.00 a. m.	400	2,850		6.00 p. m.	400	7,250
	8.00 a. m.	400	3,250		7.00 p. m.	320	7,570

[1] Time sprout mash was set.

The above scheme was intended to duplicate as nearly as possible the times at which the different amounts of the solutions would be added from the different yeast tubs to the fermenters on a commercial scale. The first steps up to 3 a. m. are acclimating and propagating the yeast in the yeast tubs, and the final transfer into the fermenters is made at 3 a. m. From then on it takes from 12 to 18 hours in

[35] All fermentations were made in a fermentation room, the temperature of which was kept constant at 30° C. ±0.5° C., and which could be sterilized and kept in a clean condition.

commercial practice to fill the fermenters. The length of this period depends on the size of the coolers and on the temperature of the cooling water and of the neutral juice to be cooled; for the extraction of sugar is carried on either at 70° to 80° C. or at 40° to 45° C. in the diffusion battery, and the solutions cool only slightly while being neutralized and settled.

At 9.30 a. m., September 26, the first-day Brix reading was taken; and at 9.30 a. m., September 29, the beers were distilled for analysis. This gave a fermenting period slightly in excess of 96 hours (the time allowed by the Bureau of Internal Revenue for a sour-mash fermentation), for the filling of the fermenters was actually begun at 3 a. m., September 25, instead of at 9.30 a. m., September 24. However, the error introduced is practically of no significance, for the attenuation on the fourth day is usually only 0.2° Brix at the most. The work was greatly simplified by this scheme, and most of it could be done in the usual laboratory working hours.

As will be noted on the sugar and alcohol yield sheets, the fermentation efficiencies are high; that is, higher than the 90 to 94 per cent that would ordinarily be obtained, the chief reasons for this are to be found in: (1) The alcohol added along with the starting yeast; (2) the unfermented molasses in the starting yeast, which subsequently fermented; [36] (3) errors in sugar determinations; (4) errors in sampling.

The fermentable sugars and fermentation efficiencies are calculated as follows, and the effect of the above errors and their magnitude will be shown. The wood-sugar solution obtained after neutralization and settling, and hereafter called the neutral juice, is analyzed before and after fermentation. The solution after fermentation is called the beer. The sugar is always expressed in grams of dextrose to the liter, although it was actually a mixture of dextrose, possibly other hexoses (as in the case of western larch), and pentoses. The following formula gives the percentage of the total sugars that are fermentable, expressed as dextrose:

$$\frac{\dfrac{\text{Dx. in neutral juice, grams per liter}}{\text{Sp. gr. of juice}} - \dfrac{\text{Dx. in beer, grams per liter}}{\text{Sp. gr. of beer}}}{\dfrac{\text{Dx. in neutral juice}}{\text{Sp. gr. of juice}}} \times 100 = \text{Percentage of total sugars fermentable.}$$

The fermentable sugars are defined as all sugars that have disappeared during fermentation, whether the resulting product is alcohol or not. If the product is not alcohol, it will appear in the fermentation efficiency figure. If the sugar in the neutral juice before fermen-

[36] The 18° Brix molasses worked off to about 12° Brix when it was added to the sprout mash. On the fourth day, when a sample of the yeast was distilled for analysis, the Brix readings ranged between 4° and 5°.

tation, expressed in percentage, is multiplied by the percentage of sugar fermentable, and by the constant 0.5111 (which is the amount of alcohol theoretically possible from 1 unit of dextrose), the result is the amount of alcohol theoretically obtainable from the sugar present in the neutral juice. The actual percentage by weight of alcohol in the beer divided by this theoretical alcohol figure will give the fermentation efficiency.

The first and second causes for the high fermentation efficiencies may be grouped together. As shows on the fermentation record sheets, the starting yeast will average 6 per cent of alcohol on the fourth day, which is equivalent to 4.5 c. c. of absolute alcohol. A 12.5° Brix neutral juice will give a beer averaging 2.4 per cent of alcohol, the 2 gallons being equivalent to 181.7 c. c. of absolute alcohol. The alcohol from the yeast is, therefore, 2.48 per cent of the total alcohol and causes the fermentation efficiency to be high by approximately this amount. In beers having less than 2.4 per cent of alcohol the error will be greater, and in beers of greater alcohol content, the error will be correspondingly less. The figure obtained for fermentation efficiency is very important for comparative purposes; and, as the error is nearly a constant one, no corrections were made in calculating these values in order to eliminate the alcohol derived from the yeast. In addition, it permits of the expression of yields in the way they would be obtained commercially, for, in either case, commercial or experimental, about 1 per cent by volume of the total mash consists of the starting yeast solution.

The magnitude of the errors involved in the sugar determination is more difficult to determine. In addition to sugars, there are other reducing substances present. These are principally aldehydes and formates, for it is known that considerable quantities of formic acid are present before neutralization. Further, although the sugar is determined and calculated as dextrose (*d*-glucose), the sugar is actually a mixture of this hexose, sometimes with pentoses and sometimes with other hexoses. Moreover, the ratio of these sugars to each other varies in the different samples taken, and, although after fermentation the sugars consist entirely of pentoses and nonfermentable hexoses, they are determined and calculated as dextrose. This opens two possibilities for error: First, varying quantities of pentoses affect the accuracy of the actual dextrose determination; second, the reducing powers of sugars other than *d*-glucose are not the same as the power of *d*-glucose.

Stone [37] and Browne [38] differ as to the relative reducing powers of arabinose and xylose as compared with *d*-glucose, but both writers

[37] Stone, W. E., Berichte 23, 3796.

[38] Browne, C. A., Jour. of the Am. Chem. Soc. 28, 439.

show that the first two are not the same as *d*-glucose in reducing power. Browne says:

> The statement has been made that in a mixture of sugars the reducing power of the individual sugars is somewhat modified by the other members present. The writer has subjected this statement to a thorough test and can discover no such influence.

However, no wide ranges of varying sugar concentrations were tried by Browne, and therefore this point was checked up at the Forest Products Laboratory with mixtures of arabinose, xylose, and *d*-glucose, and no modifying influence in mixtures was found at widely varying concentrations. Since there is no mutual influence, it is possible to correct the analyses after fermentation, if desired, for the non-fermentable sugars may in most cases be regarded as pentoses such as xylose. As the ratio of the reduction factors of xylose and dextrose, as found by Browne and corroborated by the work at the Forest Products Laboratory, was 0.983, no great error has been introduced, because the reducing power of xylose is so nearly that of dextrose.

The main error due to sampling, other than unavoidable ones arising from the sampling of large quantities of material, has been found and in a great measure overcome. On the sugar and alcohol yield sheets it will be noticed that up to cook 43 it was necessary to discard one or more of the fermentations in many of the cooks, because of poor yields or abnormal fermentation efficiencies. The reasons for these discrepancies were apparent. After the sugar was extracted from the wood and the acid solution had been neutralized, the clarified, settled neutral juice was concentrated to a heavy sirup in vacuo and stored as such. In the different cooks, varying amounts of sludge were precipitated when the neutral juice was concentrated. This sludge consists mainly of calicum sulphate, some calcium acetate, and calcium formate, with possibly some crystallized sugar. When a fermentation was to be made, the heavy sirup was diluted with water to give a solution of about 12.5° Brix. Previous to cook No. 43, samples of the 12.5° Brix juice were taken for analysis along with the sludge remaining in the carboy before sterilization. After that time the samples were made up and allowed to stand all night; the clear juice was then siphoned out into a clean 5-gallon bottle and given two intermittent sterilizations. The sample for analysis and the final Brix reading were taken at the same time that the 240 c. c. sample was taken for making up the sprout mash. This apparently obviated all of the former difficulties, and but few fermentations were discarded after this scheme was inaugurated. In addition, the sugar data in each run were much more concordant.

A constant-temperature bath, which will regulate to ±0.05° C., also materially assisted in the accuracy of the alcohol determination. The beers were cooled to 20° C. Portions of 100 c. c. each were taken for distillation, to which were added 50 c. c. of distilled water and about 5 grams of precipitated calcium carbonate, along with 3 or 4 drops of high-boiling paraffin oil to prevent foaming. A portion of 100 c. c. was distilled over and caught in a volumetric flask. If a drop or two of paraffin oil came over, it was readily removed with a small strip of absorbent paper toweling. The 100 c. c. of distillates was then placed in the 15.6° C. constant-temperature bath; after it came to temperature the volume was made up, and the specific gravity was determined by means of a Boots double-wall vacuum pycnometer. In this way the alcohol-content of the beer could be determined very accurately. Although only a small amount of calcium carbonate was necessary to neutralize the volatile acid present, as can be shown by a redistillation of the first distillate, an excess of calcium carbonate—about 5 grams—was used to prevent bumping.

Beginning with fermentation No. 10, the total solids in the neutral juice and beer were determined. This was done in an attempt to correlate the specific gravity, Brix, and sugar data in the neutral juice, and also to give a check on the fermentable sugars and alcohol determinations. It has been found, for instance, in the fermentation of waste sulphite liquors that sufficient volatile compounds, mostly sulphur compounds, distill over in the alcohol determination to make this determination from the gravity of the distillate practically worthless. The addition of alkali and the redistillation helped, but even then there was not much correlation between the alcohol as determined and the sugar data. When determinations were made of total solids, however, it was found that, if the difference in the two determinations before and after fermentation were assumed to be alcohol and carbon dioxide, and if the alcohol were calculated from that difference, the results agreed quite well with the other analytical data and especially with the yields of alcohol obtained commercially or on a large scale experimentally. The data obtained at the Forest Products Laboratory on total solids, however, have not been of such assistance, and frequently the total solids do not even follow the specific gravity or Brix readings; much less do they give a good indication of the alcohol yields, as the following table will show:

COOK 56.

Mash before fermentation.					Beer.								
Fermentation No.	Sp. gr. at 15° C.	Brix.	Total solids.	Dextrose per liter.	Sp. gr. at 15° C.	Brix.	Total solids.	Alcohol by weight.	Alcohol from total solids.	Difference in total solids.	Fermentable sugar, average.	Alcohol yields, average.	Alcohol per ton.
			Per ct.	Grms.			P. ct.	Per ct.				P. ct.	Galls.
16.....	1.0514	12.4	9.567	65.20	1.0270	6.8	5.842	2.390	1.899	3.715			
16.....	1.0509	12.4	8.858	64.60	1.0268	6.8	5.848	2.395	1.548	3.010			
17.....	1.0475	12.0	9.428	57.34	1.0268	6.8	5.873	2.259	1.817	3.555			
17.....	1.0498	12.4	9.978	60.10	1.0278	7.2	6.160	2.345	1.952	3.818	77.15	8.295	25.09
18.....	1.0487	12.3	11.110	66.52	1.0262	6.6	6.070	2.543	2.576	5.040			
20.....	1.0429	10.7	8.606	56.90	1.0227	5.8	5.278	1.968	1.701	3.328			
20.....	1.0542	13.1	10.750	71.29	1.0287	7.1	6.493	2.590	2.176	4.257			

COOK 57.

17.....	1.0529	13.1	10.614	70.24	1.0279	7.2	6.264	2.558	2.223	4.350			
17.....	1.0509	12.5	10.076	66.32	1.0263	6.8	6.023	2.543	2.072	4.053			
18.....	1.0463	11.5	9.962	62.02	1.0247	6.3	5.781	2.318	2.137	4.181			
18.....	1.0400	10.0	8.705	52.26	1.0213	5.3	4.948	1.909	1.920	3.757	78.90	8.222	24.87
19.....	1.0474	11.7	8.539	60.98	1.0240	6.3	5.805	2.266	1.398	2.734			
19.....	1.0472	11.5	8.465	60.48	1.0246	6.3	5.951	2.274	1.314	2.514			

COOK 58.

18.....	1.0468	11.7	10.996	75.81	1.0258	6.5	6.204	2.218	2.449	4.792			
18.....	1.0497	12.4	11.006	81.48	1.0275	7.0	6.484	2.117	2.311	4.522			
19.....	1.0523	12.7	9.679	83.15	1.0285	7.3	7.196	2.421	1.780	3.483	60.48	6.768	20.47
19.....	1.0540	13.3	10.598	87.19	1.0300	7.6	7.453	2.500	1.608	3.145			
20.....	1.0553	13.2	11.180	87.79	1.0300	7.5	7.063	2.456	2.104	4.117			

In this table two extremes of fermentable sugars were chosen, namely, cooks Nos. 56 and 57, with high fermentable sugar and alcohol yields, and cook No. 58, with low fermentable sugar and alcohol yields. There were always some alcohol yields, as calculated from the total solids, that were above, as well as some that were below, those actually determined by distillation. It seems, therefore, that the figure for total solids is no criterion, especially when the ratio of sugar to total solids given on the digester record sheet is examined. Extreme cooking conditions, such as high acid, high pressure, and long-time cooks, increased the production of total solids other than sugars. In these experiments, however, the total solids were determined in the acid extracts. After the latter had been neutralized, as in the neutral juice before fermentation, the proportion of sugars to total solids was still lower because of the large amount of calcium salts of the organic acids present. Because of the latter, apparently, there was a large variation of alcohol, as calculated from the total solids and by distillation. The Brix and specific gravity sometimes varied with the total solids and sometimes with the sugars. In cook No. 56, fermentation No. 17, there was a 12°

Brix juice with 57.34 grams per liter of dextrose; and in the same cook, fermentation No. 20, there was a 10.7° Brix juice, with 56.90 grams per liter of dextrose. The whole question here seems to be one of the solubility of the sludge at the time the neutral juice is diluted before fermentation. Commercially no such variation would be obtained. Concentration of the neutral juice in an evaporator is unnecessary, for the reason that a juice of proper concentration for fermentation is obtainable directly from the diffusion battery.

As outlined previously, the variations in sugar data in the different fermentations seem to have been caused by the presence of sludge when the sample was taken. With the adoption of the method by which the clear neutral juice was siphoned from the sludge before sampling, these variations practically vanished. Cook No. 41, however, affords two check sets of fermentable sugar data with wide variations, as shown in the following table:

Cook 41.

Fermentation No.	Total sugar, per cent of dry wood.	Per cent of total sugars fermentable.	Fermentation efficiency.	Alcohol yield.	
				Per cent of dry wood.	Gallons absolute. per ton.
4	23.09	32.95	102.66	3.992	12.075
5		57.18	89.14	6.690	20.235
6		56.80	95.46	6.399	19.355
7		47.20	101.06	5.629	17.026
8		45.46	101.90	5.466	16.533

Fermentation No. 4 is evidently of no value. This was found to be true of most of the other cooks included in this fermentation, although no reason can at present be assigned for it, as the acidity and attenuation of the yeast seemed to be normal. Fermentations Nos. 5 and 6, however, show an average of 56.99 per cent of sugars fermentable, and fermentations Nos. 7 and 8 an average of 46.33 per cent of sugars fermentable. Both fermentations show fairly good checks and apparently normal fermentation.

The first of the above averages was chosen as the cook average, for, as will be shown later, that point is on the curve in the series in which cook No. 41 belongs and is, no doubt, the proper value. The reason for the second set of results is still unknown. It is to be regretted that lack of material prevented further fermentations on this cook, as the above is the only case in which a condition of this kind was noticed.

The acidity of the yeast, neutral juice, and beer is expressed in degrees, each degree being the number of cubic centimeters of N/10 alkali required for 20 c. c. of solution, phenolphtalein being used as an indicator. Another unit that is frequently used in this country is based upon the number of cubic centimeters of N/10 alkali required to neutralize 10 c. c. of this solution and is, consequently, equivalent to two of the above-mentioned degrees. In general, both the yeast and the neutral-juice acidity increased about 4° during fermentation. However, as outlined previously, the yeast was propagated in molasses which had not been sulphited, and in the course of several years the acidity of the molasses increased about 15°. A microscopic examination showed the presence of both bacteria and cocci, and the increase in acidity was probably caused by both of these. Sometimes the acidity increased during the fermentation almost double the average amount without doing any apparent harm.

RESULTS.

The first series of digestion experiments was more or less preliminary in character, as it was necessary to overcome a number of technical difficulties growing out of unusual conditions that required a combination of high pressure and high temperature in the presence of an acid. It required further time to organize and coordinate the work properly, especially in view of the fact that each successive run or pair of runs represented different experimental conditions. The fermentation equipment was not ready at the time; and, although some fermentations were necessarily made, no great confidence was placed in the value of the results. The total sugar data may be considered accurate, however, in view of the fact that confirmative runs were made later, in which the necessary fermentations also were carried out.

The complete data for all the runs, beginning with No. 21, will be found in the Appendix. These include the digester record, fermentation record, sugar and alcohol yields, and volatile-acid yields. An analysis of the various results obtained is given under the different subheadings that follow.

EFFECT OF TEMPERATURE AND PRESSURE.

The effects of various temperatures and pressures are grouped into two classes—the first series, in which the ratio of water to wood was 400 per cent (four times as much water as dry wood), the ratio recommended by Simonsen; and the second series, in which the ratio of water to wood was 125 per cent. In the first series the ratio of acid to wood was 1.8 per cent, which was found by Simonsen to yield the best results; and in the second series the ratio of acid to wood was 2.5 per cent. In addition, the first series was run with two time variables—first, a 15-minute cooking period, and, second, an instantaneous (0-minute) cook. The results are given in the following tables and curves.

Series I*a*.

400 per cent of H_2O; 1.80 to 1.85 per cent of H_2SO_4; cooking time, 15 minutes.

Cook No.	Pressure (atmospheres).	Yield of total sugars (per cent of dry wood).
8	4.25	14.29
7	6.3	20.48
21	[1] 7.1 to 7.3	21.50
18	7.5	22.85
5	7.75	21.54
11	8.1	20.05
12	9.3	11.58

[1] The steam pressure varied between these points and it was not possible to keep the digester pressure uniform.

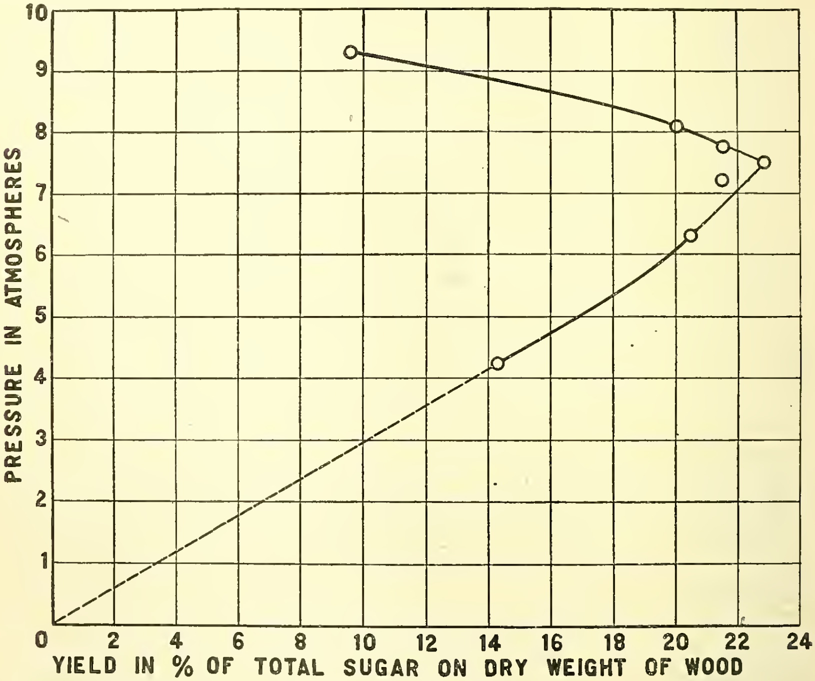


FIG. 1.—Series Ia, showing the variation of yield of total sugars with varying pressures of cooking. Cooking period, 15 minutes.

Series I*b*.

400 per cent of H_2O; 1.80 to 1.85 per cent of H_2SO_4; cooking time, 0 minutes.

Cook No.	Pressure (atmospheres).	Yield of total sugars (per cent of dry wood).
20	6.5	18.34
15	7.5	22.59
16	7.5	22.70
19	9.0	21.29

SERIES II.

125 per cent of H_2O; 2.5 per cent H_2SO_4; cooking time, 15 minutes.

Cook No.	Pressure (atmospheres).	Yield of total sugars.	Per cent of total sugars fermentable.	Alcohol (per cent of dry wood).
58	6.0	22.82	60.48	6.768
(2)	7.5	23.50	69.36	8.260
57	9.0	21.08	78.90	8.222

[2] Not an actual cook. The data are interpolated from cooks Nos. 45, 46, and 47, which are similar to the above but for 0, 10, and 20 minutes. The 15-minute cook was not made, but may easily be derived from the above series.

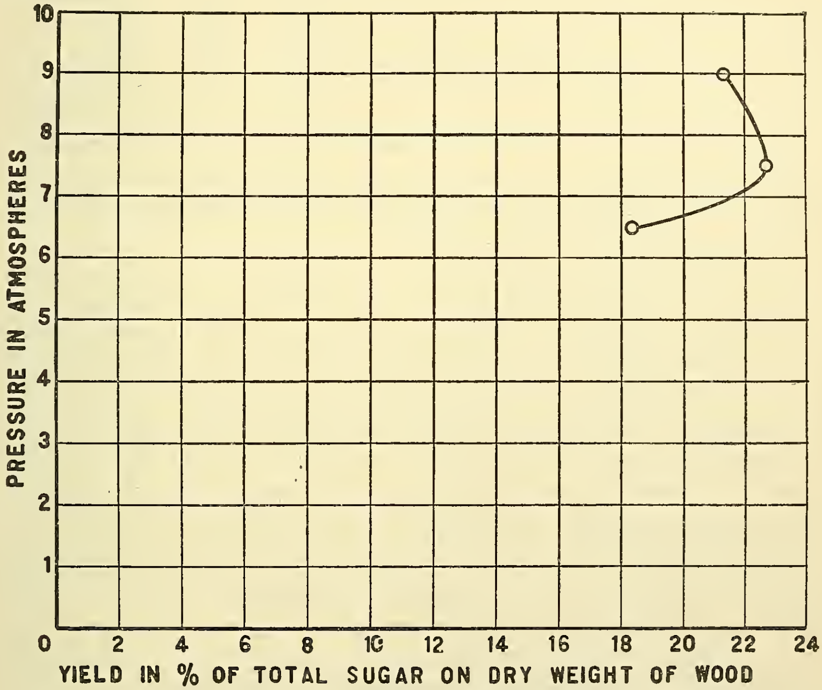


FIG. 2.—Series 1b, showing the variation of yield of total sugars with varying pressures of cooking. Cooking period, 0 minutes (instantaneous).

From the above results a maximum is observed in total sugar yields at 7.5 atmospheres gauge-pressure and the temperature corresponding thereto, which was 174° C. or 344° F. Above this point decomposition set in, and if I*a* series is compared with I*b*, it is seen that this decomposition was naturally much greater in the 15-minute cook than in the instantaneous (0-minute) cook. Below the above temperature, as was to be expected, the yield was not so great, because the speed of reaction and the yield of the final product is a function of the temperature. The higher the temperature the greater the speed of the reaction and the greater the yield in a given time, so long as decomposition does not become appreciable; but the following table[39] on the decomposition of dextrose in sulphuric-acid solution shows a marked decomposition above 175° C. (1 gram of dextrose in 25 c. c. of sulphuric acid of various concentrations heated for 30 minutes at the indicated temperatures.)

Per cent of sulphuric acid.	Per cent of undecomposed dextrose.			
	At 150° C.	At 160° C.	At 175° C.	At 185° C.
0.1	100.0	94.4	94.2	88.8
.5	96.1	92.7	91.6	50.0
1.0	94.4	83.3	86.6	33.3
1.5	88.8	80.5	55.5	31.1
2.0	87.7	75.0	37.2	5.5
2.5	86.6	72.2	33.3	5.0
3.0	83.3	71.0	25.0	2.7
5.0	80.5	38.8	5.5	.0

Neuman calls 175° C. the "critical point" and claims that technically there is no need of investigating the production of sugars at higher temperatures. The results of the work at the Forest Products Laboratory support this statement.

Series II, however, shows that even though the total sugar yield decreased at temperatures higher than that corresponding to 7.5 atmospheres, the portion of the total sugars which was fermentable increased sufficiently to balance the decrease in total sugars, and hence the final alcohol yield was practically the same at 7.5 and 9 atmospheres. As outlined before, the necessity for complete data is at once apparent, and much of the value of series I*a* and I*b* would be lost if the data for series II were not at hand. The increase, or rather, the percentage of increase, in fermentable sugars may be explained in part by the fact that there is a selective decomposition; that is, the pentose or reducing substances other than the hexose present are more easily decomposed at the high temperature than is the dextrose. The following table of volatile-acid yields shows that there was greater sugar decomposition, with consequent formation of formic acid, at 9 atmospheres than at 6 atmospheres.

Cook No.	Pressure (atmospheres).	Acetic acid (per cent of dry wood).	Formic acid (per cent of dry wood).	Ratio.	Total acid (per cent of dry wood).
58	6.0	2.47	0.399	6.19 : 1	2.869
57	9.0	3.53	.659	5.36 : 1	4.189
47[a]	7.5	2.62	.340	7.71 : 1	2.960
46[b]	7.5	2.36	1.450	1.63 : 1	3.810

[a] 10-minute cook. [b] 15-minute cook.

[39] Neumann, Dissertation, Dresden, 1910, p. 31.

A similar increase in formic acid is shown in the curve for series I*b* on page 50.

As no data were available in the literature on the decomposition of pentoses under the conditions that obtained in these experiments, a number of autoclave cooks were made in which both pure dextrose and pure xylose in sulphuric-acid solutions were used. The solutions were made in such a way that the concentrations of sugar would be comparable to those obtained in the regular runs, and the data from these cooks are given in the two following tables:

Solution of 0.8 of a gram of xylose in 100 c. c. of 0.5 per cent sulphlric acid, heated to 112 pounds in 20 minutes. Held at 112 pounds for 15 minutes.

	I.	II.	III.
Original xylose .... grams..	0.4000	0.4000	0.4000
Residual reducing sugars .... do....	.2268	.2044	.2056
Residual reducing sugars, per cent of original	56.7	51.15	51.4
Acetic acid .... grams..	None.	None.	None.
Formic acid .... do....	.0232	.0280	.0280

Solution of 4 grams of dextrose in 100 c. c. of 0.5 per cent sulphuric acid, heated to 112 pounds in 20 minutes. I, held at 118 pounds for 15 minutes; II, held at 112 to 116 pounds for 15 minutes.

	I.	II.	III.
Original dextrose .... grams..	1.000	2.000	....
Residual reducing sugars .... do....	1.072	1.472	....
Acetic acid .... do....	.0046	.0070	....
Formic acid .... do....	.0926	.0766	....

In addition to the above two series, one cook was made on an aqueous solution of dextrose instead of a sulphuric-acid solution and with the following results:

Aqueous solution of 4 grams of dextrose in 100 c. c. of solution, heated to 112 pounds in 20 minutes. Held at 112 pounds for 15 minutes. Reducing sugar 0.1891 gr. cu.$=0.09685\times10\times4=3.874$ grams of dextrose per 100 c. c.

Acetic.	Formic.	Total.
0.70 c. c.	0.25 c. c.	0.95 c. c.
.70 c. c.	.25 c. c.	.95 c. c.
.00406 g.	.0011 g.	....

The above data confirm the experimental results obtained in cooks in the series mentioned and are also extremely interesting, as it is found that approximately 50 per cent of xylose was decomposed under the conditions used, even in a solution containing only 0.8 of a gram per 100 c. c. of 0.5 per cent sulphuric acid. Furthermore, only formic acid is produced, with no acetic acid whatever. A dextrose solution having five times the concentration of dextrose showed on an average 64 per cent of the original dextrose remaining; and, although formic acid was the main constituent of the total volatile acid, some acetic acid was formed.

Another series of experiments was made on autoclaving the neutralized juice before and after fermentation. The results of these experiments are given in the following tables. It is of particular interest to note here that a greater sugar decomposition occurred in the autoclave of both the neutral juice and the beer when no sulphuric acid was added than when sulphuric acid was added before autoclaving. The volatile-acid figures, although somewhat erratic, show a decided tendency toward an increase of volatile acid, although here we have a mixture of conditions in which, undoubtedly, a number of secondary reactions take place, and some of the combined acids that are present either as calcium salts or organic combinations are liberated during the autoclave process.

Autoclave cooks on fermented and unfermented wood-sugar extracts.

No.	Reducing sugars per 100 c. c.	Acetic acid per 100 c. c.	Formic acid per 100 c. c.	Sulphuric acid per 100 c. c.	Total volatile acid.
Neutral juice:					
74-6 (1)	39.72	0.248	0.380	....	0.628
74-6 (2)	18.148	.356	.582	....	.938
74-6 (3)	31.824	.263	.540	....	.803
74-6 (4)	36.08	.333	.338	....	.671
Beer:					
74-7 (1)	17.99	.387	.665	....	1.052
74-7 (2)	7.70	.480	.754	....	1.234
74-7 (3)	12.29	1.208	.095	....	1.303
74-7 (4)	13.11	.341	.671	....	1.012
Neutral juice:					
73-6 (1)	41.29	.713	.184	....	.897
73-6 (2)	14.24	.883	.404	....	1.287
73-6 (3)	22.04	.868	.238	....	1.116
73-6 (4)	29.03	.527	.439	....	.966
Beer:					
73-7 (1)	41.624	1.038	.392	....	1.430
73-7 (2)	12.94	1.418	.540	....	1.958
73-7 (3)	20.75	1.356	.410	....	1.866
73-7 (4)	19.01	1.286	.475	....	1.761

(1) original; (2) original autoclaved, 112 pounds for 15 minutes; (3) original plus 0.5 per cent of sulphuric acid autoclaved, 112 pounds for 15 minutes; (4) original plus 0.5 per cent of sulphuric acid autoclaved, 112 pounds for 15 minutes.

The experimental procedure covering the previous series of autoclave cooks on fermented and unfermented extracts, also sugar solutions in both water and sulphuric acid, was carried on as follows: Fifty cubic centimeters of the solution was put into a pear-shaped, porcelain-stoppered, rubber-gasketed pressure flask of glass, which was put into an autoclave, the flask being surrounded by water. The autoclave was gas heated, and steam pressure was turned into the autoclave so fast as to make the autoclave cooks comparable with the digester cooks. As the flasks were stoppered, none of the volatile acids could escape, and they were determined along with the sugars in the solutions after they were cooked in the autoclave.

Comparing these yields with those shown above for series II, it is seen that the yields were higher at 6 and 9 atmospheres, no doubt on account of different amounts of water present. For all technical purposes, therefore, there is no advantage in exceeding 7.5 atmospheres (112 to 115 pounds per square inch gauge pressure), for above this point decomposition of sugar sets in. The decomposition of the fermentable sugars was apparently not so great as that of the nonfermentable sugars, and the final alcohol yield was, therefore, not greatly affected; but the increased amounts of volatile acids formed are undesirable because of the possibility of an inhibiting action during fermentation.

LENGTH OF TIME OF COOKING.

When the pressure of 7.5 atmospheres was used as a constant, and when the time of cooking was varied, the following results were were obtained:

PRELIMINARY SERIES III.

Time variable; 1.8 to 1.85 per cent of H_2SO_4; 400 per cent of H_2O; 7.5 atmospheres.

Cook No.	Time of cook, minutes.	Per cent of total sugars.	Per cent of total sugars fermentable.	Alcohol yields.	
				Per cent of dry wood.	Gallons absolute per ton.
15	0	22.59	54.87	6.096	....
16	0	22.70			
21 [1]	0	23.16			
18	15	22.85			
17	30	22.95			

[1] Cook 21 had 300 per cent water instead of 400 per cent.

SERIES III.

Time variable; 2.50 per cent of H_2SO_4; 125 per cent of H_2O_2; 7.5 atmospheres.

Cook No.	Time of cook, minutes.	Per cent of total sugars.	Per cent of total sugars fermentable.	Alcohol yields.	
				Per cent of dry wood.	Gallons absolute per ton.
31	0	21.45	63.66	6.859	20.75
45	0	22.77	62.65	6.994	21.15
Average	0	22.11	63.16	6.927	20.95
32	10	21.32	69.79	7.339	22.20
47	10	23 40	67.27	7.984	24.15
Average	10	22.36	68.53	7.662	23.18
46	20	23.61	71.44	8.537	25.82
56	45	21.56	77.15	8.295	25 09
55	90	18.06	81.40	7.387	22.34

SERIES IIIa.

1.4 per cent of H_2SO_4; 125 per cent of H_2O; 7.5 atmospheres.

Cook No.	Time of cook, minutes.	Per cent of total sugars.	Per cent of total sugars fermentable.	Alcohol yields.	
				Per cent of dry wood.	Gallons absolute per ton.
33	0	23.17	54.20	6.972	21.09
40	0	23.74	53.67	6.319	19.11
39 [1]	0	22.37	53.92	6.214	18.80
Average	0	23.46	53.94	6.646	20.10
24	10	23.81	53.16	6.362	19.24
41	10	23.09	56.99	6.550	19.81
Average	10	23.45	55.08	6.456	19.53
42	30	22.34	63.22	6.862	20.73

[1] Blow-off open, not averaged.

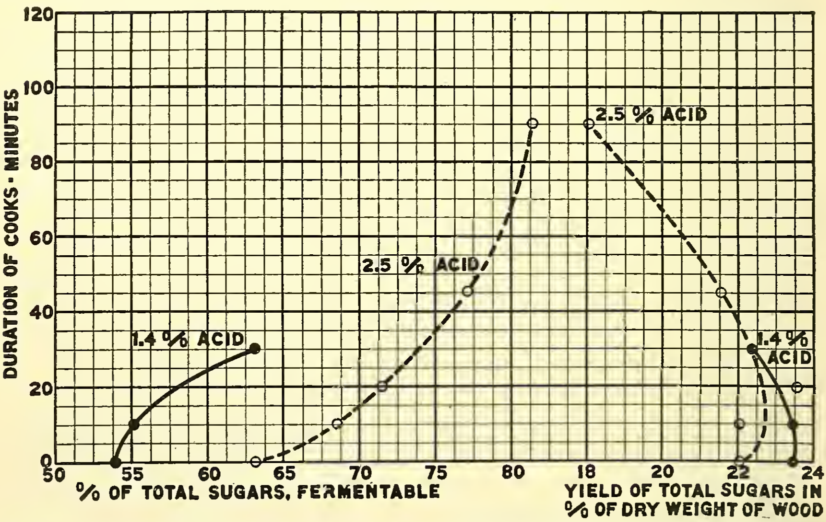


FIG. 3.—Series III and IIIa, showing the variation in yield of total sugars and percentage of total sugars that is fermentable with varying cooking periods at two different acid concentrations. Cooking pressure, 7.5 atmospheres.

These results are further illustrated graphically in figures 3, 4, and 5.

In a previous publication,[40] based on preliminary series III, the author stated that the time of cooking was apparently without effect. This statement was based on a total sugar data only, as practically all other alcohol data up to that time had been, and must now be, modified.

Altogether three concentrations of acid and two concentrations of water were used, except in cook 21, as noted in the table. For

[40] Jour. of Ind. and Eng. Chem. 1914, 625.

the instantaneous cooks no great difference in total sugars will be noted. Figure 3, series III*a*, shows a gradual decrease in the 1.4 per cent acid series, and a slight increase followed by a decrease in the 2.5 per cent acid series in total sugar yields; whereas figure 4, preliminary series III, shows practically no difference in a 0, 15, or 30 minute period. As shown in figure 3, however, decided increases were attained in the portion of total sugars which is fermentable, with increased alcohol yields (fig. 5), especially in the 2.5 per cent acid series. In this series the maximum yield was 8.54 per cent of alcohol, after which the yield dropped, although the yield of fermentable sugars kept on increasing. The total sugar yield, however,

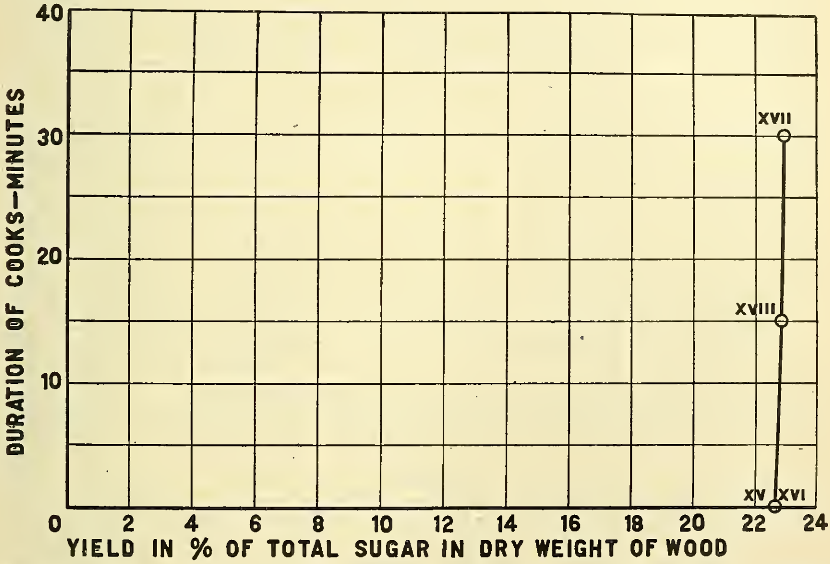


FIG. 4.—Preliminary series III, showing the variations in yield of total sugars with varying periods of cooking. Cooking pressure, 7.5 atmospheres.

decreased at a greater rate than the above increase, and gave lower alcohol yields.

Here again the data would permit of only doubtful interpretation or would lead to erroneous conclusions if only the total sugars were taken into account. The explanation of these results will be taken up later.

RATIO OF WATER TO WOOD.

All of the preliminary cooks were made with 400 per cent of water—that is, four times the dry weight of wood. This was the water ratio used by Simonsen, although that given in United States Patent No. 938308 by Ewen and Tomlinson was somewhat less than 4 to 1.

From an operating standpoint the reduction of the amount of water used is greatly to be desired. The reasons for this are: First, the steam consumption in cooking is greatly decreased. Second, there is difficulty in obtaining a juice sufficiently concentrated to ferment and distill economically, because, if an excess of liquor is present in the digester, a large portion of the sugar is dissolved therein. Third, there is difficulty in handling a dripping, digested sawdust from which the acid liquor must be separated. The following table shows the results obtained by decreasing the ratio of 4 parts of water to 1 of dry wood down to equal parts of each.

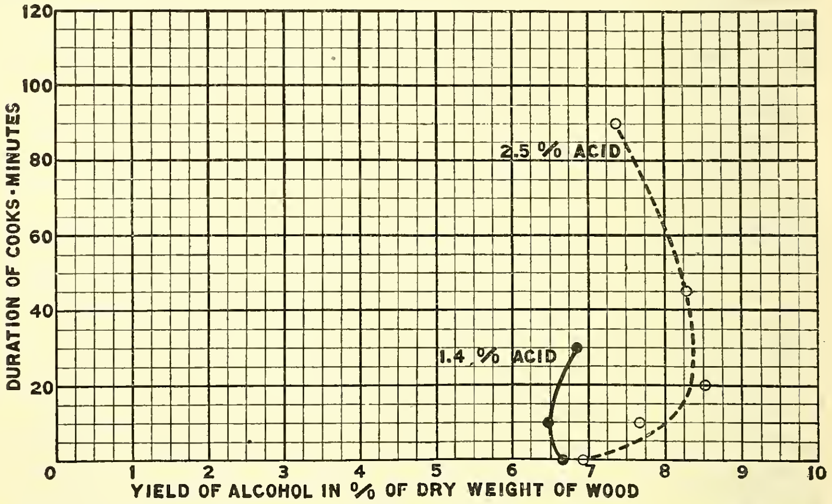


FIG. 5.—Series III and IIIa, showing variation in alcohol with varying cooking periods at two different acid concentrations. Cooking pressure, 7.5 atmospheres.

SERIES IV.

Water to wood ratio variable; 1.80 to 1.83 per cent of H_2SO_4; 7.5 atmospheres; 0 minute.

Cook No.	Per cent H_2O.	Per cent of total sugars.	Per cent of total sugars fermentable.	Alcohol yields.	
				Per cent of dry wood.	Gallons absolute per ton.
26	400	22.24	56.19	6.154	18.61
21	300	23.16	54.87	6.096	18.44
22	250	23.75	55.31	6.648	20.11
34	125	21.96	59.29	6.805	20.58
30	100	21.09	60.68	6.440	19.48

SERIES IV*a*.

1.40 per cent of H_2SO_4; 7.5 atmospheres; 0 minute.

Cook No.	Per cent H_2O.	Per cent of total sugars.	Per cent of total sugars fermentable.	Alcohol yields.	
				Per cent of dry wood.	Gallons absolute per ton.
43	200	21.84	57.94	6.369	19.62
44	100	23.00	57.16	6.665	20.16

In the experiments of series IV, 1.80 per cent of sulphuric acid was used. The experiments were then repeated with the use of 100 and 200 per cent of water with 1.40 per cent of sulphuric acid, and the results were the same. These results are shown graphically in

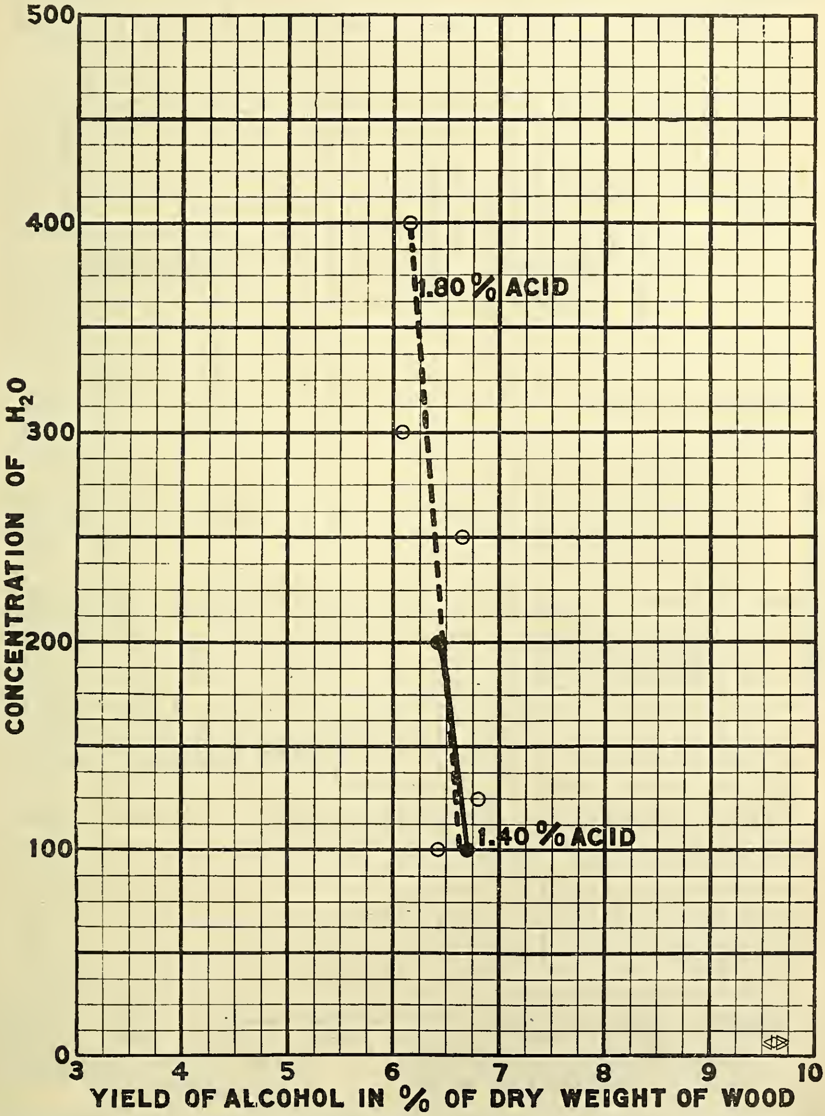


FIG. 6.—Series IV and IVa, showing variation in alcohol yields with varying concentrations of water at two different acid concentrations.

figures 6 and 7. Figure 6 shows that the average alcohol yields were very nearly constant for the different concentrations of water used, and figure 7 shows that this also held true for both the amounts of total sugars and the percentages of sugars that were fermentable.

There was a little more variation in the latter figures than in the alcohol values, because in the sugar data there was apparently a combination of variables in opposite directions. The 1.80 per cent

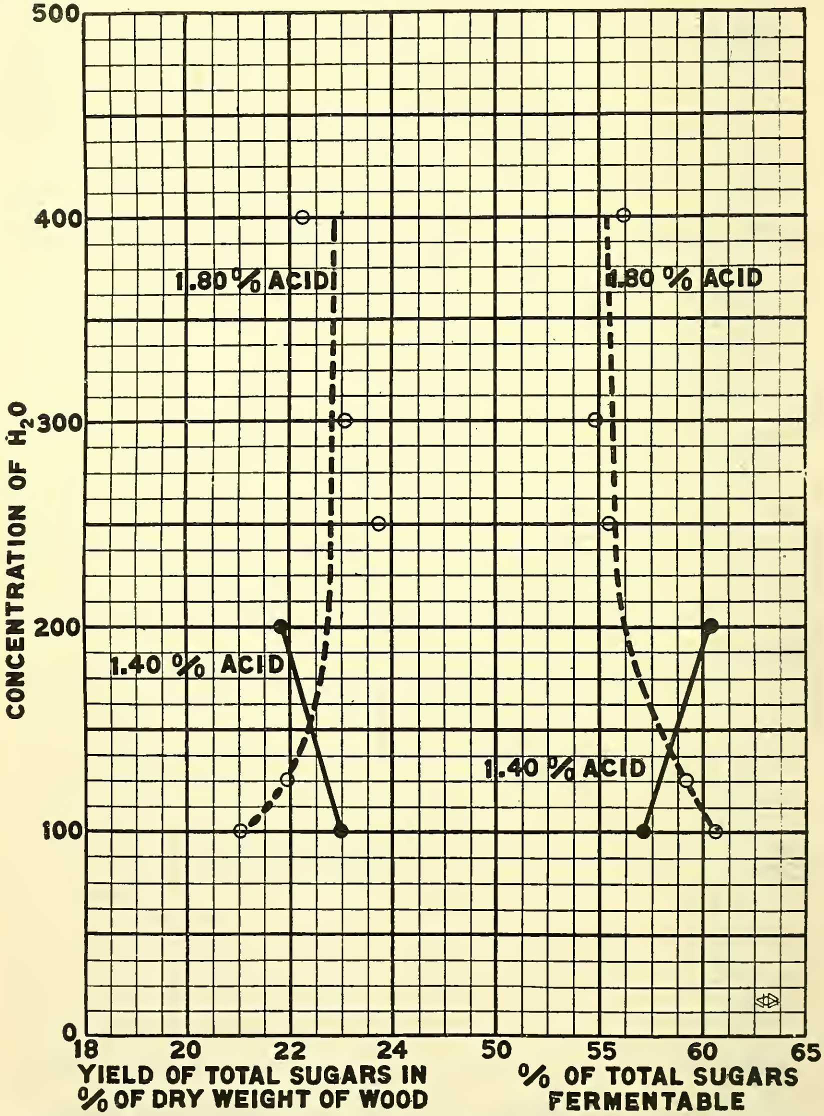


FIG. 7.—Series IV and IVa, showing variations in yield of total sugars and percentage of total sugars fermentable with varying concentrations of water at two different acid concentrations.

acid curves show that there was a slight decrease in total sugars with decreasing amounts of water; but the percentage of fermentable sugars increased at the same time, with the result that the actual alcohol yield was practically constant. A larger number of cooks would probably have reduced these variations, but they were not deemed necessary to establish the principle involved.

Although 100 per cent of water gave results practically as good as did larger amounts, the operating conditions chosen for future work was 125 per cent of water. This was done for two reasons: First, to insure a better mixture of the acid in the wood, which, of course, is easier to accomplish with larger amounts of water, and, second, to use the maximum amount of water possible and still obtain a digested sawdust that has no drip. The advantages from the use of 125 per cent of water were felt to outweigh the small increase in steam consumption and to justify its adoption for future work. From calculations that have been made to determine the steam load on a commercial digester it was found that it takes 1,816,000 B. t. u. to a cook for heating the wood and acid solution, and 1,183,000 B. t. u. to heat the digester—a total of 2,999,000 B. t. u. to a cook. Decreasing the ratio of water to wood from 125 per cent to 100 per cent would decrease the total steam load to 2,709,000 B. t. u., a difference of 290,000, or about 10 per cent. The digester load, however, is only 25 to 30 per cent of the total steam load of the plant; consequently, the above would make a difference of only 2 or 2.5 per cent of the total steam load of the plant.

RATIO OF ACID TO WOOD.

The above ratio of water to wood (125 per cent) and a 0-minute cooking period were the constants used in the next series, in which the ratio of acid to wood was the variable. Sulphuric acid was used as the catalytic agent and in amounts varying from 0.5 per cent to 4 per cent of the dry weight of the wood. The results are given in the following table:

SERIES V.

125 per cent of H_2O; 7.5 atmospheres; 0 minute.

Cook No.	Per cent H_2SO_4.	Per cent of total sugars.	Per cent of total sugars fermentable.	Alcohol yields.	
				Per cent of dry wood.	Gallons absolute per ton.
38	0.5	17.42	43.13	4.172	12.62
37	.75	21.83	56.03	6.085	18.41
35	1.00	21.68	56.43	6.506	19.68
33	1.40	23.17	54.20	6.972	21.09
40	1.40	23.74	53.67	6.319	19.11
39[1]	1.40	22.37	53.92	6.214	18.80
Average	1.40	23.455	53.935	6.6455	20.10
34	1.80	21.96	59.29	6.805	20.58
30[2]	1.80	21.09	60.68	6.440	19.48
31	2.50	21.45	63.66	6.859	19.75
45	2.50	22.77	62.65	6.994	21.15
Average	2.50	22.11	63.155	6.9265	20.95
36	4.00	21.10	66.63	7.000	21.17

[1] Blow-off open, not averaged. [2] 30 to 100 per cent H_2O, not averaged.

SERIES V*a*.—*Shortleaf pine.*

125 per cent of H_2O; 7.5 atmospheres; 10 minutes.

Cook No.	Per cent H_2SO_4.	Per cent of total sugars.	Per cent of total sugars ferment-able.	Alcohol yields.	
				Per cent of dry wood.	Gallons absolute per ton.
48	2.50	17.15	60.27	5.201	15.73
49	4.00	14.02	66.59	4.262	12.89

The results of series V and V*a* for both spruce and shortleaf pine are shown graphically in figures 8 and 9. Figure 8 shows the actual alcohol yield based on the dry weight of the wood, and figure 9 gives

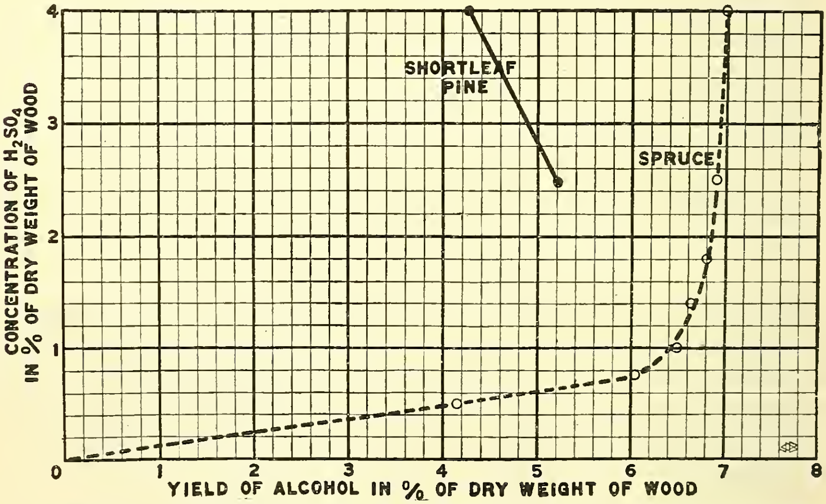


FIG. 8.—Series V and Va, showing variation in alcohol yield with varying concentrations of sulphuric acid for spruce and shortleaf pine.

the variations in total sugars and the portion of total sugars that is fermentable.

Figure 8 shows that the yield of alcohol from spruce increased rapidly with the lower concentrations of acid, but that above 1 per cent of acid the increase was comparatively small, there being little difference between 1 per cent and 3.5 per cent of acid. There was an actual decrease in the alcohol yield from shortleaf pine. This was because of the decrease of total sugars (fig. 9), although the amount of sugars fermentable increased from 60.29 per cent to 66.59 per cent of the total. The shortleaf pine used was a mixture of band sawdust and hogged slabs and edgings containing about 8 per cent of cypress and a considerable quantity of bark.

Even from spruce a decrease in total sugars is noticeable with acidities above 1.4 per cent, but here again the percentage of the total fermentable sugars increases. As a result the total yield is not appreciably lessened and the alcohol yield remains practically constant.

In this series is seen again the importance of complete data; that is, data on total sugars, percentage of total sugars fermentable, and alcohol yields. All of these are necessary for a proper interpretation of the results, especially in an experiment like this, in which there is an apparent neutralization of two factors that vary in different ways.

A study of these two variables—namely, the ratio of water to wood and of acid to wood—shows that they are not mutually dependent,

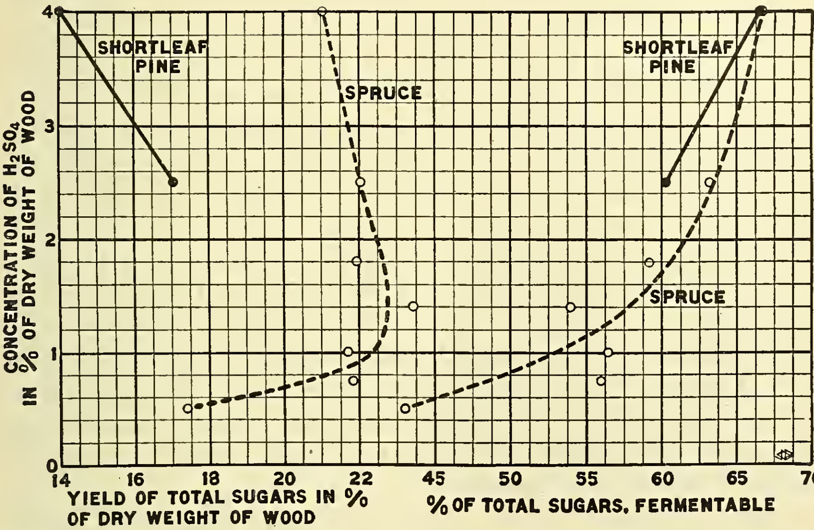


FIG. 9.—Series V and Va, showing variation in yields of total sugar and percentage of total sugars that is fermentable with varying concentrations of sulphuric acid for spruce and shortleaf pine.

that the acidity of the solution used for hydrolysis is of minor or no importance, but that the concentration of the catalytic agent expressed in percentage of dry wood is the decisive factor. As stated previously, Simonsen expressed all of his results in total sugar. When such long cooking periods are used (two hours in his work on variable No. 3—the influence of the amount of water present and of the acid concentration), it is not surprising that he found variable sugar yields with a constant amount of acid and varying amounts of water, or varying "acidities," as he called them. The decomposition products so obtained would be largely reducing agents, formic and lævulinic acids, which would show high sugar yields. Practically always, especially in the above work on cellulose, Simonsen used amounts of water which were technically not feasible. Neuman realized the technical importance of decreasing the ratio of water to wood, but carried it no further than 3 to 1—300 per cent of water.

He inverted 50 grams of air-dry sawdust with 150 c. c. of 0.5 per cent sulphuric acid (equivalent to 1.5 per cent of sulphuric acid based on air-dry wood) for one-half hour at 175° C., with 112 pounds of pressure to the square inch, and duplicate experiments showed yields of 20.4 and 20 per cent of total sugars. The percentages of total sugars fermentable and the alcohol yields were not given. In the discussion of his results he gives the following:

These experiments prove that one can work with small amounts of liquid without exerting a deleterious action on the yields. In fact, the yields in experiments 63 and 64 (the two referred to above) are higher than in former ones in which larger amounts of liquids were used. At the same time, the extracts contained a greater percentage of sugar which is also favorable for fermentation. On the contrary, a small amount of liquid (acid solution) is not advisable, since in another experiment with sawdust and 2 parts of liquid (0.5 per cent sulphuric acid) at 175° C. a considerable evolution of sulphur dioxide took place with partial cooking of the materials used.

It must be remembered that the above experiments were made on 50-gram samples of wood heated in an autoclave indirectly; whereas the results obtained at the Forest Products Laboratory were based on 100-pound samples cooked with steam. At the laboratory there was no coking in instantaneous or short-time cooks with 1 part of water to 1 of wood; although, with the higher acid concentrations, irrespective of the amount of water used, there was always some coking—that is, a darkening of the digested wood. When Neumann used sulphuric acid as the catalytic agent, he nearly always employed a 0.5 per cent solution and simply varied the amount. He thereby confused the effect of his ratios of water and acid to wood, since they were both varied simultaneously.

If steam was used as the heating agent, of course some further dilution occurred during cooking; the more water used to begin with, the greater was this dilution. In an experimental apparatus, like that used at the Forest Products Laboratory, the amount of steam required to heat the digester was greater in proportion to the amount necessary to heat the wood and acid solution than it would be in a large commercial digester holding two or more cords of wood. The following data from cooks Nos. 30 and 34 show in general how much this dilution was:

	Cook 30, June 30, 1914.	Cook 34, July 29, 1914.
Water .... per cent..	100.	125.
H_2SO_4 .... do....	1.80	1.80.
Minutes	0.	0.
Atmospheres	7.5.	7.5.
Blow-off (condensed) .... pounds..	38.48.	41.41.
Digested sawdust .... do....	271.20.	288.06.
Dry wood .... do....	103.55.	100.68.
Water added .... do....	103.5.	126.
Excess water in digested sawdust over amount added .... do....	64.10.	61.38.
Ratio of water to wood in digested sawdust	1.62 to 1.	1.86 to 1.

In cook No. 30, with an original ratio of water to wood equal to 1 to 1, the ratio increased to 1.62 to 1, an increase of 62 per cent. In cook No. 34, with an original ratio of 1.25 to 1, the ratio increased to 1.86 to 1, an increased of 61 per cent, which was practically identical with that of cook No. 30. In both cooks the yields of total sugars, percentages of total sugars fermentable, and yields of alcohol were practically identical, as shown in the table of results on series IV, page 36. It seems, therefore, that if there is sufficient water to insure a good mixture of the catalytic agent with the wood, both the water and acidity of the solution added are without effect; and that, of these two variables, the only one affecting the yields is the concentration of the catalytic agent based on the amount of dry wood present.

Increasing the concentration of the catalytic agent caused increased yields of total sugars up to about 1.5 per cent of sulphuric acid; then the yields begin to decrease, although the portion of the sugars that is fermentable increased without a break in the curve. The increase in the amount of sugars fermentable is sufficient to offset the decrease in total sugars, and consequently the resulting alcohol yield is practically constant. The explanation of this condition, as shown on pages 30 to 33, is that the nonfermentable sugars (the pentoses) are the more unstable under the conditions used, and pentose decomposition takes place with increasing amounts of the catalytic agent. This pentose decomposition accounts for a decrease of the total sugar yield and an increase of the fermentable sugars, especially if there is little or no hexose decomposition; and the result is a practically constant alcohol yield similar to that obtained. As in the inversion of cane sugar in the presence of an acid, here also the speed of the reaction is probably determined by a combination of the catalytic effects of both the hydrogen ions and the non-ionized acid; moreover, the increased amounts of sugar formed with increased acid concentration may in part be a result of the non-ionized molecule. However, this is not the full explanation of the conditions observed. If it were, the 4 per cent acid series should give yields as much greater than those of the 2.5 per cent acid as the 2.5 per cent acid yields are greater than those of the 1 per cent; but this is not the case.

The above discussion has been limited entirely to the results of the experiments on spruce. Only two cooks were made on shortleaf pine, and these were insufficient to warrant any conclusions, especially in view of the complex nature of the raw material.

SIZE OF CHIPS.

Two cooks were made on chips of two different sizes and under the conditions outlined in the table below.

125 per cent of H_2O; 2.5 per cent of H_2SO_4; 7.5 atmospheres; 15 minutes.

Cook No.	Length of chip with the grain (inches).	Per cent of total sugars.	Per cent of total sugars fermentable.	Alcohol yields.	
				Per cent of dry wood.	Gallons absolute per ton.
59	$\frac{1}{8}$ to $\frac{3}{16}$	20.21	73.50	7.126	21.55
60	$\frac{5}{8}$	21.005	69.07	7.214	21.82
61	Mixture.	20.14	71.16	7.109	21.50

Even the larger chips were thoroughly penetrated and cooked, and the yield obtained from them compares favorably with that obtained from sawdust under similar conditions. The chips, however, did not extract readily, and while they were being stirred in the leaching tank they were ground to a powder. In a commercial diffusion battery there would not, of course, be a similar mechanical action, but the time of extraction and the capacity of the battery would be decreased. A lack of material prevented leaching experiments, and these results were obtained primarily to determine whether material of this size would give yields similar to those from sawdust. Further work along this line is necessary.

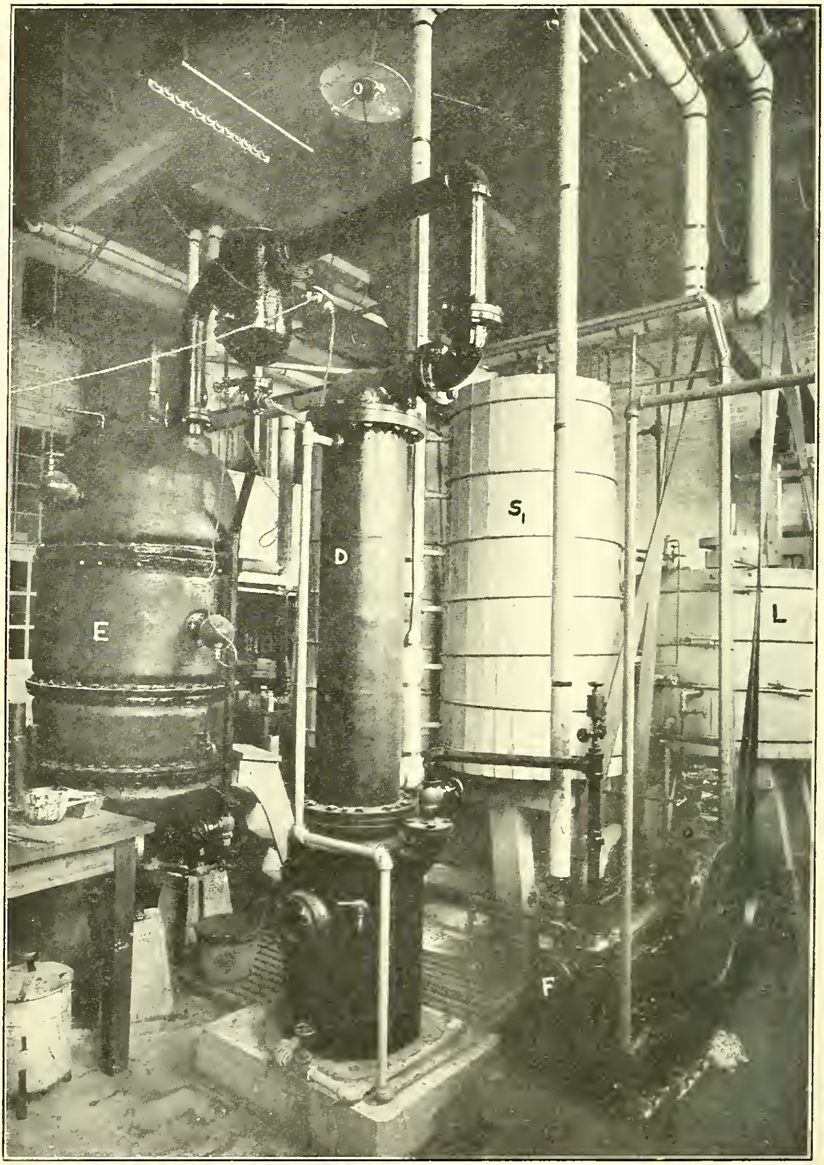
Cook No. 61 was a mixture of sawdust, small chips, and large chips in the following amounts:

	Moisture.	Air-dry weight.	Dry weight.
	Per cent.	*Pounds.*	*Pounds.*
Sawdust	8.78	31.35	28.60
Large chips	9.67	46.96	42.41
Small chips	9.37	41.04	37.20

This mixture was cooked at 7.5 atmospheres with 125 per cent of water and 2.5 per cent of sulphuric acid for 15 minutes. After it was cooked, a sample of the mixture was taken and extracted and the extract analyzed in the usual way. Another part of the sample was screened through a screen having openings three-eighths of an inch square, and the materials passing through the screen and remaining on it were also extracted and analyzed in the usual way. The following table shows the results of these analyses:

Digested mixture.	Moisture (per cent).	Total sugars, (per cent of wet weight).	Total solids (per cent of wet weight).	Acidity of extract (C. c. N/10 NaOH).
Unscreened	70.26	6.616	7.196	7.5
Remaining on $\frac{3}{8}$-inch screen	70.54	6.853	7.28	7.6
Passing through $\frac{3}{8}$-inch screen	71.11	6.688	7.32	7.6

LEACHING TANK, *L*; SETTLING TANKS, S_1 AND S_2; SINGLE-EFFECT VACUUM EVAPORATOR, *E*; HYDRO-EXTRACTOR, *H*.



EVAPORATOR *E*, CONNECTED TO SURFACE CONDENSER *D*, AND DRY VACUUM PUMP *F*. CORNER OF FERMENTATION ROOM BUILT IN UPPER CORNER OF LABORATORY BEYOND EVAPORATOR AND CONDENSER.

From these figures it will be seen that all the material was equally cooked and gave practically the same yields, irrespective of size within the limits used. In addition, the material leached readily without formation of fine stuff, and 88.4 per cent of the sugar present was extracted without difficulty in three leachings. A certain amount of sawdust or material of similar size, therefore, seems necessary in order to obtain a good extraction, even though chips as large as five-eighths of an inch with the grain may be cooked under the conditions outlined in as short a time as 15 minutes and with good yields.

It has been observed in commercial practice that a mixture of dust and chips in the proportion of 10 to 15 per cent of dust and 90 to 85 per cent of chips gives the best results in the diffusion battery. If all dust or too much dust is used, the cooked material packs in the cells, high pressures are required to force the extracting water through it, and the material hangs in the cells at the time of discharge, causing loss of time in operation. If dust-free chips are used, the opposite is true; the extracting water percolates too fast, and extraction is not good. With the proper combination of dust and shredded chips, a 92 per cent extraction of the total sugar may be obtained.

LEACHING EXPERIMENTS.

The determination of the number of cells in a diffusion battery necessary to get a maximum extraction in a minimum time, with a minimum amount of water, is a very important point in this process. Furthermore, it was desirable to determine whether there was any selective solubility between the different sugars present or the soluble solids other than sugars. With this end in view, two series of cooks were made under the same conditions, viz, 125 per cent of water, 2.5 per cent of sulphuric acid, a pressure of 7.5 atmospheres, and a cooking period of 15 minutes. It is regrettable that an accident to some of the condensing apparatus prevented blowing off these cooks, and after each cook it was necessary to allow the digester to cool gradually to 212° F. or less before the contents were discharged. Undoubtedly reducing substances were formed and retained which were the cause of erratic sugar data being obtained.

Cooks Nos. 51 and 52 were preliminary and were made for the purpose of outlining a method of procedure. The digested sawdust from both cooks was put into the leaching tanks and successively leached by sprinkling small quantities of boiling water over the digested sawdust and collecting the drip as soon as it had drained through the sawdust. The different extracts were then analyzed, neutralized, and fermented in the usual manner with the following results.

COOKS NOS. 53 AND 54.

Leach No.	Fermentation No.	Neutral juice before fermentation.		Beer.			Per cent of total sugars fermentable.	Theoretical alcohol.	Fermentation efficiency.	Acidity.		
		Sp. gr. at 15° C.	Reducing sugars, (grams per liter).	Sp. gr. at 15° C.	Reducing sugars (grams per liter).	Alcohol (per cent by weight), (liter).				Neutral juice.	Beer.	Increase.
1	10	1.0502	62.28	1.0262	17.40	1.910	71.40	2.164	88.26	6.2	12.0	5.8
	11	1.0508	61.70	1.0280	11.74	2.267	80.55	2.418	93.76	2.4	9.6	7.2
2	10	1.0482	61.56	1.0277	14.88	2.233	75.34	2.262	98.72	4.4	11.2	6.8
	11	1.0509	66.04	1.0270	14.74	2.313	77.16	2.478	93.34	4.4	10.4	6.0
3	10	1.0492	59.52	1.0273	17.08	2.171	70.68	2.050	105.90	6.4	12.5	6.1
	11	1.0480	60.24	1.0269	16.00	2.152	72.89	2.142	100.47	6.0	11.2	5.2
4	10	1.0486	62.12	1.0286	18.52	2.129	69.62	2.108	101.00	3.6	11.4	7.8
	11	1.0521	68.70	1.0296	18.88	2.360	71.91	2.400	98.33	4.0	9.6	5.6
5	10	1.0488	57.28	1.0304	17.86	1.844	68.26	1.905	96.80	2.4	10.4	8.0
	11	1.0532	62.28	1.0338	18.92	1.949	69.05	2.087	93.39	3.8	10.0	6.2

Cooks Nos. 53 and 54 were combined and handled in the same way; but not until previous experiments had indicated the quantities of water necessary to leach out approximately equal quantities of sugar. In all, nine leaches were made, although only the drip and the first eight leaches contained enough sugar to make a fermentation possible. The following table shows the amounts of water added for each leach, the amounts of extract recovered, the sugars and total solids in each extract, and the percentages of total sugars fermentable, with the fermentation efficiencies:

COOKS NOS. 53 AND 54.

Leach No.	Amount of water added.		Amount of extract recovered (pounds).	Sp. gr. of extract at 15° C.	Reducing sugars (grams per liter).	Weight of sugars in extract (pounds).	Total solids (per cent).	Total solids in extract, (pounds).	Ratio of sugars to total solids (per cent).	Acidity (c. c. N/10 NaOH per 100 c. c.).
	Liters.	Pounds.								
Drip	....	....	83.29	1.0482	74.54	5.93	8.187	6.72	88.3	73.4
1	20	44.0	38.39	1.0518	80.12	2.92	8.897	3.41	85.7	75.0
2	30	66.1	61.70	1.0522	79.48	4.66	8.866	5.47	85.3	74.5
3	30	66.1	63.76	1.0501	78.48	4.77	8.195	5.22	91.4	76.8
4	30	66.1	71.32	1.0504	75.86	5.12	8.180	5.83	87.9	74.6
5	50	110.2	94.21	1.0443	65.75	5.94	7.314	6.90	86.1	74.0
6	75	165.3	160.93	1.0360	50.08	7.77	5.757	9.27	83.4	63.0
7	100	220.5	194.21	1.0258	34.29	6.51	4.188	8.14	81.9	45.1
8	300	661.4	647.14	1.0109	14.00	8.96	2.198	14.21	63.1	18.9
9	500	1,102.3	997.94	1.0015	1.66	1.655	0.220	2.19	75.6	2.1

COOKS Nos. 53 AND 54—Continued.

Leach No.	Fermentation No.	Neutral juice before fermentation.		Beer.			Per cent of total sugars fermentable.	Therotetical alcohol.	Fermentation efficiency.	Acidity.		
		Sp. gr. at 15° C.	Reducing sugars (grams per liter).	Sp. gr. at 15° C.	Reducing sugars (grams per liter).	Alcohol (per cent by weight).				Neutral juice.	Beer.	Increase.
Drip	12	1.0515	62.38	1.0337	23.52	1.625	61.65	1.869	86.94	3.9	12.0	8.1
	13	1.0506	61.92	1.0284	10.84	2.188	82.12	2.474	88.44	8.0	13.2	5.2
1	12	1.0497	62.12	1.0422	44.70	0.648	27.51	0.832	77.88	3.8	7.0	4.8
	13	1.0460	55.12	1.0367	33.86	0.897	38.03	1.024	87.60	6.8	8.0	1.2
2	12	1.0473	57.08	1.0298	18.72	1.690	66.64	1.856	91.06	3.6	10.8	7.2
	13	1.0510	63.92	1.0284	11.74	2.266	81.22	2.525	89.74	9.4	12.4	3.0
3	12	1.0495	59.52	1.0275	10.04	2.087	82.77	2.399	86.99	3.7	12.1	8.4
	13	1.0520	61.96	1.0401	35.30	1.019	42.38	1.276	79.86	8.8	11.8	3.0
4	12	1.0508	57.74	1.0287	10.68	2.090	81.11	2.278	91.75	4.3	12.8	8.5
	13	1.0502	57.34	1.0299	12.36	1.913	78.02	2.177	87.87	9.2	12.4	3.2
5	12	1.0515	54.76	1.0321	13.12	1.836	75.60	2.012	91.25	3.9	12.9	9.0
	13	1.0538	58.34	1.0475	41.16	0.549	29.03	0.824	66.87	8.6	11.4	2.8
	14	1.0504	53.22	1.0329	15.24	1.646	70.89	1.836	89.65	8.0	12.4	4.4
6	12	1.0456	52.52	1.0343	7.84	2.016	84.91	2.180	92.48	3.3	12.2	8.9
	13	1.0490	47.38	1.0308	8.14	1.790	82.51	1.905	93.96	4.4	11.0	6.6
	14	1.0515	49.56	1.0324	8.28	1.951	82.92	1.999	97.60	6.0	10.0	4.0
7	12	1.0576	53.04	1.0371	8.48	1.851	83.69	2.145	86.29	4.1	12.4	8.3
	13	1.0496	46.19	1.0326	8.00	1.724	82.39	1.853	93.03	3.8	11.2	7.4
	14	1.0481	43.76	1.0314	7.78	1.682	81.94	1.748	96.22	6.4	11.0	4.6
8	12	1.0547	47.32	1.0380	9.00	1.772	80.67	1.850	95.78	3.6	12.0	8.4
	13	1.0519	44.14	1.0357	8.52	1.685	80.39	1.724	97.74	6.6	10.8	4.2
	14	1.0489	42.46	1.0338	7.56	1.610	81.94	1.695	94.98	6.4	12.0	5.6
9[1]	......	......	......	......	......	......	......	......	......	......	......	......

[1] Insufficient sugar for fermentation.

A considerable amount of variation will be noted in the percentages of total sugars fermentable, although all of the extracts, excepting Nos. 1 and 5, have at least one fermentation with over 80 per cent of the total sugars fermentable. Extract No. 5 shows one fermentation with 75.60 per cent of sugars fermentable, but both fermentations of extract No. 1 are very low. The latter is only 2.72 per cent of the total weight of extract obtained, but contains 5.40 per cent of the total sugar calculated as dextrose. Apparently we have here some strongly reducing substances present which are very soluble, which react as a sugar toward Fehling's solution, but which do not ferment. This material was also extracted in a greater or less quantity in the succeeding leaches up to and including No. 5, and it was, therefore, difficult for the yeast to get control and furnish a good fermentation. Not until the beginning of the sixth leach were fairly uniform and constant fermentations obtained.

From the foregoing results it is apparent that the sugars should be extracted as completely as possible, as the last extracts are apparently the purest from a fermentation standpoint. This work should be repeated, however, for additional data are necessary before final judgment is passed on a phase of the work of so great technica importance. The data given are indicative but insufficient to be conclusive in this respect.

Commercially, the subject of extraction, covering the questions of size, design, and number of cells in a diffusion battery, is one that has received a great deal of attention in the beet-sugar industry. In the light of data obtained in units of commercial size in the ethyl-alcohol industry, it may be said that at least a 5-cell draw—that is, passing the extracting medium through 5 cells in rotation—is necessary, and that a 6 or 7 cell draw is more desirable. The amount of water to be used and the proper end point or time of drawing must be determined for each particular battery, and with proper care and supervision the efficiency of the entire operation can be maintained at a 92 per cent extraction with a 10° to 11° Brix acid juice corrected for temperature.

VOLATILE ACID YIELDS.

In addition to the sugars obtained as hydrolytic products, acetic and formic acids were also obtained in varying amounts. The yields are given on the acid-yield sheet in the Appendix, in addition to the following tables, in which the cooks have been outlined in the different series as given before under pressure, time, water to wood and acid to wood ratios:

SERIES I*b*.

PRESSURE VARIABLE.

1.80 per cent of H_2SO_4; 400 per cent of H_2O (water); 0 minute.

Cook No.	Pressure.	Yield of volatile acid (per cent of dry weight of wood).		
		Acetic.	Formic.	Both.
20	6.5	1.25	0.105	1.355
15	7.5	1.22	.185	1.405
16	7.5	1.62	.220	1.840
19	9.0	1.60	.443	2.043

SERIES III.

TIME VARIABLE.

2.5 per cent of H_2SO_4; 125 per cent of H_2O; 7.5 atmospheres.

Cook No.	Time of cook (minutes).	Yield of volatile acid (per cent of dry weight of wood).		
		Acetic.	Formic.	Both.
31	0	1.755	0.572	2.827
45	0	1.670	.790	2.460
32	10	1.67	1.090	2.760
47	10	2.62	.340	2.96
46	20	2.360	1.450	3.81
56	45	2.915	1.492	4.407
55	90	2.140	.440	2.580

SERIES IIIa.

TIME VARIABLE.

1.4 per cent of H_2SO_4; 125 per cent of H_2O; 7.5 atmospheres.

Cook No.	Time of cook (minutes).	Yield of volatile acid (per cent of dry weight of wood).		
		Acetic.	Formic.	Both.
33	0	1.457	0.355	1.812
40	0	1.560	.470	2.030
24	10	2.39	.059	2.449
41	10	1.416	.430	1.846
42	30	1.55	.570	2.120

PRELIMINARY SERIES III.

TIME VARIABLE.

1.80 per cent of H_2SO_4; 400 per cent of H_2O; 7.5 atmospheres.

Cook No.	Time of cook (minutes).	Yield of volatile acid (per cent of dry weight of wood).		
		Acetic.	Formic.	Both.
15	0	1.22	0.185	1.405
16	0	1.62	.220	1.840
18	15	1.32	.598	1.918
17	30	1.48	.570	2.050

SERIES IV.

WATER TO WOOD RATIO.

1.80 to 1.83 per cent of H_2SO_4; 7.5 atmospheres; 0 minute.

Cook No.	Per cent of water.	Yield of volatile acid (per cent of dry weight of wood).		
		Acetic.	Formic.	Both.
26	400	1.75	0.431	2.181
21	300	1.52	.239	1.759
22	250	(1)	(1)	(1)
34	125	2.11	.480	2.590
30	100	1.38	.642	2.022

[1] Data not complete.

SERIES IVa.

WATER TO WOOD RATIO.

1.40 per cent of H_2SO_4; 7.5 atmospheres; 0 minute.

Cook No.	Per cent of water.	Yield of volatile acid (per cent of dry weight of wood).		
		Acetic.	Formic.	Both.
43	200	1.51	0.160	1.660
44	100	1.69	.290	1.980

Series V.

ACID TO WOOD RATIO.

125 per cent of H_2O; 7.5 atmospheres; 0 minute.

Cook No.	Sulphuric acid (per cent of dry wood).	Yield of volatile acid (per cent of dry weight of wood).		
		Acetic.	Formic.	Both.
38	0.5	0.87	0.430	1.30
37	.75	1.43	.253	1.683
35	1.00	1.05	.443	1.493
33	1.40	1.457	.355	1.812
40	1.40	1.56	470	2.030
34	1.80	2.11	.480	2.59
30	1.80	1.38	.642	2.022
31	2.50	1.755	.572	2.827
45	2.50	1.67	.790	2.460
36	4.00	2.43	.735	3.165

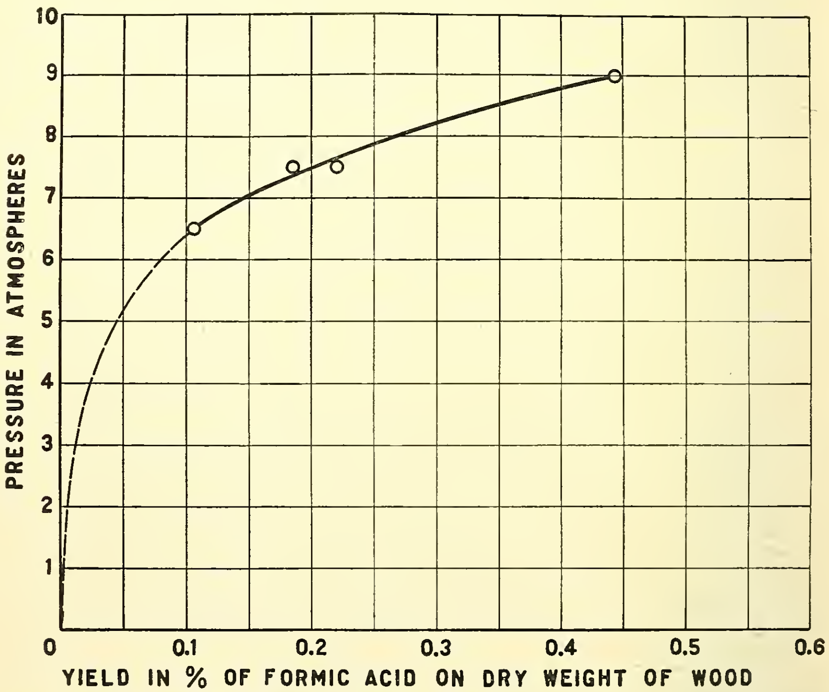


Fig. 10.—Series Ib, showing the variation in formic-acid yields, with varying cooking pressures. Cooking period, 0 minutes.

Both the yields of acetic and formic acid varied with the cooking conditions, although the former was the more constant of the two. The variations in the water to wood ratio in general seemed to be without effect on the yields of both acids, and this was to be expected. Increasing the pressure of cooking increased the amount of formic acid, particularly as shown in the curve for series *Ib* in figure 10, and this was apparently due in part to sugar decomposition. Increasing the acidity based on the dry wood increased particularly the amount of formic acid produced, whereas increasing the time of cooking seemed to increase both acids, although the increase of formic acid was proportionately much greater than that of acetic acid.

The source of these acids at the temperatures used is apparently a hydrolysis of the acetyl and formyl groups present in the lignin complex, as suggested by Cross and Bevan [41] and by Cross,[42] who determined these acids as results of the acid hydrolysis of a number of materials. Bergström [43] also obtained these acids as a result of hydrolysis without the aid of an acid catalyst, with the use of water at 6 atmospheres of pressure. Formic acid, however, with lævulinic acid, carbon dioxide, etc., is a decomposition product of the sugars, and undoubtedly the large increases in formic acid yields with increased pressure, time of cooking, and concentration of catalyst are due to sugar decomposition. The data are of particular interest as furnishing an approximate index of the degree of this decomposition.

These acids in certain concentrations also have a toxic effect on yeast growth and no doubt inhibit fermentation to some extent, even in the neutralized juice in which the acids are present as their calcium salts. In addition, nearly the same amount of acid was obtained at the Forest Products Laboratory as is usually obtained by the destructive distillation of this species of wood, and in a few cases more. It is known that the rapid decomposition of wood does not begin till a temperature of 275° to 280° C.[44] is reached, after which the decomposition is exothermic. Since the formic acid is derived from the wood and also from sugar decomposition, the amount hydrolyzed from the wood directly is difficult to determine. If this amount were known, it would give a helpful index, similar to the methoxy number now used, of the value of a species of wood for certain purposes. It has been shown beyond question [45] that the destructive distillation of cellulose, sulphite, or soda wood pulp, as well as cotton, yields acetic acid, but no methyl alcohol, and Klason and his coworkers have obtained a yield of 2.79 per cent of acetic acid from spruce sulphite cellulose. More than this amount of acetic acid was obtained in cook No. 56 at the Forest Products Laboratory by hydrolysis of the wood at a temperature 100° C. lower.

In view of the work of Cross and Bergström, it seems that the greater part of the acetic and formic acids, with the exception of the formic acid that results from sugar decomposition, comes from the hydrolysis

[41] Cross and Bevan, Berichte, 28, 1940.

[42] Cross, W. E., Dissertation, Göttingen, 1910, Ueber das Vorkommen der Formyl- und Acetyl Gruppen im Lignin.

[43] Bergström, Der Papierfabrikant, 2, 305.

[44] Klason, P., Jour. für prakt. Chemie, 1914, 90, 413–447.

[45] Buttner, G., and Wislicenus, H., Jour. für prakt. Chemie, 79, 177–234; Klason, von Heidenstam, and Norlin, Zeit. für ang. Chemie, 1909, 1205.

of the acetyl and formyl groups in the lignin. Bergström obtained as much as 1.53 per cent acetic acid and 0.23 per cent of formic acid from spruce boiled in water at a pressure of 6 atmospheres for two hours without any catalyst, whereas cellulose produced from spruce yielded only 0.08 per cent of combined acids under similar treatment.

This being true, the maximum amount of acid obtainable from wood is the sum of the acid produced by the destructive distillation of the cellulose and the hydrolysis of the lignin. This would be 5.7 per cent total acid, which, so far as the writer's knowledge extends, has never been obtained by the destructive decomposition of wood. Undoubtedly secondary decomposition products are formed, such as $2CH_3COOH = (CH_3)_2CO$ plus H_2O plus CO_2, $2\ HCHO$ plus $H_2O = CH_3OH$ plus $HCOOH$, and similar reactions, which may account for the acetone and in part for the formic acid obtained from destructive distillation.

A series of destructive distillations has been made at the Forest Products Laboratory on spruce and spruce-digester residues cooked with sulphuric acid for sugar and alcohol production. These distillations were made, some slowly and some quickly, some very wet and some very dry, to determine whether the hydrolytic effect noted above could be reproduced in the destructive-distillation process. The details of this work are being reserved for later publication; but it may be stated here that the distillation of either wet wood or wet residue produced more total acid than was obtained from the dry wood or dry residue under similar distillation conditions, showing that there was a hydrolytic effect from the added water. The increased amount of acid, however, was not sufficient to pay for its recovery from the more dilute pyroligneous acid produced.

Aside from the scientific interest of the subject and its bearing on the chemistry of wood, the technical importance of the recovery of these acids is to be considered. As outlined previously, this has been attempted in France and in the processes covered by the patents granted to Cohoe in this country. Cohoe, however, worked with broad-leaved woods, which would give even larger amounts of these acids. The table in the Appendix, however, shows that the amount of acid which might be recovered in the condensed blow-off averages only about 10 per cent of each, and this would yield a condensate of little value. As the average concentration of acetic acid in the condensed blow-off was only about 0.20 per cent, it is questionable whether recovery in commercial amounts is possible. If some means could be devised, however, for washing out the volatile acids with steam and making a practically complete recovery of them without too great expense or delay to the digester cycle, these acids might form a valuable by-product of this industry.

EFFECT OF TANNIN AND BARK.

Various mixtures of spruce and spruce bark were cooked under the usual conditions of 7.5 atmospheres of pressure, 125 per cent of water, and 2.5 per cent of sulphuric acid based on dry weight. The results are given in the following table:

	Cook No.	Total sugars (per cent of original dry weight).	Per cent of total sugars fermentable.	Alcohol yields.	
				Per cent of original dry weight.	Gallons absolute per dry ton.
All spruce wood	84	22.11	70.38	7.457	22.55
91.5 per cent of wood, 8.5 per cent of bark	87	19.60	69.47	6.765	20.46
74.5 per cent of wood, 25.5 per cent of bark	85	22.49	60.04	6.364	19.25
All bark	88	17 07	31.95	2.730	8.25

From the result it is seen that as much as 25 per cent of spruce bark may be mixed with the wood without appreciably decreasing the yield of alcohol. Other barks were not available in sufficient quantity to determine the practical limits to which they may occur in waste mixtures without appreciable effect. Commercial experience however, has shown that not more than 10 per cent of the total of yellow pine may be bark without seriously affecting the yield. Spruce bark has long been used in Europe as a tanning material and has found favor because of its high sugar content, which in the "mellowing" or fermentation and acidification of the tanning liquors produced a comparatively large amount of acid and was therefore used as a plumping agent.

The tannin present shows no inhibitory action toward yeast growth, for even sugar liquors produced from red and white oak gave normal fermentation and fermentation efficiencies. In commercial practice other factors have been found, such as long cooking periods with increased formations of acids, acetone, and aldehydes, which influence yeast growth and fermentation much more than does the tannin found in the sugar liquors usually produced from mill waste.

EFFECT OF CATALYZERS OTHER THAN SULPHURIC ACID OR IN ADDITION THERETO.

As indicated previously, Körner, Cohoe, and others have attempted the production of sugar and alcohol from wood with the use of hydrogen peroxide, potassium dichromate, and potassium persulphate as hydrating and oxidizing agents in addition to sulphuric acid, and these investigators have also recommended the use of hydrochloric acid. The experiments at the Forest Products Laboratory have been only preliminary to an investigation of the field, but they have confirmed several known facts besides establishing several new ones.

Theoretically, hydrochloric acid, because of its maximum ionization should produce even greater sugar yields than sulphuric acid. Hydrochloric acid presents greater technical difficulties than does sulphuric acid, and its cost is greater; however, if the yield were increased sufficiently, the other difficulties could probably be overcome. Two concentrations of hydrochloric acid were therefore tried, one of 1.80 per cent and another of 2.50 per cent, based on dry-wood weight, and the respective total sugar yields were 19.69 per cent and 17.02 per cent. The complete data on cooks Nos. 89 and 90 are given in the tables in the Appendix. That yeast is intolerant of the Cl ion is well known, and the laboratory workers were unable, as others before had been, to obtain any fermentations. Unless, therefore, the Cl ion is removed by precipitation, as with silver nitrate, fermentation is impossible. No fermentation was obtained when chlorine or chlorides were used. The chief interest of the following experiments, therefore, is in the data adduced with respect to total sugars, for, as stated before, if it were possible materially to increase the total sugars obtained, other difficulties might possibly be overcome.

Spruce.

7.5 atmospheres; 125 per cent of H_2O.

Cook No.	Catalyst.	Total reducing sugars (per cent of original dry wood).
93 90	1.8 per cent of hydrochloric acid	18.25 19.69
89	2.5 per cent of hydrochloric acid	17.02
92	1.8 per cent of sulphuric acid plus salt (NaCl) for equation $H_2SO_4+NaCl=NaHSO_4+HCl$	20.44
94	1.8 per cent of sulphuric acid plus salt (NaCl) for equation $H_2SO_4+2\,NaCl=Na_2SO_4+2\,HCl$	19.44
95	2 per cent of chlorine from $2\,KClO_3+H_2SO_4+10\,HCl=K_2SO_4+6\,H_2O+6\,Cl_2$	19.59
96	1.8 per cent of sulphuric acid plus 10 per cent of $KClO_3$ to make $2\,KClO_3+H_2SO_4=K_2SO_4+2\,HClO_3$	20.34
97	1.8 per cent of sulphuric acid plus 50 per cent of $KClO_3$ to make $2\,KClO_3+H_2SO_4=K_2SO_4+2\,HClO_3$	21.45

The above table shows no yields of total sugars greater than it is possible to obtain with the use of sulphuric acid only. Even if all the sugars produced were fermentable and could be fermented, the yield would not justify the added expense. Simple chloride and chlorine treatments in their technical aspect may, therefore, be dismissed, although the results are of interest in their bearing on the chemistry of wood.

The next experiment was with the use of ferrous sulphate in conjunction with sulphuric acid—that is, with an increase in the concentration of sulphate ions. The result, especially when taken in connection with the experiments on niter cake described below, is of sufficient interest and value to warrant further investigation. Reference should be made to all the data of cook No. 104, which was a standard cook using 1.8 per cent of sulphuric acid plus 0.1 per cent of ferrous sulphate. The results are given in the following table, along with data from cook No. 34, showing the results from the use of 1.8 per cent of acid without the addition of ferrous sulphate. Although the differences between the two cooks are small, the slight increase in fermentable sugar when the ferrous sulphate was used is worthy of consideration.

125 per cent of H_2O; 7.5 atmospheres.

Cook No.	Catalyst.	Total sugars.	Per cent of total sugars ferment-able.	Alcohol yield.	
				Per cent of dry wood.	Gallons per ton.
34	1.8 per cent of H_2SO_4	21.96	59.29	6.805	20.58
104	1.8 per cent of H_2SO_4; 0.1 per cent of $FeSO_4$	21.40	63.23	6.927	20.97

Two cooks were made with niter cake furnished through the courtesy of the E. I. du Pont de Nemours Co. In cook No. 107, niter cake only was used, and the amount of it was equivalent to 1.8 per cent of concentrated acid. In other words, 5.55 pounds of cake are equal to 1 pound of 100 per cent acid. In cook No. 108 a mixture of 0.9 per cent of acid and niter cake equivalent to 0.9 per cent of acid, making a total of 1.8 per cent of acid, was used. The results follow:

Cook No.	Catalyst.	Total sugars.	Per cent of total sugars ferment-able.	Alcohol yields.	
				Per cent of dry wood.	Gallons per ton.
107	Niter cake	17.93	60.13	5.583	16.89
108	0.5 niter cake, 0.5 H_2SO_4	19.25	59.18	5.077	15.38

When these results are compared with those obtained from the use of acid alone, it is found that niter cake will produce, either alone or when mixed with as high as 50 per cent of the usual acid concentration, 75 or 80 per cent of the yield obtained with sulphuric acid alone. These experiments suggest interesting possibilities, provided the niter cake can be obtained at an appreciable saving as compared with the cost of sulphuric acid.

Three cooks were made with the use of phosphoric acid (H_3PO_4) alone or in mixture with sulphiric acid, and the results were as follows:

Spruce.

7.5 atmospheres; 125 per cent H_2O.

Cook No.	Catalyst.	Total sugars (per cent of original dry wood.)	Per cent of total sugars ferment-able.	Alcohol yields.	
				Per cent of original dry wood.	Gallons per ton.
100	1.8 per cent of sulphuric acid, 0.1 per cent of phosphoric acid.	21.12	64.32	7.726	23.24
101	0.9 per cent of H_2SO_4, 0.9 per cent of H_3PO_4.	20.83	55.20	5.635	19.62
102	1.8 per cent of H_3PO_4	19.38	51.58	5.180	15.69

The above results are even better than were to be expected, if the relative degrees of dissociation of the two acids are considered. The slight increase in yield of cook No. 100, containing 0.1 per cent of phosphoric acid in addition to 1.8 per cent of sulphuric acid, as compared with cook No. 34 (p. 55), containing 1.8 per cent of sulphuric acid only, is not sufficient when its cost is considered to warrant the commercial use of even small quantities of phosphoric acid. Phosphates, of course, are necessary for yeast growth; and if they are present in considerable quantities in the mash during fermentation they act as a yeast stimulant. It has not been found necessary, however, to add any great quantity of phosphates in order to secure satisfactory fermentation. A pound or two of ammonium phosphate or a pint of "sirupy" acid added to the starting yeast in the early stages of its propagation is sufficient to insure vigorous growth.

STUDY OF DIFFERENT SPECIES.

All the cooks in this series were made under the following conditions: 2.5 per cent of sulphuric acid; 125 per cent of water; 7.5 atmospheres of pressure; 20 minutes cooking period. The results obtained divide the different species into their natural botanical classifications, namely, the coniferous and broad-leaved species. Although not all species in each class were tested, authentic samples of enough species were used to demonstrate the value of most of those woods that are commonly available for this process.

CONIFEROUS WOODS.

The results of the experiments on the various coniferous species are given in the following table:

Cook No.	Species of wood.	Total reducing sugars (per cent of original dry wood).	Per cent of total reducing sugars.		Alcohol yields.		
			Fermentable.	Unfermentable.	Per cent of original dry wood.	Gallons of absolute per dry ton.	Gallons of 190-proof per dry ton, allowing 5 per cent distillation loss.
63	White pine, Idaho	21.00	74.49	25.51	7.762	23.48	23.43
64	Red spruce	20.48	74.16	25.84	7.565	22.88	22.84
65	Douglas fir, Montana	21.10	[1] 67.42	[1] 32.58	6.822	20.64	20.59
66	White pine	20.02	75.67	24.33	7.437	22.48	22.46
67	Longleaf pine	23.06	73.32	26.68	8.282	25.05	24.90
68	do	23.25	72.49	27.51	8.330	25.20	25.16
69	Lodgepole pine	21.93	67.37	32.63	7.205	21.79	21.75
70	Norway pine extra large or small ships	25.62	66.88	33.12	7.745	23.42	23.38
71	Red spruce	22.06	72.67	27.33	7.956	24.06	24.01
50 [1]	Western larch	29.72	37.89	62.11	4.977	15.05	15.03
83 [2]	do	30.52	57.88	42.12	8.687	26.26	26.21
72 [3]	do	26.21	54.69	45.31	6.934	20.97	20.93
86	Western hemlock	21.15	77.63	22.37	7.622	23.05	23.01
99	Sugar pine	18.03	72.55	27.45	6.276	18.96	18.93
103	do	20.23	66.49	33.51	7.115	21.51	21.47
74	Douglas fir, Washington	21.13	75.16	24.84	7.934	23.99	23.95
46	White spruce	23.61	71.44	28.56	8.537	25.82	25 78

[1] 1.8 per cent of acid; 10 minutes cook.
[2] 2.5 per cent of acid; 20 minutes cook.
[3] 2.5 per cent of acid; 40 minutes cook.

The experiments on western larch will be considered separately. No great differences were found among the various other species. Those highest in cellulose, like white spruce and white pine, gave the best yields. The West Coast Douglas fir gave higher yields than the Montana mountain-grown fir. Cook No. 70 was on Norway pine chips left from the Yaryan extraction process, in which the turpentine had been steamed out and the rosin had been dissolved out with gasoline. The yield was probably 3 to 5 per cent higher than it would have been on the original wood basis, because of the difference in cellulose content calculated on a basis of freedom from volatile oil and rosin, as compared with the original wood. At the same time, the results of cooks Nos. 67 and 68 on true longleaf pine showed that the turpentine, pine oil, and rosin do not interfere in the production of the sugars from the wood or in the fermentation of the sugar liquors produced. However, sugar liquors produced from woods having appreciable quantities of volatile oils do contain some of the oils mentioned, and, unless particular care is exercised in the distillation and refining of the beers and alcohol made from such liquors, the alcohol finally obtained will contain some of those oils. On the other hand, it is not impossible to remove the oils, as evidenced by the fact that the finest Cologne spirits being produced in this country to-day is manufactured from longleaf pine.

Practically all the commercially available coniferous woods of this country are of equal value for alcohol production, and, as the waste from them constitutes the greater portion of the mill waste of the country, the results obtained from the experiments with them are naturally the most interesting. Cypress and the cedars were not tried; and the writer has no data to present regarding them except commercial results obtained from cypress in mixture with longleaf pine. As the exact composition of the mixture is not known, no positive data can be offered; it may, however, be said that cypress seems to give yields only from 60 to 75 per cent as good as pine.

The different results obtained in cooks Nos. 50, 83, and 72 on western larch are due to differences in material as well as in treatment. The differences will be considered in greater detail later. Cook No. 50 was made on material from the butt log, which is usually left in the woods, and with 1.8 per cent acid at 7.5 atmospheres for 10 minutes. Cooks Nos. 72 and 83 were made with 2.5 per cent of acid, the first for 20 minutes and the second for 40 minutes. Unfortunately, all three cooks were not made on material from the same sample, although cooks Nos. 72 and 83 were on the same sample and indicate a tendency toward an increase of fermentable sugars with an increase in the time of cooking. This tendency is probably due to pentose decomposition, as it was with spruce. The high figure for total sugars is due to the production of galactose, which is not fermentable under ordinary conditions, and the figures for fermentable sugars are therefore correspondingly lower than they are in the other coniferous woods.

BROAD-LEAVED WOODS.

The broad-leaved woods neither give the yields obtained from the coniferous woods, nor do they exhibit the uniformity of yield shown by the coniferous species. The yields of total sugars are sometimes nearly as great as those obtained from the coniferous species; but, as the following table shows, the portion of the total sugars fermentable is very much less than that from the coniferous species:

Cook No.	Species of wood.	Total reducing sugars, per cent of original dry wood.	Per cent of total reducing sugars.		Alcohol yields.		
			Fermentable.	Unfermentable.	Per cent of original dry wood.	Gallons of absolute per dry tons.	Gallons of 190-proof per dry ton allowing 5 per cent distillation loss.
62	Birch	20.53	46.29	53.71	4.288	12.97	12.95
73	Hard maple	18.93	34.04	65.96	3.029	9.16	9.14
75	Silver maple	20.74	47.22	52.78	4.661	14.10	14.07
76	Beech	21.24	22.22	77.78	1.995	6.03	6.02
77	White oak	17.30	50.48	49.52	4.102	12.40	12.38
78	Red oak	18.38	30.40	69.59	2.675	8.09	8.07
79	Sycamore	18.30	38.86	61.14	3.205	9.69	9.67
80	Slippery elm	16.60	26.79	73.21	1.382	5.99	5.98
81	Red gum	20.42	38.81	61.19	3.658	11.06	11.03
82	Cottonwood	18.19	32.86	67.14	2.392	7.23	7.21

The reason for these marked differences between the evergreens and the deciduous trees must reside in their chemical composition rather than in any physical or structural differences and, no doubt, may be ascribed primarily to differences in cellulose content. As a class, the deciduous trees contain less cellulose and more lignin and wood gums than the coniferous species. The gums, such as xylan and araban, are in part converted into the respective pentose sugars. This accounts for the comparatively high total sugar yields and also for the comparatively small portion of the sugar that is fermentable. Those constituents, lignin and gums, which make the hardwoods as a class, and especially beech, birch, and maple, desirable in destructive distillation, bring about a different result in alcohol production, and it is questionable whether commercial recovery would be possible from any of those species alone that are mentioned in the above table. If mixed in small amounts with coniferous waste, the broad-leaved species will not interfere with the production of sugar and alcohol from the coniferous waste, in spite of the large amounts of acetic and formic acids produced. In fact, it is when the recovery of these acids is considered in conjunction with the alcohol process that hardwood waste utilization appears possible if the waste is available in sufficient quantity.

Ordinary destructive distillation practice recovers 180 pounds of crude acetate of lime per cord of wood. Under good conditions this may be brought up to 200 or 220 pounds per cord.

The following table shows the amounts of acetic and formic acid produced from beech, birch, and maple, the three species commonly distilled:

Cook No.	Species.	Acetic acid (per cent of original dry wood).	Formic acid (per cent of original dry wood).	Total volatile acid (per cent of original dry wood).
76	Beech	4.800	0.445	5.245
62	Birch	4.700	.706	5 406
73	Hard maple	3.770	.512	4.282

The amounts of acetic acid produced, as shown in the above table, are equal to or greater than the amounts produced by the destructive-distillation process; and, aside from the technical value of the facts disclosed, additional light is thrown on the difference in chemical composition of those woods and woods of the coniferous species.

SOURCE OF FERMENTABLE SUGAR.

As previously outlined, the source of the fermentable sugar obtained from the hydrolysis of wood has long been a mooted question. Cellulose and materials higher in cellulose than wood, however, have yielded fermentable sugars and alcohol in proportion to their cellulose content. In order to throw additional light on this subject, and also to ascertain whether another common waste material other than mill waste could be used for the production of alcohol, cook No. 50 was made on western larch.

The logging of western larch shows a woods loss of about 8 per cent, caused by butting off the lower portion of the tree.[46] The presence of shakes in the butt is chiefly responsible for this practice. In addition, the base of the tree is usually swollen. This portion is denser than the rest of the trunk, and usually sinks, thus preventing rafting. The length of the butts left in the woods varies from 4 to 8 feet, although a 16-foot piece is sometimes rejected.

Hitherto the utilization of this waste material has not met with success, and it was hoped that it might profitably be employed as a raw material in the production of alcohol. A sample of sawdust from a butt log was cooked with 1.8 per cent of sulphuric acid, 125 per cent of water, 7.5 atmospheres of pressure, for 10 minutes. A yield of sugars equal to 29.72 per cent and of total solids equivalent to 35.18 per cent of the dry weight of the wood was obtained. Under the same conditions white spruce would yield from 22 to 23 per cent of total sugars of which 60 to 65 per cent would be fermentable, making an alcohol yield of 6.8 to 7 per cent of the dry weight of the wood. The extracts obtained from the hydrolysis of the larch were fermented under standard conditions, the fermentation records and the alcohol yields being shown in the tables in the Appendix.

The larch yielded about 35 per cent more of total sugars than did the spruce, and yet only 37.9 per cent of that sugar fermented as compared with 60 or 65 per cent of the total sugar from spruce. A. W. Schorger, of the Forest Products Laboratory, has analyzed both of these woods with the following results:

	Western larch (base) (per cent).	White spruce (4 samples).	
		Range (per cent).	Mean (per cent).
Soluble in ether	9.75	0.90 to 1.95	1.36
Soluble in cold water	14.47	.82 to 1.45	1.12
Soluble in hot water	16.52	1.88 to 2.52	2.14
Soluble in 1 per cent of NaOH, 10 minutes heating	32.72	6.72 to 8.84	7.70
Soluble in 1 per cent of NaOH, 60 minutes heating	38.58	11.18 to 13.87	12.21
Pentosan	6.99	10.04 to 10.78	10.39
Methyl pentosan	3.42	3.08 to 3.95	3.55
Cellulose	42.57	51.95 to 58.47	56.17
Volatile oil	.84		
Ash	.36	.285 to .326	.307

It will be noticed that the larch contained a large amount of material soluble in water and a proportionately small amount of cel-

[46] U. S. Department of Agriculture, Forest Service, Bulletin 122, "The Mechanical Properties of Western Larch," by O. P. M. Goss.

lulose. The chief constituent of this material soluble in water was a galactan that yielded approximately 10 to 12 per cent of the dry weight of the wood of galactose, and this in turn accounts for the high sugar yields from the larch. If the sugar yield of the larch were recalculated, so that it would be proportionate to the cellulose content (22 per cent being assumed as the yield of sugar from spruce), there would then be 16.7 per cent of sugar instead of 29.7 per cent, as actually obtained. However, as noted above, about 10 or 12 per cent of galactose was obtained. If this were subtracted from the total sugar yield of 29.7 per cent, there would remain 18 or 19 per cent of sugar comparable to the yield obtained from spruce. Under normal conditions, with a good fermentation and on the assumption that 60 to 65 per cent of the total sugar would be fermentable, there would be an alcohol yield of 4.8 to 5.2 per cent; whereas the actual alcohol yield obtained from the larch is 4.997 per cent. This corresponds to about 62 per cent of the total sugars fermentable, which is the average of the above figures chosen for spruce. It appears, therefore, that the yield of fermentable sugars and of alcohol is proportionate to the cellulose content of the wood, as suggested by Körner,[47] but disputed by Gallagher and Pearl,[48] irrespective of other materials that may be present in the wood.

Western larch butts will be a good raw material for the production of ethyl alcohol if a yeast is found that will ferment the galactose as well as the dextrose within the time limit and under the other conditions as prescribed by the Bureau of Internal Revenue.

In addition to the evidence regarding the source of the fermentable sugars that was presented in the description of the results obtained from the broad-leaved woods, cook No. 98 was made on the leached residue from cook No. 95, which had been given a chlorine and sulphuric acid treatment. Cooking this residue with 2.5 per cent of sulphuric acid gave only 6.56 per cent of total sugars as compared with the 22 per cent normally obtained from spruce. Through an accident the sugar liquor was lost and no fermentations were made, but the data obtained shows the small yield of sugars obtainable on reinversion, and also indicates that the source of the sugars is the cellulose; for, if the lignin as well as the cellulose were the source, as much sugar would be obtained from the residue as from the original wood, equal weights of material being compared.

BY-PRODUCTS.

From longleaf pine and the other pines of the South, about 1 gallon of crude turpentine per cord, consisting of the higher-boiling fractions of turpentine and pine oil, can be recovered from the blow-

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[47] Zeit. für ang. Chemie., 1908, 2353.

[48] Proc. Eighth International Congress of Appl. Chemistry, vol. 13, p. 147.

off. The commercial values of the beer-still slops that contain the unfermented pentoses, and of the solid residue from the diffusion battery are being investigated. Recent investigations point to the use of the latter as a stock food. The potential value of both of these by-products is very great, and their investigation is exceedingly interesting both as a chemical and as a commercial question.

ANALYSIS OF RESULTS.

In a review and summary of the results obtained from the experiments described in this paper, the following points seem to be established for coniferous woods:

1. The temperature and pressure of cooking should not exceed 7.5 atmospheres (112 to 115 pounds per square inch).

2. This temperature and pressure should be reached as soon as technically possible, and the boiler capacity of the plant should be such that this may be accomplished in 15 or 20 minutes.

3. The digester contents should be cooked at the above pressure and temperature for 15 or 20 minutes. This requires only enough steam for radiation.

4. The ratio of water to dry wood should be about 125 parts of water to 100 parts of dry wood.

5. The ratio of sulphuric acid (100 per cent) to dry wood should be from 1.8 to 2.5 parts of acid to 100 parts of dry wood.

6. Under the above conditions a yield of 25 gallons of 190-proof alcohol per dry ton has been obtained, allowance being made for a distillation loss of 2.5 per cent, but no allowance being made for any manufacturing losses.

7. After the cooking, the digester should be blown off as quickly as possible. If the plant is operating on longleaf pine or a similar resinous wood, about 1 gallon of crude turpentine can be recovered per cord. If the plant is operating on other coniferous species, the amount of turpentine in the blow-off will not pay for recovery; and the same thing is true of the volatile acid in all coniferous species. Usually the digester may be blown off directly into the air.

8. Under the above conditions a complete cycle for each digester would be about as follows:

	Minutes.
Loading	5 to 5
Heating	15 to 20
Cooking	15 to 20
Blowing-off	5 to 8
Discharging	5 to 7
Total	45 to 60

9. Broad-leaved woods produce only about one-half as much fermentable sugars and alcohol as do coniferous woods, although the

volatile-acid production from some of the broad-leaved woods is as great as that from the same species by the destructive-distillation process.

10. Sulphuric acid and possibly some sulphates are the best catalysts if cost, technical conditions, and yields are all considered.

11. Chlorides prohibit fermentation, but tannin in the concentrations as ordinarily obtained does not.

PLANT EQUIPMENT AND OPERATION.

The essential parts of a plant equipped to produce ethyl alcohol from wood, considered in the order of their use, are as follows:

1. Adequate sawdust storage.
2. Disintegrating equipment—hogs, screens, and shredders.
3. Sawdust storage above digesters, and acid storage.
4. Digesters.
5. Diffusion battery.
6. Neutralizing and settling tanks.
7. Coolers.
8. Fermenters and yeast equipment.[49]
9. Beer still.[49]
10. Rectifying still.[49]
11. Bonded warehouse.[49]
12. Boilers and engines.
13. Laboratory and office.
14. Charcoal rectifiers (desirable, but not absolutely necessary).

SAWDUST STORAGE.

What constitutes adequate sawdust storage will depend upon the location and the continuity of operation of the sawmill and upon the character of the logging operation. The operation of the alcohol plant and distillery must be continuous. The storage, therefore, must be adequate to make it possible for the plant to comply with the regulations of the Bureau of Internal Revenue governing the operation of distilleries. These alcohol plants are surveyed as to their output and must produce daily the amount required in the survey; if they do not produce that amount, they are penalized with the tax on such a quantity of alcohol as is necessary to make up the amount required by the survey. In general, therefore, the alcohol plant should have at least 15 days' supply of wood on hand; and, if the logging operations require frequent shutdowns, the alcohol plant should always have sufficient material in storage to last twice as long as the average shutdown. The waste may be best stored and handled in the condition in which it is ready for use, that is, hogged and shredded. Protection from the rain is all that is needed, and any type of open-walled, covered building would be suitable. Belt conveyors may be used to handle the material, and

[49] These items must be approved and supervised by the U. S. Bureau of Internal Revenue.

a long, open, covered shed with an inclined bottom sloping into a trough, similar to those used for the storage of sugar beets, would answer the purpose; or the material may be windrowed in piles and permitted to hopper itself, the danger of its rotting in the hoppers being obviated by this plan.

All hoppers, both in the storage building and over the digesters, as well as all other parts of these buildings coming in contact with the hogged and shredded waste, should be either of steel or of heavily creosoted timber construction in order that decay may be avoided. The green shredded wood makes an ideal medium for the cultivation of wood-destroying fungi, and even in exposed places too dry, it would seem, for decay to take place, the writer has found it progressing rapidly wherever there were accumulations of fine stuff.

DISINTEGRATING EQUIPMENT.

The disintegrating equipment should consist of hogs or chippers, shredders, and screens. A chip one-half an inch long in the direction of the grain will be penetrated thoroughly with acid, but the ease with which the sugar can be leached out is a problem that requires attention. However, as the residual digested sawdust or waste after extraction is ample for power production, and as all exhaust steam from the engine has value for heating and distillation purposes, the extra power required to chip down to a three-sixteenths or one-quarter inch chip would not be prohibitive, and the greater efficiency of extraction would probably make the chipping down very desirable. After being screened—for the screenings should be reshredded—the fine stuff should go by belt to the loading bin over the digester.

SAWDUST AND ACID STORAGE.

The loading bins should be of sufficient size to serve as intermediate storage for the material as it comes from the screen on its way to the digester. Each of the bins should hold several digesterfuls and should be placed over the digester, being tapered down so that the material may flow directly into the digester, according to the arrangement in chemical-pulp plants.

The acid intended for the plant should be in concentrated form, to permit of shipment in tank cars and storage in steel tanks. The concentrated acid should be pumped into a lead-lined tank above the digester and be diluted in order that the dilute acid may flow into the digester along with the sawdust. If rotating digesters are used, no special mixing apparatus will be necessary; at least, no appreciable quantities of uncooked material have ever been found at the Forest Products Laboratory when such digesters were used.

DIGESTERS.

The digesters should be of the rotating kind, and may be spherical or in the form of a short cylindrical section with dished ends. If they are of the latter type, the diameter should be double the length of the cylindrical section in order that the digester may be filled as nearly full as possible. A number of satisfactory acid-proof linings are now obtainable. During the cooking the mass shrinks in volume and settles, the final volume being only about two-thirds the original volume. There is, therefore, ample room for thorough mixing during the cooking.

The size of the digesters will be governed by the daily capacity of the plant, the heating period, and the time of the complete cycle for each digester. If the heating period is 15 minutes out of a total of 1 hour for each cook, four digesters or multiples of four should be used; whereas if the heating period is 20 minutes out of a total of 1 hour, only three or multiples of three should be used. In this way the steam load on the boilers will be made as uniform as possible. The boiler capacity will be largely determined by this load, since that for power and distillation purposes will usually be constant. In addition, the hogging, shredding, and digester capacity of the plant should be sufficient to give enough digested sawdust in 18 or 20 hours to run the rest of the plant 24 hours, thereby allowing time for breakdowns and repairs.

By the rotation of the digester the cooked sawdust is discharged and falls into a large bin, which receives this material from all the digesters. From this bin it goes by mechanical conveyor to the different cells of the diffusion battery.

DIFFUSION BATTERY.

Closed cells similar to those used for the extraction of sugar beets or dyewood chips may be used. These should be lined and made acid-resistant like the digesters, and are usually fitted with bronze and copper. The top and bottom should be so arranged that charging and discharging may be readily accomplished. Cells of this type may be obtained from which the extracted material will empty itself when the bottom of the cell is released.

The temperature of the extracting water will rise 30° to 50° F. during extraction because of the hot dust. In cold weather it would be advisable to warm the water before it is used. If the acid juice comes from the battery with a temperature between 125° and 150° F., a good extraction will be obtained, and the large volumes of water that would be required to cool hotter juice will not be necessary.

The size and number of cells in the battery and the amount of water in each cell will be governed by the size of the plant and the size of the material that is to be cooked, as, for instance, sawdust will extract more readily than larger material. As the sugars are readily soluble, only a short extraction period is necessary—that is, from 5 to 10 minutes on each cell—making a total extraction period of 50 to 75 minutes. This period, however, will be governed in part by the length of time that it takes the water to drain through each cell, and this in turn depends on the size of the cell.

The cells should not be too large, else the extracting water will not pass through the material easily, and there will be a tendency to channel. The amount of water used should be such as to make the resulting acid extract 11° to 12° Brix, the proper concentration for fermentation. The Brix will rise another degree on neutralization.

As in laboratory work, so in regular practice, a large number of extractions or washings with small amounts of liquid will give a better extraction or a more thorough washing with a more concentrated extract than will fewer extractions with larger amounts of water for each extraction.

NEUTRALIZATION AND SETTLING.

After extraction the acid extract is nearly neutralized with lime or a high-grade limestone. For this purpose a magnesia stone is undesirable. For a number of reasons it has been found preferable to cool the acid juice to 100° F. or less before it is neutralized. During neutralization the temperature will rise a few degrees. The extract is then allowed to stand and settle out the sludge of calcium sulphate. As this usually requires from 15 to 18 hours, adequate tank capacity is required.

COOLERS.

The clear juice is then drawn off and passed through coolers to reduce its temperature to from 80° to 90° F., after which it goes into the fermenting tanks. The coolers should be of copper, and their size will depend upon the temperature of the water supply available. As the calcium sulphate in the neutral juice will partially crystallize out during the cooling, the coolers should be so designed as to be easily taken apart and cleaned.

FERMENTATION, DISTILLATION, ETC.

A 96-hour fermentation period is permitted; hence a 4-day fermenter capacity is required. The size of the individual fermenter will be determined largely by the outdoor mean temperature and other local conditions. The other apparatus is the standard distillery equipment in use in grain and molasses distilleries.

POWER REQUIREMENTS.

The steam load of the plant will be distributed about as follows:

	Per cent.
Pumps—boiler, fire, general water supply, beer, alcohol	20
Digesters	30
Hogs and shredders	20
General power for driving conveyors, digesters, etc	15
Distillation and rectification, (including all exhaust steam not used for heating boiler-feed and extraction water)	15
	100

A large supply of pure, cool water is also necessary. It should be pure for boiler and extraction purposes, and cool for use in cooling and condensing. The disposal of the beer-still slop requires attention, because it contains a large amount of pentose carbohydrate and dead yeast; the latter of which is highly nitrogenous. However, the slop does not putrefy on standing and will maintain a nearly sterile condition for a long time.

COSTS.

As outlined before, the commercial production of alcohol by this process, with two exceptions, has not been a success. If such a yield is assumed, however, as that obtained at the Forest Products Laboratory, and if the necessary manufacturing losses are allowed, as for instance, the extraction loss in the sludge of the settled juice, and the distillation and rectification losses (which, combined, should not be over 20 per cent of the total product), a yield of about 20 gallons a dry ton is obtained. Assuming this yield, and a location in which the supply of waste will be uniform and constant for a period of 20 years, and in which plenty of good water may be had, with a supply of sulphuric acid and lime reasonably nearby, the cost of a gallon of 190-proof alcohol from wood in a properly designed and constructed plant having a capacity of 2,500 or 3,000 gallons a day, is estimated to be as follows:

Yeast nutrients	$0.015 to	$0.020
Repairs and materials (exclusive of fuel and wood)	.030 to	.040
Labor	.015 to	.030
Wood and fuel	.020 to	.020
Interest at 7 per cent	.019 to	.020
Depreciation at 10 per cent	.023 to	.035
Overhead, taxes, etc	.015 to	.030
Total	.137 to	.195

In the above table wood has been valued at 40 cents a cord, 1,800 pounds of dry wood being considered to be a cord. This wood should consist of sawdust and hogged refuse, but should not contain over 10 per cent of bark, as the yield of sugars and alcohol from bark is very low. A large quantity of bark would mean running a large volume of inert material through the alcohol plant at considerable expense and without return. Moreover, the use of most barks would add large quantities of tannin to the solutions to be fermented, and this also is undesirable.

If all waste is disposed of for this purpose, a sawmill could not only net the price of 40 cents a cord mentioned above, but it could also avoid the cost of burning the waste, which, as given before, ranges from 30 to 66 cents a cord. To the sawmill this would mean a net gain practically double the figure at which the waste is sold.

The successful production of ethyl alcohol from sawdust seems to depend upon the proper design, equipment, and management of the plant, rather than upon the improvement of the chemical or fermentological features of the process. The problem involves the quick and efficient handling of large volumes of low-grade material under unusual technical conditions, the perfecting of the necessary acid-resisting pieces of apparatus, a study of the experience of the plants that have been built and operated, and the efficient utilization of material whose mere removal is now an expense. This industry unquestionably is worthy the serious study of experimental and practical investigators of the utilization of forest products.

TABLE 1.—*Sugar and alcohol yields.*

Species of wood.	Fermentation No.	Cook No.	Total reducing sugars (per cent of original dry wood).	Per cent of total reducing sugars. Fermentable.	Per cent of total reducing sugars. Nonfermentable.	Fermentation efficiency.	Alcohol in beer. Actual alcohol yield.	Alcohol in beer. Theoretical alcohol yield.	Per cent of total sugars obtained as alcohol.	Alcohol yields. Per cent of original dry wood.	Alcohol yields. Gallons of absolute per dry ton.	Alcohol yields. Gallons of 190-proof per dry ton, allowing 5 per cent distillation loss.	Remarks.
White spruce	....	21	23.16	54.57	45.43	83.20	1.818	2.185	45.40	5.374	16.255	16.224	
	....	21	23.16	55.17	44.83	104.38	1.452	1.391	57.59	6.817	20.619	20.581	
				54.87	45.13					6.096	18.44	18.40	Average.
	....	22	23.75	55.01	44.99	96.68	2.443	2.527	53.18	6.455	19.524	19.488	
	....	22	23.75	55.61	44.39	101.34	2.271	2.241	56.36	6.841	20.692	20.653	
	....	22	23.75	54.44	35.56	107.70	.783	.727	69.40	8.424	25.480	25.432	Discard.
				55.31	44.69					6.648	20.11	20.07	Average.
	....	23	23.55	54.22	45.78	101.19	2.128	2.103	54.87	6.607	19.984	19.946	
	....	23	23.55	55.09	44.91	94.37	2.045	2.167	51.99	6.260	18.935	18.899	
				54.66	45.34					6.434	19.46	19.42	Do.
	....	24	23.81	53.76	46.24	95.21	1.849	1.942	51.18	6.228	18.838	18.802	
	....	24	23.81	52.45	47.55	93.73	1.778	1.897	49.16	5.982	18.094	18.060	
	....	24	23.81	53.26	46.74	106.08	2.364	2.228	56.50	6.876	20.798	20.759	
				53.16	46.84					6.362	19.24	19.21	Do.
	....	25	25.01	54.93	45.07	97.69	2.115	2.165	53.66	6.859	20.746	20.707	
	....	25	25.01	58.20	41.80	96.97	2.340	2.413	56.44	7.210	21.808	21.767	
	....	25	25.01	54.75	45.25	98.37	2.180	2.216	53.86	6.885	20.825	20.786	
				54.84	45.16					6.985	21.13	21.09	Do.
	....	26	22.24	58.18	41.82	92.56	2.141	2.313	53.85	6.121	18.514	18.479	
	....	26	22.24	53.79	46.21	97.93	2.314	2.363	52.67	5.987	18.109	18.075	
	....	26	22.24	56.61	43.39	98.77	2.334	2.363	55.91	6.355	19.222	19.186	
				56.19	43.81					6.154	18.61	18.58	Do.

TABLE 1.—*Sugar and alcohol yields*—Continued.

Species of wood.	Fermentation No.	Cook No.	Total reducing sugars (per cent of original dry wood).	Per cent of total reducing sugars.		Fermentation efficiency.	Alcohol in beer.		Per cent of total sugars obtained as alcohol.	Alcohol yields.			Remarks.
				Fermentable.	Nonfermentable.		Actual alcohol yield.	Theoretical alcohol yield.		Per cent of original dry wood.	Gallons of absolute per dry ton.	Gallons of 190-proof per dry ton, allowing 5 per cent distillation loss.	
Shortleaf pine	....	27	18.57	56.21	43.79	91.74	1.811	1.974	51.57	4.893	14.800	14.772	
	....	27	18.57	54.25	45.75	103.85	2.40	2.311	56.34	5.858	17.719	17.685	
				55.23	44.77					5.376	16.255	16.228	Average.
	....	28	5.34	32.29	67.71	101.11	.453	.448	32.65	.891	2.710	2.690	
	....	29	16 37	56.52	43.48	84.69	1.494	1.764	47.87	4.00	12.099	12.076	
	....	29	16.37	53.15	46.85	106.30	1.265	1.190	56.50	4.727	14 298	14.271	
	....	29	16.37	53.85	46.15	87.84	2.008	2.286	47.30	3.957	11.959	11.946	
				54.51	45.49					4.226	12.78	12.76	Do.
White spruce	....	30	21 09	60.09	39.91	91.89	1.619	1.762	55.22	5.952	18.003	17.969	
	....	30	21 09	61 26	38.74	104.98	2.322	2.213	64.27	6.928	20.955	20.916	
				60.68	39.32					6.440	19.48	19.44	Do.
	....	31	21.45	63.56	36.44	101.58	2.189	2.155	64.56	7.078	21.409	21.368	
	....	31	21.45	63.76	36.24	95.00	2.299	2.420	60.57	6.640	20.084	20.046	
	....	31	21.45	42.14	57.86	99.74	1.586	1.590	42.03	4.096	12.389	12.366	Discard.
				63.66	36.34					6.859	20.75	20.71	Average.
	....	32	21.32	69.45	30.55	99.18	2.169	2.187	68.88	7.506	22.703	22.661	
	....	32	21.32	58.97	41 03	146 77	2.956	2.014	86.55	9.431	28.526	28.472	Discard.
	....	32	21.32	38.47	61.53	95.68	1.153	1.205	36.81	4.011	12.132	12.109	Do.
	....	32	21.32	70.12	29 88	93.85	2.016	2.148	65.82	7.171	21.690	21.649	
				69.79	30.21					7 339	22.20	22.16	Average.
	....	33	23.17	54.46	45.54	113.64	3 066	2.698	61.89	7.320	22 168	22.126	
	....	33	23.17	53.93	46.07	103.57	2.409	2.326	55.86	5.615	20.008	19.971	
				54.20	45.80					6.972	21.09	21.05	Do.

....	34	21.96	....	....	....	....	....	....	....	....	....	
....	34	21.96	59.08	40.92	100.63	2 887	2.869	59.53	6.682	20.211	20.173	
....	34	21.96	59.49	40.51	103.75	2.463	2.374	61.72	6.927	20 952	20.913	
....	34	21.96	53.56	46.44	95.94	2.243	2.338	51.39	5.768	17.446	17.414	Discard.
			59.29	40.71					6.805	20.58	20.54	Average.
....	35	21.68	56.06	43.94	107.27	3.348	3.121	60.14	6.664	20.157	20.119	
....	35	21.68	56.80	43.20	100.85	2.737	2.714	57.28	6.347	19.198	19.162	
			56.43	43.57					6.506	19.68	19.64	Do.
....	36	21.10	65.71	34.29	95.62	2.316	2.422	62.83	6.776	20.495	20.457	
....	36	21.10	69.03	30.97	96.97	2.114	2.180	66.94	7.219	21.835	21.794	
....	36	21.10	65.15	34.85	99.72	1.824	1.829	64.97	7.006	21.191	21.151	
			66.63	33.37					7.000	21.17	21.13	Do.
....	37	21.83	55.25	44.75	99.52	3.079	3.094	54.98	6.135	18.557	18.522	
....	37	21.83	55.52	44.48	98.97	2.403	2.428	54.95	6.131	18.544	18.509	
....	37	21.83	57.31	42.69	93.70	2.336	2.493	53.70	5.990	18.118	18.984	
			56.03	43.97					6.085	18.41	18.37	Do.
....	38	17.42	42.40	57.60	115.31	1.732	1.502	48.89	4.363	13.167	13.142	
....	38	17.42	44.63	55.37	111.53	1.673	1.500	49.78	4.432	13.405	13.380	
....	38	17.42	42.36	57.64	103.44	1.382	1.336	43.82	3.901	11.799	11.777	
			43.13	56.87					4.172	12.62	12.60	Do.
....	39	22.37	52.53	47.47	100.55	2.564	2.550	52.82	6.039	16.266	18.232	
....	39	22.37	53.18	46.82	105.79	2.121	2.005	56.26	6.432	19.455	19.418	
....	39	22.37	56.05	43.95	96.31	1.983	2.059	53.98	6.172	18.668	18.633	
			53.92	46.08					6.214	18.80	18.76	Do.
....	40	23.74	63.83	36.17	91.92	2.424	2.637	58.67	7.119	21.533	21.492	Discard.
....	40	23.74	33.93	66.07	109.00	1.501	1.377	36.98	4.487	13.572	13.546	
....	40	23.74	53.67	46.33	97.03	2.483	2.559	52.08	6.319	19.113	19.077	
			53.67	46.33					6.319	19.11	19.08	Average.
....	41	23.09	57.18	42.82	99.14	2.415	2.436	56.69	6.690	20.235	20.197	
....	41	23.09	56.80	43.20	95.46	2.397	2.511	54.22	6.399	19.355	19.319	
....	41	23.09	32.95	67.05	102.66	1.390	1.354	33.83	3.992	12.075	12.052	Discard.
....	41	23.09	47.20	52.80	101.06	2.008	1.987	47.70	5.629	17.026	16.994	Do.
....	41	23.09	45.46	54.54	101.90	2.199	2.158	46.32	5.466	16.533	16.502	Do.
			56.99	43.01					6.550	19.81	19.77	Average.

TABLE 1.—*Sugar and alcohol yields*—Continued.

Species of wood.	Fermentation No.	Cook No.	Total reducing sugars (per cent of original dry wood).	Per cent of total reducing sugars.		Fermentation efficiency.	Alcohol in beer.		Per cent of total sugars obtained as alcohol.	Alcohol yields.			Remarks.
				Fermentable.	Nonfermentable.		Actual alcohol yield.	Theoretical alcohol yield.		Per cent of original dry wood.	Gallons of absolute per dry ton.	Gallons of 190-proof per dry ton, allowing 5 per cent distillation loss.	
White spruce	....	42	22.34	40.22	59.78	99.42	1.533	1.512	39.99	4.566	13.811	13.785	Discard.
	....	42	22.34	53.44	46.56	116.40	2.356	2.024	62.20	7.102	21.480	21.441	Do.
	....	42	22.34	60.99	39.01	91.38	2.501	2.650	57.56	6.572	19.878	19.841	
	....	42	22.34	26.88	73.12	118.30	1.138	.962	31.80	3.631	10.983	10.962	Do.
	....	42	22.34	64.14	35.86	91.50	2.745	3.000	58.69	6.701	20.269	20.230	
	....	42	22.34	64.58	35.42	96.77	2.488	2.571	62.49	7.135	21.581	21.541	
	....	42	22.34	63.16	36.84	97.64	2.439	2.498	61.67	7.041	21.297	21.257	
				63.22	36.78					6.862	20.760	20.72	Average.
	....	43	21.84	55.17	44.83	107.27	2.258	2.105	59.18	6.606	19.981	19.944	
	....	43	21.84	58.95	41.05	100.00	2.278	2.278	58.95	6.580	19.903	19.865	
	....	43	21.84	58.34	41.66	97.32	2.720	2.795	56.78	6.338	19.171	19.134	
	....	43	21.84	57.70	42.30	99.86	2.815	2.819	57.62	6.432	19.455	19.418	
	....	43	21.84	59.10	40.90	93.34	2.297	2.461	55.16	6.157	18.623	18.588	
	....	43	21.84	58.38	41.62	93.59	2.116	2.261	54.64	6.099	18.448	18.413	
				57.94	42.06					6.369	19.26	19.23	Do.
	....	44	23.00	56.91	43.06	93.67	2.589	2.764	53.34	6.270	18.965	18.929	
	....	44	23.00	54.22	45.78	103.19	2.752	2.667	55.95	6.577	19.893	19.856	
	....	44	23.00	58.91	41.09	100.31	2.258	2.251	59.09	6.946	21.010	20.970	
	....	44	23.00	58.56	41.44	99.73	2.536	2.543	58.40	6.865	20.765	20.725	
				57.16	42.84					6.665	20.16	20.12	Do.
	....	45	22.77	62.78	37.22	92.28	2.319	2.513	57.93	6.742	20.393	20.354	
	....	45	22.77	62.10	37.90	97.62	2.990	3.063	60.62	7.055	21.339	21.299	
	....	45	22.77	64.06	35.94	91.84	2.632	2.866	58.83	6.846	20.707	20.668	
	....	45	22.77	41.32	58.68	96.74	1.217	1.258	39.97	4.652	14.071	14.044	Discard.
	....	45	22.77	61.65	38.35	102.20	2.595	2.539	63.01	7.333	22.180	22.138	
				62.65	37.35					6.994	21.15	21.11	Average.

	46	23.61	70.93	29.07	101.84	2.548	2.502	72.24	8.717	26.366	26.317	
	46	23.61	72.56	27.44	95.30	2.130	2.235	69.15	8.344	25.238	25.191	
	46	23.61	34.24	65.76	117.73	1.089	.925	40.31	4.864	14.712	14.684	Discard.
	46	23.61	70.83	29.17	100.04	2.226	2.225	70.86	8.551	25.864	25.815	
			71.44	28.56					8.537	25.82	25.77	Average.
	47	23.40	67.70	32.30	97.92	2.830	2.890	66.29	7.928	23.980	23.935	
	47	23.40	68.47	31.53	99.89	2.713	2.716	68.39	8.179	24.739	24.692	
	47	23.40	68.01	31.99	101.59	2.485	2.446	69.09	8.263	24.993	24.946	
	47	23.40	64.88	35.12	97.52	2.321	2.380	63.27	7.567	22.888	22.845	
			67 27	32.73					7.984	24.15	24.10	Do.
Shortleaf pine	48	17.15	61.09	38.91	98.78	2.588	2.620	60.34	5.289	15.998	15.967	
	48	17.15	58.26	41.74	92.08	2.070	2.248	53.65	4.702	14.222	14.195	
	48	17.15	61.35	38.65	104.39	2.186	2.094	64.04	5.613	16.978	16.946	
			60.27	39.73					5.201	15.73	15.70	Do.
	49	14.02	65.08	34.92	92.57	1.707	1.844	60.24	4.316	13.055	13.030	
	49	14.02	68.09	31.91	86.22	1.514	1.756	58.71	4.207	12.725	12.701	
			66.59	33.41					4.262	12.89	12.87	Do.
Western larch	50	29.72	37.70	62.30	85.77	1.320	1.539	32.34	4.970	15.033	15.004	
	50	29.72	39.83	60.17	79.85	1.470	1.841	31.80	5.048	15.269	15.240	
	50	29.72	36.04	63.96	92.23	1.578	1.711	33.24	4.912	14.857	14.829	
			37.89	62.11					4.977	15.05	15.03	Do.
White spruce	55	18.06	82.35	17.65	98.95	2.311	2.330	81.48	7.520	22.746	22.703	
	55	18.06	81.41	18.59	100.88	2.259	2.239	82.11	7.580	22.927	22.884	
	55	18.06	81.82	18.18	99.11	2.259	2.289	81.09	7.485	22.640	22.597	
	55	18.06	81.37	18.63	98.34	2.345	2.381	79.02	7.294	22.062	22.021	
	55	18.06	80.04	19.96	95.53	2.224	2.328	76.46	7.058	21.348	21.308	
			81.40	18.60					7.387	22.34	22.30	Do.
	56	21.56	77.16	22.84	97.73	2.390	2.446	75.41	8.307	25.126	25.079	
	56	21.56	77.68	22.32	98.09	2.395	2.440	76.20	8.395	25.392	25.345	
	56	21.56	76.63	23.37	98.75	2.382	2.412	75.67	8.338	25.220	25.172	
	56	21.56	77.53	22.47	97.80	2.315	2.367	75.82	8.355	25.271	25.224	
	56	21.56	77.56	22.44	101.11	2.543	2.515	78.42	8.641	26.136	26.087	
	56	21.56	76.85	23.15	91.83	1.968	2.143	70.57	7.776	23.520	23.475	
	56	21.56	76.66	23.34	97.73	2.590	2.650	74.92	8.256	24.972	24.925	
			77.15	22.85					8.295	25.09	25.04	Do.

TABLE 1.—*Sugar and alcohol yields*—Continued.

Species of wood.	Fermentation No.	Cook No.	Total reducing sugars (per cent of original dry wood).	Per cent of total reducing sugars.		Fermentation efficiency.	Alcohol in beer.		Per cent of total sugars obtained as alcohol.	Alcohol yields.			Remarks.
				Fermentable.	Nonfermentable.		Actual alcohol yield.	Theoretical alcohol yield.		Per cent of original dry wood.	Gallons of absolute per dry ton.	Gallons of 190-proof per dry ton, allowing 5 per cent distillation loss.	
White spruce		57	21.08	80.26	19.74	93.46	2.558	2.541	75.01	8.082	24.446	24.400	
		57	21.08	78.73	21.27	100.07	2.543	2.468	78.78	8.488	25.674	25.625	
		57	21.08	79.00	21.00	96.86	2.318	2.393	76.52	8.249	24.951	24.904	
		57	21.08	78.09	21.91	95.16	1.909	2.006	74.31	8.006	24.216	24.170	
		57	21.08	78.43	21.57	97.09	2.266	2.334	76.15	8.204	24.815	24.768	
		57	21.08	78.91	21.09	97.64	2.274	2.329	77.05	8.301	25.108	25.060	
				78.90	21.10					8.222	24.87	24.82	Average.
		58	22.82	60.62	39.38	98.84	2.218	2.244	59.92	6.989	21.140	21.100	
		58	22.82	60.98	39.02	87.52	2.117	2.419	53.37	6.225	18.829	18.793	
		58	22.82	60.29	39.71	99.43	2.421	2.435	59.95	6.992	21.149	21.109	
		58	22.82	59.95	40.05	98.52	2.500	2.535	59.12	6.895	20.855	20.816	
		58	22.82	60.56	39.44	95.38	2.456	2.575	57.76	6.737	20.377	20.339	
				60.48	39.52					6.768	20.47	20.43	Do.
		59	20.21	73.44	26.56	89.00	1.843	2.071	65.36	6.751	20.420	20.381	
		59	20.21	74.19	25.81	93.10	2.147	2.306	69.07	7.134	21.578	21.538	
		59	20.21	73.96	26.04	97.94	2.382	2.432	72.44	7.483	22.634	22.591	
		59	20.21	72.41	27.59	95.40	2.694	2.824	69.08	7.136	21.584	21.544	
				73.50	26.50					7.126	21.55	21.51	Do.
		60	21.005	70.44	29.56	95.94	2.246	2.341	67.58	7.255	21.944	21.903	
		60	21.005	70.68	29.32	92.50	2.072	2.240	65.38	7.019	21.230	21.190	
		60	21.005	[1] 58.37	[1] 41.63	112.68	2.469	2.191	65.77	7.061	21.357	21.317	
		60	21.005	67.39	32.61	104.52	2.474	2.367	70.44	7.562	22.872	22.830	
		60	21.005	67.76	32.24	98.63	2.517	2.552	66.83	7.175	21.703	21.661	
				69.07	30.93					7.214	21.82	21.78	Do.

	....	61	20.14	70.77	29.23	97.94	2.381	2.431	69.31	7.134	21.578	21.538	
	....	61	20.14	76.12	23.88	69.28	2.226	3.213	52.74	5.429	16.421	16.390	Discard.
	....	61	20.14	71.55	28.45	96.18	2.495	2.594	68.82	7.084	21.427	21.387	
	....	61	20.14	76.68	23.32	73.64	2.596	3.525	56.47	5.813	17.583	17.549	Do.
				71.16	28.84					7.109	21.50	21.46	Average.
Birch	22	62	20.53	....	....	....	....	....	....	....	....	....	
	23	62	20.53	....	....	....	....	....	....	....	....	....	
	24	62	20.53	49.15	50.85	83.83	1.095	1.306	21.06	4.323	13.08	13.05	
	25	62	20.53	43.43	56.57	92.91	.991	1.067	20.62	4.253	12.86	12.84	
				46.29	53.71					4.288	12.97	12.95	Do.
White pine, Idaho	22	63	21.00	73.74	26.26	98.54	2.184	2.216	37.14	7.799	23.59	23.54	
	23	63	21.00	73.84	26.16	97.14	2.450	2.522	36.96	7.761	23.47	23.43	
	24	63	21.00	73.76	26.24	95.72	2.172	2.269	36.08	7.577	22.92	22.88	
	25	63	21.00	73.98	26.02	102.24	2.244	2.195	38.66	8.118	24.55	24.51	
	26	63	21.00	77.14	22.86	91.26	2.105	2.306	35.98	7.557	22.86	22.81	
	29	63	21.00	74.49	25.51	80.18	.694	.866	17.87	7.762	23.48	23.43	
				74.49	25.51					7.702	23.48	23.43	Do.
Red spruce	22	64	20.48	73.24	26.76	98.90	2.852	2.884	37.02	7.582	22.93	22.89	
	23	64	20.48	75.24	24.76	96.46	2.908	3.015	37.09	7.597	22.98	22.93	
	24	64	20.48	75.05	24.95	93.24	2.284	2.450	35.77	7.325	22.16	22.11	
	25	64	20.48	73.13	26.87	101.27	3.222	3.182	37.85	7.755	23.46	23.41	
				74.16	25.84					7.565	22.88	22.84	Do.
Douglas fir, Montana	29	65	21.60	68.28	31.72	97.63	2.197	2.250	34.07	7.189	21.74	21.70	
	22	65	21.60	65.74	34.26	95.57	2.585	2.705	32.11	6.776	20.49	20.46	
	23	65	21.60	65.89	34.11	94.33	2.358	2.500	31.77	6.703	20.28	20.24	
	24	65	21.60	65.89	34.11	90.58	2.382	2.630	30.50	6.436	19.47	19.43	
	25	65	21.60	64.99	35.01	98.96	2.815	2.845	32.87	6.936	20.98	20.94	
	26	65	21.60	66.73	33.27	97.16	2.709	2.788	33.14	6.991	21.15	21.11	
	27	65	21.60	67.42	32.58	92.42	2.361	2.555	31.85	6.720	20.33	20.29	
				67.42	32.58					6.822	20.64	20.59	Do
White pine	22	66	20.02	71.83	28.17	103.77	2.769	2.668	38.10	7.627	23.07	23.03	
	23	66	20.02	77.48	22.52	94.16	2.482	2.636	37.29	7.465	22.58	22.54	
	24	66	20.02	77.68	22.32	90.82	2.563	2.822	26.06	7.219	21.84	21.79	
				75.67	24.34					7.437	22.48	22.46	Do.
Longleaf pine	22	67	23.06	69.47	30.53	99.79	2.836	2.842	35.43	8.171	24.71	24.67	
	23	67	23.06	73.98	26.02	94.81	2.599	2.741	35.85	8.267	25.00	24.96	
	24	67	23.06	75.20	24.80	89.68	2.560	2.855	34.47	7.949	24.04	24.00	
	25	67	23.06	73.08	26.92	97.83	2.589	2.646	36.54	8.426	25.49	25.44	
	26	67	23.06	72.94	27.07	74.12	2.640	3.562	29.88	8.204	24.81	24.77	

[1] Large chips of white spruce were used in this cook.

TABLE 1.—*Sugar and alcohol yields*—Continued.

Species of wood.	Fermentation No.	Cook No.	Total reducing sugars (per cent of original dry wood).	Per cent of total reducing sugars.		Fermentation efficiency.	Alcohol in beer.		Per cent of total sugars obtained as alcohol.	Alcohol yields.			Remarks.
				Fermentable.	Nonfermentable.		Actual alcohol yield.	Theoretical alcohol yield.		Per cent of original dry wood.	Gallons of absolute per dry ton.	Gallons of 190-proof per dry ton, allowing 5 per cent distillation loss.	
Longleaf pine	27	67	23.06	74.70	25.30	100.57	2.681	2.666	38.40	8.855	26.78	26.73	
	28	67	23.06	73.50	26.50	92.66	2.379	2.567	34.78	8.021	24.26	24.22	
				73.32	26.67					8.282	25.05	24.97	Average.
	22	68	23.25	71.42	28.58	99.26	2.126	2.142	36.23	8.424	25.48	24.43	
	23	68	23.25	73.96	26.04	96.13	2.396	2.492	36.34	8.448	25.55	25.50	
	24	68	23.25	71.08	28.92	90.97	2.562	2.816	33.05	7.683	23.24	23.20	
	25	68	23.25	72.78	27.22	98.11	2.528	2.577	36.49	8.484	25.66	25.61	
	26	68	23.25	73.28	26.72	95.60	2.352	2.460	35.81	8.325	25.18	25.13	
	27	68	23.25	72.39	27.61	100.20	2.691	2.686	37.07	8.619	26.07	26.02	
	28	68	23.25	72.49	27.35	94.55	1.283	1.357	31.91	8.330	25.19	24.97	
				72.49	27.49					83.30	25.196	24.98	Do.
Lodgepole pine	25	69	21.93	66.42	33.58	99.19	2.507	2.527	33.68	7.385	22.34	22.30	
	26	69	21.93	67.26	32.74	95.75	2.609	2.725	32.92	7.219	21.84	21.79	
	27	69	21.93	66.99	33.01	92.59	2.219	2.397	31.71	6.953	21.03	20.99	
	28	69	21.93	67.64	32.36	93.78	1.943	2.072	32.42	7.183	21.73	21.69	
	29	69	21.93	68.58	31.42	94.77	2.373	2.504	33.22	7.285	22.03	21.99	
				67.37	33.66					7.205	21.79	21.75	Do.
Norway pine, extracted chips	25	70	25.62	67.52	32.48	77.74	2.014	2.591	26.83	6.873	20.79	20.75	
	26	70	25.62	65.12	34.88	91.78	2.421	2.638	30.55	7.827	23.67	23.63	
	27	70	25.62	68.02	31.98	95.83	1.940	2.024	33.32	8 536	25.82	25.77	
				66.88	33.10				30.23	7.745	23.42	23.38	Do.
Red spruce	26	71	22.06	71.23	28.77	99.35	2.949	2.968	39.29	8.668	26.22	26.17	
	27	71	22.06	72.84	27.16	98.22	2.624	2.671	36.57	8.067	24.40	24.35	
	28	71	22.06	72.84	27.16	91.29	2.366	2.592	33.98	7.497	22.68	22.63	
	29	71	22.06	75.76	24.24	91.80	2.073	1.258	35.54	7.841	23.72	23.67	

	30	71	22.06	72.94	27.06	98.05	2.752	2.807	36.55	8.063	24.39	24.34	
	31	71	22.06	71.13	28.87	98.94	2.786	2.816	35.97	7.934	24.00	23.95	
	32	71	22.06	72.00	28.00	93.95	2.709	2.884	34.57	7.626	23.07	23.02	
				72.67	27.32					7.956	24.06	24.01	Do.
Western larch	26	72	26.21	54.81	45.19	93.20	2.007	2.153	26.11	6.844	20.70	20.66	
	27	72	26.21	45.81	45.81	97.06	1.724	1.766	26.88	7.046	21.31	21.27	
	28	72	26.21	55.11	44.89	87.53	1.583	1.808	24.65	6.462	19.55	29.51	
	30	72	26.21	55.10	44.90	99.46	1.755	1.764	28.01	7.341	22.21	22.16	
	31	72	26.21	53.97	46.03	98.80	1.911	1.934	27.25	7.143	21.60	21.56	
	33	72	26.21	54.96	45.04	91.92	1.690	1.839	25.82	6.768	20.47	20.43	
	36	72	26.21	54.69	45.31					6.934	20.97	20.93	Do.
Hard maple	27	73	18.93	33.16	66.84	88.88	1.086	1.222	15.06	2.852	8.62	8.61	
	28	73	18.93	34.87	65.13	86.94	.988	1.136	15.49	2.933	8.87	8.85	
	29	73	18.93	36.31	63.69	92.07	1.118	1.214	17.09	3.234	9.78	9.76	
	30	73	18.93	34.12	65.88	94.95	1.103	1.162	16.56	3.135	9.48	9.46	
	31	73	18.93	32.94	67.06	91.94	1.008	1.096	15.48	2.930	8.86	8.85	
	32	73	18.93	32.88	67.12	97.29	.952	.978	16.35	3.095	9.36	9.34	
				34.04	65.95					3.029	9.16	9.14	Do.
Douglas fir, Washington	28	74	21.13	73.82	26.18	97.59	2.521	2,583	36.82	7.780	23.53	23.49	
	29	74	21.13	74.72	25.28	97.96	2.698	2.754	37.41	7.904	23.91	23.86	
	30	74	21.13	77.44	22.56	96.18	2.634	2.739	38.07	8.044	24.33	24.28	
	31	74	21.13	71.84	28.16	102.33	2.568	2.510	37.57	7.939	24.01	23.97	
	32	74	21.13	74.31	25.69	95.79	2.574	2.687	36.38	7.688	23.25	23.21	
	33	74	21.13	77.10	22.90	99.80	2.603	2.608	39.33	8.310	25.14	25.09	
	34	74	21.13	76.95	23.05	94.77	2.591	2.734	37.27	7.876	23.82	23.78	
				75.16	24.83					7.934	23.99	23.95	Do.
Silver maple	28	75	20.74	47.98	52.02	85.69	1.474	1.720	21.01	4.358	13.18	13.16	
	29	75	20.74	44.11	55.89	94.72	1.450	1.531	21.36	4.429	13.40	13.37	
	30	75	20.74	50.57	49.43	89.06	1.534	1.723	23.02	4.774	14.44	14.41	
	31	75	20.74	46.24	53.76	96.34	1.448	1.503	22.77	4.722	14.28	14.26	
	32	75	20.74	....	....	121.96	1.423	1.167	21.16	....	....	....	
	33	75	20.74	47.24	52.76	100.34	1.140	1.136	24.23	5.025	15.20	15.17	
				47.12	52.77					4.661	14.10	14.07	Do.
Beech	29	76	21.24	23.09	76.91	81.61	.552	.713	9.63	2.045	6.19	6.18	
	30	76	21.24	26.10	73.90	77.78	.709	.912	10.38	2.204	6.67	6.65	
	31	76	21.24	19.48	80.52	94.46	.576	.610	9.40	1.997	6.04	6.03	
	32	76	21.24	20.22	79.78	78.99	.528	.668	8.16	1.734	5.25	5.23	
				22.22	77.77					1.995	6.03	6.02	Do.

TABLE 1.—*Sugar and alcohol yields*—Continued.

Species of wood.	Fermentation No.	Cook No.	Total reducing sugars (per cent of original dry wood).	Per cent of total reducing sugars.		Fermentation efficiency.	Alcohol in beer.		Per cent of total sugars obtained as alcohol.	Alcohol yields.			Remarks.
				Fermentable.	Nonfermentable.		Actual alcohol yield.	Theoretical alcohol yield.		Per cent of original dry wood.	Gallons of absolute per dry ton.	Gallons of 190-proof per dry ton, allowing 5 per cent distillation less.	
White oak	31	77	17.30	48.46	51.54	94.56	1.575	1.666	23.42	4.051	12.25	12.23	
	32	77	17.30	49.47	50.53	94.25	1.623	1.722	23.83	4.123	12.47	12.45	
	33	77	17.30	50.36	49.64	90.19	1.743	1.933	23.22	4.017	12.15	12.13	
	34	77	17.30	51.39	48.61	87.55	1.565	1.788	23.00	3.978	12.03	12.01	
	35x	77	17.30	51.84	48.16	88.09	1.426	1.619	23.34	4.038	12.21	12.19	
	34x	77	17.30	51.41	48.59	96.95	1.467	1.513	25.48	4.407	13.33	13.31	
				50.48	49.51					4.102	12.40	12.38	Average.
Red Oak	32	78	18.38	30.79	69.21	89.73	.971	1.082	14.12	2.595	7.85	7.84	
	33	78	18.38	29.07	70.93	90.91	.988	1.087	13.51	2.483	7.51	7.49	
	34	78	18.38	31.35	68.65	100.10	1.059	1.058	16.01	2.948	8.92	8.90	
				30.40	69.59					2.675	8.09	8.07	Do
Sycamore	32	79	18.30	37.35	62.65	83.26	0.973	1.169	15.89	2.908	8.80	8.78	
	33	79	18.30	37.42	62.58	94.59	1.070	1.131	18.09	3.311	10.01	10.00	
	34	79	18.30	37.88	62.12	88.56	1.039	1.173	17.15	3.138	9.49	9.47	
	35	79	18.30	41.30	58.70	83.31	1.148	1.378	17.58	3.218	9.73	9.72	
	36	79	18.30	40.35	59.65	91.46	.727	.795	18.86	3.452	10.44	10.42	
				38.86	61.14					3.205	9.69	9.67	Do
Slippery elm	33	80	16.60	....	....	91.83	1.293	1.408	18.53	....	....	....	
	34	80	16.60	28.65	71.35	82.39	.872	1.058	12.06	2.003	6.06	6.05	
	35	80	16.60	26.21	73.79	96.73	.919	.942	12.96	2.151	6.51	6.49	
	35y	80	16.60	29.24	70.76	94.22	.465	.494	14.08	2.338	7.07	7.06	
	34y	80	16.60	26.02	73.98	89.59	.635	.709	11.92	1.978	5.98	5.97	
	36	80	16.60	23.86	76.14	71.23	.616	.865	8.69	1.442	4.36	4.35	
				26.79	73.20					1.382	5.99	5.98	Do.
Red gum	33	81	20.42	38.41	61.59	85.45	1.190	1.393	16.78	3.426	10.36	10.34	
	34	81	20.42	39.17	60.83	94.25	1.336	1.418	18.87	3.853	11.65	11.63	

	35	81	20.42	38.97	61.03	96.56	1.390	1.439	19.24	3.928	11.88	11.86	
	36	81	20.42	38.70	61.30	84.55	.956	1.131	16.72	3.415	10.33	10.31	
				38.81	61.18					3.658	11.06	11.03	Do.
Cottonwood	36	82	18.19	29.78	70.22	99.89	.899	.900	15.21	2.766	8.37	8.35	
	37	82	18.19	28.67	71.33	86.00	.955	1.110	12.60	2.292	6.93	6.92	
	38	82	18.19	44.39	55.61	53.50	.888	1.660	12.14	2.208	6.68	6.66	
	39	82	18.19	31.26	68.74	80.84	.784	.970	12.92	2.350	7.11	7.09	
	40	82	18.19	30.21	69.79	83.44	.829	.994	12.88	2.343	7.09	7.07	
				32.86	67.13					2.392	7.23	7.21	Do.
Western larch	36	83	30.52	59.50	40.50	93.05	1.664	1.788	28.29	8.635	26.12	26.07	
	37	83	30.52	59.45	40.55	87.57	1.714	1.957	26.61	8.121	24.56	24.52	
	38	83	30.52	58.64	41.36	97.32	1.664	1.710	29.17	8.902	26.93	26.88	
	39	83	30.52	60.11	39.89	90.16	1.514	1.679	27.70	8.453	25.57	25.52	
	40	83	30.52	57.52	42.48	99.74	1.743	1.748	29.32	8.950	27.07	27.02	
	41	83	30.52	41.10	58.90	130.38	1.497	1.148	27.39	8.359	25.28	25.23	
	42	83	30.52	71.48	28.52	85.06	2.415	2.839	31.08	9.485	28.69	28.63	
	43	83	30.52	55.24	44.76	99.23	1.413	1,424	28.02	8.550	25.86	25.81	
				57.88	42.12					8.687	26.26	26.21	Do.
White spruce	36	84	22.11	69.03	30.97	94.08	1.886	2.005	33.19	7.338	22.20	22.16	
	37	84	22.11	72.64	27.36	88.09	2.597	2.948	32.70	7.231	21.87	21.83	
	38	84	22.11	68.83	31.17	92.03	2.333	2.535	32.38	7.158	21.65	21.61	
	39	84	22.11	67.82	32.18	97.34	2.553	2.623	33.74	7.460	22.57	22.52	
	41	84	22.11	73.61	26.39	97.35	1.642	1.687	36.62	8.098	24.49	24.45	
				70.38	29.63					7.457	22.55	22.51	Do
White spruce and bark (25.53 per cent bark).	37	85	22.49	63.42	36.58	89.54	1.704	1.903	29.02	6.528	19.74	19.71	
	38	85	22.49	58.42	41.58	89.39	2.310	2.584	26.69	6.003	18.16	18.12	
	39	85	22.49	58.78	41.22	93.67	2.385	2.546	28.14	6.328	19.14	19.10	
	40	85	22.49	59.55	40.45	96.39	2.591	2.688	29.34	6.598	19.96	19.92	
	41	85	22.49	....	....	158.50	2.842	1.793	38.63	....	....	....	
				60.04	39.98					6.364	19.25	19.21	Do.
Western hemlock	38	86	21.15	77.48	22.52	86.95	2.175	2.502	34.43	7.282	22.03	21.98	
	39	86	21.15	77.73	22.27	92.54	2.716	2.935	36.76	7.776	23.52	23.47	
	40	86	21.15	77.70	22.30	92.99	2.500	2.691	36.93	7.810	23.62	23.58	
	41	86	21.15	....	....	66.22	2.785	4.206	28.02	....	....	....	
				77.63	22.36					7.622	23.05	23.01	Do.

TABLE 1.—*Sugar and alcohol yields*—Continued.

Species of wood.	Fermentation No.	Cook No.	Total reducing sugars (per cent of original dry wood).	Per cent of total reducing sugars.		Fermentation efficiency.	Alcohol in beer.		Per cent of total sugars obtained as alcohol.	Alcohol yields.			Remarks.
				Fermentable.	Nonfermentable.		Actual alcohol yield.	Theoretical alcohol yield.		Per cent of original dry wood.	Gallons of absolute per dry ton.	Gallons of 190-proof per dry ton, allowing 5 per cent distillation loss.	
White spruce and bark. Bark, 8.49 per cent of total.	38	87	19.60	72.22	27.78	95.08	2.532	2.663	35.10	6.879	20.81	20.77	
	39	87	19.60	71.47	28.53	96.90	2.615	2.699	35.40	6.938	20.98	20.94	
	40	87	19.60	66.77	33.23	120.72	2.407	1.994	41.20	8.075	24.42	24.38	
	41	87	19.60	70.14	29.86	90.27	2.493	2.762	32.36	6.343	19.19	19.15	
	42	87	19.60	66.78	33.22	83.59	1.651	1.975	28.53	5.592	16.91	16.88	
				69.47	30.52					6.765	20.46	20.42	Average.
White spruce bark	39	88	17.07	36.00	64.00	82.10	1.231	1.499	15.11	2.579	7.80	7.79	
	40	88	17.07	27.91	72.09	118.31	1.106	.935	16.88	2.881	8.71	8.70	
				31.95	68.04					27.30	8.25	8.24	Do.
White spruce (2.5 per cent HCl)	40	89	17.02	5.10	94.90	173.71	.171	.098	4.53	.771	2.33	2.33	
	41	89	17.02	.95	99.05	412.58	.128	.031	2.00	.341	1.03	1.03	
	42	89	17.02	(2)	(2)		.056						
				3.02	96.97					5.56	1.68	1.68	Do.
White spruce (1.8 per cent HCl)	41	90	19.69	1.79	98.21			.080					
	42	90	19.69	(2)	(2)		.147						
	43	90	19.69	(2)	(2)		.152						
Spruce (1.8 per cent H_2SO_4+$NaCl$=$NaHSO_4$)	42	92	20.44	4.06	95.94	504.46	.790	.157	(3)				
	43	92	20.44	5.22	94.78	158.40	.324	.204	4.222	.863	2.61	2.60	
	44	92	20.44	9.55	90.45	65.09	.223	.343	3.18	.650	1.97	1.96	
	45	92	20.44	11.22	88.78	70.80	.282	.398	4.06	.830	2.51	2.50	
	46	92	20.44	32.43	67.57	197.10	2.24	1.136	32.67	6.677	20.20	20.16	
				12.49	87.50					2.255	6.32	6.58	Do.
Spruce (1.8 per cent HCl neut. with $CaCO_3$)	42	93	18.25	7.78	92.22								
	44	93	18.25	.105	99.895	598.00	.0571	.0096	(3)				
	45	93	18.25	.50	99.50	257.15	.0552	.021	.66	.120	.36	.36	

	46	93	18.25	...	...	...	...	...	...	...	...	...	
	55	93	18.25	...	...	...	...	...	...	...	...	...	
Spruce (1.8 per cent H_2SO_4+NaCl=Na_2SO neut. with $CaCl_3$)	42	94	19.44	24.91	75.09	61.92	.522	.843	7.882	1.532	4.64	4.63	
	43	94	19.44	...	...	...	.584	...	...	...	...	...	
	44	94	19.44	14.82	95.18	68.79	.331	.481	5.21	1.013	3.06	3.06	
	45	94	19.44	10.45	89.55	135.70	.449	.331	7.25	1.409	4.26	4.26	
				12.63	87.86					1.211	3.66	3.66	Do.
Spruce(2 per cent Cl2$KClO_3$+H_2SO_4+10HCl =K_2SO_4+6Cl_2+6H_2O).	42	95	19.59	5.31	94.69	190.56	.247	.130	5.176	1.014	3.07	3.06	
	43	95	19.59	7.51	92.49	188.33	.334	.177	7.227	1.416	4.28	4.27	
	44	95	19.59	6.05	63.95	159.03	.228	.143	4.92	.963	2.91	2.91	
	45	95	19.59	1.75	98.25	64.39	.0284	.044	.58	.113	.34	.34	
	46	95	19.59	7.82	92.18	66.24	.123	.1858	2.62	.511	2.65	2.64	
	53	95	19.59	44.30	55.68	2.962	.067	2.262	.608	8.032	...	...	
	54	95	19.59	12.12	82.87	...	...	...	...	...	...	...	
	...	95	19.59	(4)	...	...	...	...	...	...	...	...	
	55	95	19.59	(4)	...	...	...	...	...	...	...	...	
Spruce (1.8 per cent H_2SO_4+$\frac{1}{10}$ amt. of $KClO_3$ to make 2 $KClO_3$+1+2SO_4= 2$HClO_3$+K_2SO_4).	43	96	120.34	.31	99.69	1,849.40	...	...	...	...	...	...	
	44	96	20.34	65.49	34.51	78.05	2.145	2.748	26.12	5.314	16.07	16.04	
	46	96	120.34	69.52	30.48	89.78	2.356	2.624	31.90	6.488	19.62	19.59	
				45.10	54.89					5.901	17.84	17.81	Do.
Spruce (1.8 per cent H_2SO_4+$\frac{1}{2}$ $KClO_3$ to make 2 $KClO_3$+H_2SO_4=$HClO_3$).	44	97	21.45	60.63	39.37	89.70	2.182	2.432	27.80	5.963	18.04	18.00	
	45	97	21.45	48.53	51.47	104.62	2.029	1.939	25.95	5.566	16.84	16.80	
	46	97	21.45	65.99	34.01	82.46	1.890	2.292	27.81	5.966	18.04	18.01	
	49	97	21.45	65.71	34.29	88.88	2.199	2.470	29.80	6.40	...	...	
	50	97	21.45	90.00	91.00	...	.366	...	...	...	...	...	
	51	97	21.45	68.82	31.18	84.35	2.185	2.590	29.54	6.34	...	...	
	52	97	21.45	64.52	35.48	99.75	2.203	2.221	32.90	7.075	...	...	
	53	97	21.45	30.34	69.66	365.00	2.460	.692	...	...	...	...	
	54	97	21.45	69.25	32.75	87.75	1.646	1.881	55.00	1.182	...	...	
				62.64	46.58					3.855	17.30	17.60	Do.
Residue from (cook No. 95+2.5 per cent H_2SO_4).	...	98	6.56	...	...	...	...	...	...	...	...	...	
Sugar pine (Green 58.06 and H_2O 2.5 per cent H_2SO_4 150 per cent H_2O).	[5] 45	99	18.03	...	...	115.94	2.472	2.132	36.62	...	...	...	
	46	99	18.03	72.62	27.38	97.36	2.482	2.549	36.14	6.516	19.71	19.67	
	49	99	18.03	73.75	26.25	86.00	1.989	2.317	32.35	5.835	17.63	17.59	
	50	99	18.03	71.30	28.70	98.75	2.268	2.300	35.90	6.470	19.56	19.53	
				72.55	27.45					6.276	18.96	18.93	Do.

[2] Final sugar higher than original. [3] Over 100. [4] More sugar in beer. [5] This fermentation was valueless on account of being chilled.

TABLE 1.—*Sugar and alcohol yields*—Continued.

Species of wood.	Fermentation No.	Cook No.	Total reducing sugars (per cent of original dry wood).	Per cent of total reducing sugars.		Fermentation efficiency.	Alcohol in beer.		Per cent of total sugars obtained as alcohol.	Alcohol yields.			Remarks.
				Fermentable.	Nonfermentable.		Actual alcohol yield.	Theoretical alcohol yield.		Per cent of original dry wood.	Gallons of absolute per dry ton.	Gallons of 190-proof per dry ton, allowing 5 per cent distillation loss.	
Spruce (1.8 per cent H_2SO_4, 0.1 per cent H_3PO_4, 125 per cent H_2O).	[5] 45	100	21.12	57.93	42.07	118.55	2.785	2.349	35.10	7.413	22.42	22.38	
	46	100	21.12	68.10	31.90	92.34	2.44	2.642	32.14	6.788	20.53	20.49	
	49	100	21.12	69.45	98.00	....	2.869	2.950	34.65	7.320	22.14	22.09	
	50	100	21.12	69.10	30.90	106.08	2.745	2.590	37.31	7.835	23.69	23.65	
	51	100	21.12	51.40	48.60	177.4	2.537	1.430	46.60	9.850	29.79	29.73	
	52	100	21.12	66.15	33.85	98.00	2.482	2.508	33.38	7.085	21.43	21.38	
	53	100	21.12	63.50	36.50	112.7	3.366	2.990	37.58	7.900	22.89	31.20	
	54	100	21.12	69.00	31.00	102.80	2.383	2.320	36.18	7.620	23.04	22.97	
				64.32	44.10					7.726	23.24	24.23	Average.
Spruce (0.9 per cent H_2SO_4 0.9 per cent H_3PO_4).	49	101	20.83	61.11	38.89	96.50	2.551	2.643	30.10	6.280	18.99	18.95	
	50	101	20.83	....	....	78.98	2.368	1.870	19.14	....	....	....	
	51	101	20.83	57.80	42.20	90.35	2.241	2.481	26.65	5.53	16.72	16.69	
	52	101	20.83	58.70	41.30	100.5	2.156	2.144	30.00	6.256	18.92	18.88	
	53	101	20.83	55.35	44.75	111.80	3.049	2.730	31.52	6.650	20.01	20.07	
	54	101	20.83	56.10	43.90	111.95	3.197	2.860	32.00	6.660	20.14	20.10	
	55	101	20.83	42.25	57.75	164.8	3.478	2.109	35.49	7.413	22.42	22.38	
				55.20	44.79					5.635	19.65	19.62	Do.
Spruce (1.8 per cent H_3PO_4)................	49	102	19.38	53.75	46.25	9.175	2.286	2.498	25.10	4.87	14.73	14.70	
	50	102	19.38	51.70	48.30	104.0	2.368	2.280	27.40	5.32	16.09	16.06	
	51	102	19.38	56.65	43.35	86.7	2.355	2.710	25.14	4.86	14.70	14.67	
	52	102	19.38	46.52	53.48	122.3	2.849	2.330	28.05	5.64	17.05	17.02	
	53	102	19.38	50.05	49.95	104.0	2.545	2.445	26.70	5.15	15.57	15.54	
	54	102	19.38	50.85	49.15	104.9	2.676	2.548	27.28	5.29	16.00	15.97	
				51.58	44.74					5.18	15.69	15.66	Do.
Sugar pine (18 per cent H_2SO_4)............	49	103	20.23	72.60	27.40	96.7	2.255	2.333	35.81	7.244	21.91	21.86	
	50	103	[6]	....	....	84.0	2.521	3.001	27.45	....	....	....	
	51	103	[6]	70.85	79.15	96.3	2.004	2.082	34.78	7.036	21.28	21.24	
	52	103	[6]	51.35	48.65	136.8	2.306	1.688	35.80	7.242	21.90	21.86	

	53	103	(6)	69.20	30.80	100.1	2.416	2.413	35.24	7.139	21.59	21.55	
	54	103	(6)	71.45	28.55	94.1	2.402	2.558	34.30	6.939	20.98	20.94	
	55	103	(6)	63.50	36.50	108.3	3.195	2.945	35.05	7.091	21.44	21.40	
				66.49	33.51					7.115	21.51	21.47	Do.
Spruce (1.80 per cent H_2SO_4, 0.10 per cent $FeSO_4$).	49	104	21.40	62.68	37.32	101.00	2.802	2.778	32.25	6.910	20.92	20.86	
	50	104	21.40	....	....	186.7	3.107	1.665	32.08	....	20.82	20.68	
	51	104	21.40	63.72	36.28	101.50	2.630	2.586	33.00	7.052	21.33	23.89	
	52	104	21.40			80.75	2.641	3.272	31.95	....	....	....	
	53	104	21.40	....	....	90.85	2.179	2.400	25.66	....			
	54	104	21.40	64.15	35.85	100.2	2.916	2.900	32.79	7.015	21.21	21.17	
	55	104	21.40	62.35	37.65	100.0	2.674	2.672	31.81	6.805	20.58	20.54	
				63.23	36.77					6.927	20.97	21.42	Do.
Spruce..........	51	107	17.93	61.50	38.50	105.20	1.699	1.615	33.00	5.865	17.73	17.70	
	52	107	(7)	58.76	41.24	111.8	1.677	1.500	29.50	5.300	16.03	16.00	
				60.13	39.87					5.583	16.89	16.85	Do.
Spruce (0.9 per cent H_2SO_4, 0.9 per cent niter cake).	51	108	....	59.50	....	86.80	2.166	2.500	25.00	4.800	14.51	14.79	
	52	108	....	56.84	....	103.4	2.365	2.290	30.00	5.765	17.43	17.40	
	53	108	....	60.50	....	70.95	2.115	2.842	21.92	4.220	12.86	12.74	
	54	108	....	59.80	40.20	94.00	2.330	2.482	28.70	5.522	16.70	16.67	
	55	108	....	59.18	40.82	....	4.585	....	1.64	5.077	15.38	15.34	

[6] Recalculate alcohol yields.
[7] Niter cake with H_2SO_4 equivalent of 18 per cent used to 19.25 make 1.8 H_2SO_4.

TABLE 2.—*Acid yields.*

Cook.	Acetic acid (per cent of original dry wood).	Formic acid (per cent of original dry wood).	Ratio of acetic acid to formic acid.	Per cent of total volatile acid in blow-off.		Remarks.
				Acetic.	Formic.	
21	1.52	0.239	6.36 to 1	9.24	9.00	Data not complete.
22						
23	2.27	.540	4.20 to 1	7.54	8.70	Blow-off open.
24	2.39	.059	40.40 to 1			Do.
25	1.77	.337	5.25 to 1			
26	1.75	.431	4.07 to 1	5.22	9.95	Do.
27	1.29	.171	7.55 to 1			Data not complete.
28						
29	1.29	.310	4.16 to 1	5.78	4.94	
30	1.38	.642	2.15 to 1	11.70	12.27	
31	1.755	.572	3.05 to 1	8.53	14.23	
32	1.67	1.090	1.53 to 1	11.48	10.64	
33	1.457	.355	4.10 to 1	12.65	6.01	
34	2.11	.480	4.40 to 1	7.91	24.55	
35	1.05	.443	2.37 to 1	16.30	4.49	
36	2.43	.735	3.31 to 1	6.80	16.28	
37	1.43	.253	5.65 to 1	10.75	3.82	
38	.87	.430	2.02 to 1	7.48	.47	
39	1.33	.056	23.75 to 1			Blow-off open.
40	1.56	.470	3.32 to 1	11.68	8.14	
41	1.416	.430	3.30 to 1	8.24	13.50	
42	1.55	.570	2.72 to 1	12.25	12.80	
43	1.51	.160	9.44 to 1	11.80	23.40	
44	1.69	.290	5.82 to 1	8.80	9.40	
45	1.67	.790	2.11 to 1	9.48	8.26	
46	2.36	1.450	1.63 to 1	9.45	9.75	
47	2.62	.340	7.71 to 1	9.03	12.32	
48	2.97	.469	6.33 to 1	5.19	3.55	
49	1.97	.230	8.57 to 1	7.59	18.48	
50	1.715	.254	6.75 to 1	5.26	1.74	
51						Data not complete.
52						Do.
53						Do.
54						Do.
55	2.14	.440	4.86 to 1	13.01	23.18	
56	2.915	1.492	1.95 to 1	7.32	3.88	
57	3.53	.659	5.36 to 1	7.69	14.79	
58	2.47	.399	6.19 to 1	7.84	6.28	
59	2.16	.869	2.49 to 1	10.23	8.91	
60						Do.
61	3.34	.933	3.58 to 1	7.39	5.45	
62	4.70	.706	6.66 to 1	15.53	4.09	Birch.
63	2.96	.846	3.50 to 1	8.09	11.82	White pine, Idaho.
64	2.70	1.08	2.50 to 1	9.06	5.93	Red spruce.
65	2.24	1.42	1.58 to 1	6.45	7.75	Douglas fir, Montana.
66	2.68	.626	4.28 to 1	14.87	29.75	White pine.
67	2.60	1.44	1.80 to 1	8.53	6.95	Longleaf pine.
68	2.47	1.18	2.09 to 1	18.11	7.38	Do.
69	2.84	.447	7.34 to 1	6.76	3.25	Lodgepole pine.
70	1.76	1.19	1.48 to 1	7.53	2.32	Norway pine.
71	2.75	1.18	2.33 to 1	8.92	6.59	Red spruce.
72	2.84	1.46	1.945 to 1	7.72	9.31	Western larch.
73	3.77	.512	7.36 to 1	12.52	4.26	Hard maple.
74	2.19	.962	2.28 to 1	7.92	8.15	Douglas fir, Washington.
75	1.09	.079	13.80 to 1	49.7	20.3	Silver maple.
76	4.80	.445	10.75 to 1	15.65	2.51	Beech.
77	2.57	.789	3.26 to 1	2.84	1.77	White oak.
78	3.98	.180	22.1 to 1	11.55	10.9	Red oak.
79	5.65	.634	8.91 to 1	10.48	4.09	Sycamore.
80	4.04	.738	5.48 to 1	11.02	9.42	Slippery elm.
81	4.18	.700	5.97 to 1	7.66	6.30	Red gum.
82	2.82	.406	6.94 to 1	7.79	26.90	Cottonwood.
83	1.90	.667	2.83 to 1	14.24	6.62	White spruce.
86	2.14	1.59	1.35 to 1	9.63	7.14	Western hemlock.

TABLE 3.—*Fermentation record.*

Fermentation No.	Cook No.	Yeast. Seed yeast. Brix.	Yeast. Seed yeast. Acidity.	Yeast. 96-hour yeast. Sp. gr. at 15° C.	Yeast. 96-hour yeast. Alcohol (per cent by weight).	Yeast. 96-hour yeast. Acidity.	Fermenter set. Date.	Fermenter set. Hour.	Hours filling fermenter.	Hours fermenting, including time of filling.	Mash before fermentation. Sp. gr. at 15° C.	Mash before fermentation. Reducing sugars (grams per liter).	Mash before fermentation. Acidity.	Mash before fermentation. Total solids (per cent).	Mash before fermentation. Brix.	Brix record (decrease in Brix). First day.	Brix record. Second day.	Brix record. Third day.	Brix record. Fourth day.	Brix record. Fifth day.	Attenuation (degrees).	Beer. Brix fourth day.	Beer. Distillation. Date.	Beer. Distillation. Hour.	Beer. Reducing sugars (grams per liter).	Beer. Sp. gr. at 15° C.	Beer. Acidity.	Beer. Total solids (per cent by weight).	Beer. Alcohol (per cent by weight).
								a. m.																*a. m.*					
1	21	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0486	82.16	8.0	......	11.9	4.3	0.4	0.1	0.2	0.0	5.0	6.9	Sept. 18, 1914	10.00	36.50	1.0254	10.2	......	1.818
4	21	....	....	1.0208	5.672	14.8	Oct. 14, 1914	9.00	32.5	128.5	1.0293	50.76	2.8	......	7.5	2.6	.1	.3	.0	.1	3.0	4.5	Oct. 19, 1914	9.00	22.46	1.0160	6.4	......	1.452
4	22	....	....	1.0208	5.672	14.8	Oct. 14, 1914	9.00	32.5	128.5	1.0151	22.46	2.0	......	4.1	.8	.5	.2	.0	.0	1.6	2.5	Oct. 19, 1914	9.00	7.49	1.0086	4.7	......	0.783
1	22	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0476	82.58	5.0	......	11.7	4.3	.4	.1	.0	.2	4.8	6.9	Sept. 18, 1914	10.00	35.92	1.0266	9.6	......	2.271
14	22	....	....	1.0235	5.784	24.5	Mar. 18, 1915	9.15	32.5	128.5	1.0551	94.86	8.0	......	13.6	4.6	1.0	.1	.2	.....	5.9	7.7	Mar. 23, 1915	9.15	41.72	1.0314	13.2	......	2.443
1	23	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0489	79.58	8.8	......	12.2	4.1	.6	.1	.1	.2	4.9	7.3	Sept. 18, 1914	10.00	35.70	1.0278	14.4	......	2.128
5	23	....	....	1.0203	5.616	14.0	Oct. 21, 1914	9.00	32.5	128.5	1.0483	80.66	8.8	......	11.6	4.0	.4	+.1	−.1	.0	4.4	7.2	Oct. 26, 1914	9.00	35.48	1.0269	12.4	......	2.045
1	24	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0470	74.06	10.4	......	11.6	3.8	.3	.1	.1	.1	4.3	7.3	Sept. 18, 1914	10.00	34.56	1.0277	15.7	......	1.778
5	24	....	....	1.0203	5.616	14.0	Oct. 21, 1914	9.00	32.5	128.5	1.0540	86.27	12.0	......	13.1	4.6	.1	.1	.1	.1	4.9	8.2	Oct. 26, 1914	9.00	39.48	1.0320	16.0	......	2.364
14	24	....	....	1.0235	5.784	24.5	Mar. 18, 1915	9.15	32.5	128.5	1.0461	73.94	9.6	......	11.4	4.1	.3	.0	.0	.....	4.4	7.0	Mar. 23, 1915	9.15	33.58	1.0276	15.6	......	1.849
1	25	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0486	85.064	4.6	......	11.9	4.2	.4	.2	.1	.0	4.9	7.0	Sept. 18, 1914	10.00	34.80	1.0261	9.6	......	2.340
5	25	....	....	1.0203	5.616	14.0	Oct. 21, 1914	9.00	32.5	128.5	1.0479	82.98	4.7	......	11.5	3.8	.6	.2	.1	.1	4.7	6.8	Oct. 26, 1914	9.00	36.74	1.0253	7.6	......	2.180
14	25	....	....	1.0235	5.784	24.5	Mar. 18, 1915	9.15	32.5	128.5	1.0470	80.75	6.0	......	11.5	4.3	.5	.1	.0	.....	4.9	6.6	Mar. 23, 1915	9.15	35.66	1.0260	11.2	......	2.115
1	26	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0470	81.43	7.6	......	11.5	4.5	.1	.2	+.1	−.1	4.7	6.8	Sept. 18, 1914	10.00	33.36	1.0254	11.6	......	2.141
5	26	....	....	1.0203	5.616	14.0	Oct. 21, 1914	9.00	32.5	128.5	1.0559	90.76	6.8	......	13.5	4.1	.8	.0	.0	.2	4.9	8.6	Oct. 26, 1914	9.00	41.04	1.0329	4.8	......	2.314
15	26	14.7	....	1.0224	6.113	17.4	Mar. 26, 1915	9.15	32.5	128.5	1.0506	85.80	8.9	......	12.1	4.2	.7	.1	.1	.....	5.1	7.0	Mar. 31, 1915	9.15	36.44	1.0282	10.8	......	2.334
1	27	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0453	71.84	5.2	......	11.0	3.8	.3	.1	.1	.0	4.3	6.7	Sept. 18, 1914	10.00	30.88	1.0259	10.4	......	1.811
5	27	....	....	1.0203	5.616	14.0	Oct. 21, 1914	9.00	32.5	128.5	1.0550	87.94	6.0	......	13.2	4.0	.6	.1	.0	.1	4.7	8.5	Oct. 26, 1914	9.00	39.40	1.0332	8.8	......	2.400
1	28	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0283	27.90	1.2	......	7.4	.7	.1	.0	.2	.0	1.0	6.4	Sept. 18, 1914	10.00	18.82	1.0246	4.6	......	0.453
1	29	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0386	63.42	3.6	......	9.9	3.2	.3	.1	.1	.1	3.7	6.2	Sept. 18, 1914	10.00	27.18	1.0237	7.0	......	1.494
2	29	12.0	....	......	......	....	Sept. 24, 1914	9.30	32.5	128.5	1.0511	87.28	4.0	......	12.2	3.6	.5	.0	.0	.....	4.1	8.1	Sept. 29, 1914	9.30	39.52	1.0308	7.2	......	2.008
15	29	14.7	....	1.0224	6.113	17.4	Mar. 26, 1915	9.15	32.5	128.5	1.0306	45.14	3.5	......	7.8	2.3	.2	.2	.2	.....	2.9	4.9	Mar. 31, 1915	9.15	20.92	1.0195	13.8	......	1.265
1	30	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0495	60.20	4.8	......	9.1	3.0	.2	.0	.1	.0	3.3	5.8	Sept. 18, 1914	10.00	23.40	1.0221	9.6	......	1.619
4	30	....	....	1.0208	5.762	14.8	Oct. 14, 1914	9.00	32.5	128.5	1.0477	74.04	6.3	......	11.7	3.6	.9	.2	.0	.1	4.7	7.0	Oct. 19, 1914	9.00	28.12	1.0272	11.0	......	2.322
1	31	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0444	69.28	3.8	......	10.9	3.7	.9	.1	.1	.1	4.8	6.1	Sept. 18, 1914	10.00	24.74	1.0235	8.4	......	2.189
4	31	....	....	1.0208	5.672	14.8	Oct. 14, 1914	9.00	32.5	128.5	1.0500	77.84	4.4	......	11.9	1.6	1.4	.1	.1	.1	3.2	8.7	Oct. 19, 1914	9.00	44.17	1.0342	9.2	......	1.586
6	31	....	....	1.0202	5.533	12.8	Nov. 4, 1914	9.00	32.5	128.5	1.0497	77.94	6.0	......	11.9	2.9	1.6	.4	.1	.0	5.0	6.9	Nov. 9, 1914	9.00	27.62	1.0265	9.8	......	2.299
1	32	....	....	......	......	....	Sept. 13, 1914	10.00	32.5	128.5	1.0447	64.36	5.0	......	11.0	3.0	1.2	.5	.3	.0	5.0	6.0	Sept. 18, 1914	10.00	19.26	1.0235	11.0	......	2.169
4	32	....	....	1.0208	5.672	14.8	Oct. 14, 1914	9.00	32.5	128.5	1.0447	64.04	4.5	......	10.8	1.8	.1	.2	.1	.0	2.2	8.6	Oct. 19, 1914	9.00	39.00	1.0361	9.8	......	1.153
6	32	....	....	1.0202	5.533	12.8	Nov. 4, 1914	9.00	32.5	128.5	1.0490	70.10	6.2	......	11.7	0.5	1.7	.6	.4	.1	3.2	8.5	Nov. 9, 1914	9.00	28.34	1.0336	13.0	......	2.956
11	32	....	22.0	1.0262	5.398	26.4	Feb. 11, 1915	9.15	32.5	128.5	1.0441	62.58	6.4	......	11.6	4.3	1.1	.0	.2	.....	5.6	6.0	Feb. 16, 1915	9.15	18.34	1.0242	11.2	......	2.016

TABLE 3.—*Fermentation record*—Continued.

Fermentation No.	Cook No.	Yeast. Seed yeast. Brix.	Yeast. Seed yeast. Acidity.	Yeast. 96-hour yeast. Sp. gr. at 15° C.	Yeast. 96-hour yeast. Alcohol (per cent by weight).	Yeast. 96-hour yeast. Acidity.	Fermenter set. Date.	Fermenter set. Hour.	Hours filling fermenter.	Hours fermenting, including time of filling.	Mash before fermentation. Sp. gr. at 15° C.	Mash before fermentation. Reducing sugars (grams per liter).	Mash before fermentation. Acidity.	Mash before fermentation. Total solids (per cent).	Mash before fermentation. Brix.	Brix record (decrease in Brix). First day.	Brix record. Second day.	Brix record. Third day.	Brix record. Fourth day.	Brix record. Fifth day.	Attenuation (degrees).	Brix fourth day.	Beer. Distillation. Date.	Beer. Distillation. Hour.	Beer. Reducing sugars (grams per liter).	Beer. Sp. gr. at 15° C.	Beer. Acidity.	Beer. Total solids (per cent by weight).	Beer. Alcohol (per cent by weight).
2	33	12.0	....	......	......	....	Sept. 24, 1914	*a. m.* 9.30	32.5	128.5	1.0598	102.74	5.3	......	14.5	3.9	1.4	0.3	0.0	.....	5.5	8.9	Sept. 29, 1914	*a. m.* 9.30	45.65	1.0340	8.7	......	3.066
3	33	....	....	1.0209	5.867	14.0	Oct. 7, 1914	9.00	32.5	128.5	1.0516	88.72	5.0	......	12.6	3.5	1.2	.2	.0	.....	4.9	7.6	Oct. 12, 1914	9.00	40.06	1.0296	9.6	......	2.409
2	34	12.0	....	......	......	....	Sept. 24, 1914	9.30	32.5	128.5	1.0583	100.56	4.4	......	14.1	3.8	1.5	.3	.0	.....	5.7	8.4	Sept. 29, 1914	9.30	40.14	1.0323	8.4	......	2.243
3	34	....	....	1.0209	5.867	14.0	Oct. 7, 1914	9.00	32.5	128.5	1.0529	89.92	4.8	......	13.0	2.9	1.4	.4	.1	.....	4.8	8.2	Oct. 12, 1914	9.00	40.92	1.0319	10.2	......	3.348
15	34	14.7	....	1.0224	6.113	17.4	Mar. 26, 1915	9.15	32.5	128.5	1.0499	81.92	6.0	......	12.2	4.3	1.0	.0	.1	.....	5.4	6.8	Mar. 31, 1915	9.15	32.48	1.0271	6.8	......	2.463
2	36	12.0	....	......	......	....	Sept. 24, 1914	9.30	32.5	128.5	1.0552	76.08	5.4	......	13.4	3.2	1.3	.2	.1	.....	4.8	8.6	Sept. 29, 1914	9.30	25.56	1.0340	10.3	......	2.316
3	36	....	....	1.0209	5.867	14.0	Oct. 7, 1914	9.00	32.5	128.5	1.0492	64.84	4.8	......	11.9	2.1	1.1	.2	.0	.....	4.4	7.5	Oct. 12, 1914	9.00	19.70	1.0290	10.2	......	2.114
11	36	....	22.0	1.0262	5.398	26.4	Feb. 11, 1915	9.15	32.5	128.5	1.0450	57.42	5.8	......	11.0	3.1	.9	.1	.2	.....	4.3	6.7	Feb. 16, 1915	9.15	19.68	1.0278	10.0	......	1.824
2	35	12.0	....	......	......	....	Sept. 24, 1914	9.30	32.5	128.5	1.0629	115.76	4.0	......	15.2	4.7	1.4	.2	.0	.....	6.8	8.9	Sept. 29, 1914	9.30	49.52	1.0349	8.8	......	3.348
3	35	....	....	1.0209	5.867	14.0	Oct. 7, 1914	9.00	32.5	128.5	1.0540	98.56	4.0	......	13.2	3.6	1.3	.4	.0	.....	5.3	7.9	Oct. 12, 1914	9.00	41.64	1.0304	8.9	......	2.737
2	37	12.0	....	......	......	....	Sept. 24, 1914	9.30	32.5	128.5	1.0632	116.37	3.4	......	15.4	4.5	1.5	.2	.0	.....	6.2	9.2	Sept. 29, 1914	9.30	50.78	1.0360	8.4	......	3.079
3	37	....	....	1.0209	5.867	14.0	Oct. 7, 1914	9.00	32.5	128.5	1.0508	89.44	2.0	......	13.4	5.2	.9	.0	.0	.....	6.1	7.3	Oct. 12, 1914	9.00	37.41	1.0294	8.0	......	2.336
15	37	14.7	....	1.0224	6.113	17.4	Mar. 26, 1915	9.15	32.5	128.5	1.0504	89.87	5.0	......	12.4	4.4	.8	.2	.1	.....	5.5	6.9	Mar. 31, 1915	9.15	39.12	1.0278	8.8	......	2.403
2	38	12.0	....	......	......	....	Sept. 24, 1914	9.30	32.5	128.5	1.0454	72.44	2.0	......	11.2	3.4	.2	.0	.1	.....	3.7	8.5	Sept. 29, 1914	9.30	41.32	1.0335	6.2	......	1.732
3	38	....	....	1.0209	5.867	14.0	Oct. 7, 1914	9.00	32.5	128.5	1.0479	68.92	1.8	......	10.9	2.6	.2	.1	.0	.....	2.9	8.0	Oct. 12, 1914	9.00	37.56	1.0313	5.2	......	1.673
7	38	....	....	1.0200	5.673	14.0	Nov. 11, 1914	9.00	32.5	128.5	1.0427	64.32	2.8	......	11.0	2.6	.3	.1	.0	0.2	3.0	8.0	Nov. 16, 1914	9.00	36.66	1.0309	4.0	......	1.382
2	39	12.0	....	......	......	....	Sept. 24, 1914	9.30	32.5	128.5	1.0585	100.54	2.2	......	14.3	4.1	1.1	.1	.0	.....	5.3	9.0	Sept. 29, 1914	9.30	46.68	1.0353	6.0	......	2.564
3	39	....	....	1.0209	5.867	14.0	Oct. 7, 1914	9.00	32.5	128.5	1.0446	75.08	2.8	......	11.0	3.7	.4	.1	.1	.....	4.3	6.7	Oct. 12, 1914	9.00	32.42	1.0262	6.8	......	1.923
15	39	14.7	....	1.0224	6.113	17.4	Mar. 26, 1915	9.15	32.5	128.5	1.0464	77.20	4.3	......	11.4	3.7	.7	.0	.1	.....	4.5	6.9	Mar. 31, 1915	9.15	35.50	1.0278	7.2	......	2.121
3	40	....	....	1.0209	5.867	14.0	Oct. 7, 1914	9.00	32.5	128.5	1.0546	98.36	3.6	......	13.7	2.7	1.6	.7	.3	.....	5.3	8.4	Oct. 12, 1914	9.00	44.64	1.0332	8.2	......	2.483
4	40	....	....	1.0208	5.672	14.8	Oct. 14, 1914	9.00	32.5	128.5	1.0491	83.34	3.2	......	11.8	2.4	.2	.0	.0	.0	2.6	9.2	Oct. 19, 1914	9.00	54.38	1.0361	8.0	......	1.501
15	40	14.7	....	1.0224	6.113	17.4	Mar. 26, 1915	9.15	32.5	128.5	1.0499	84.85	4.4	......	12.3	3.7	1.3	.3	.1	.....	5.4	6.9	Mar. 31, 1914	9.15	30.30	1.0273	9.2	......	2.424
4	41	....	....	1.0208	5.672	14.8	Oct. 14, 1914	9.00	32.5	128.5	1.0491	84.36	2.8	......	11.7	2.1	.3	+.1	−.2	.0	2.6	9.1	Oct. 19, 1914	9.00	55.86	1.0362	6.0	......	1.390
5	41	....	....	1.0203	5.616	14.0	Oct. 21, 1914	9.00	32.5	128.5	1.0518	87.67	4.2	......	12.2	3.9	1.1	.2	0	.1	5.2	7.0	Oct. 26, 1914	9.00	36.66	1.0271	7.2	......	2.415
6	41	....	....	1.0202	5.533	12.8	Nov. 4, 1914	9.00	32.5	128.5	1.0517	90.96	4.4	......	12.5	3.0	1.6	.4	.2	.0	5.2	7.3	Nov. 9, 1914	9.00	38.42	1.0284	8.8	......	2.397
7	41	....	....	1.0200	5.673	14.0	Nov. 11, 1914	9.00	32.5	128.5	1.0471	86.25	4.0	......	11.5	2.5	.7	.4	.2	.0	3.8	7.7	Nov. 16, 1914	9.00	44.84	1.0310	4.4	......	2.008
8	41	....	....	1.0234	6.088	16.0	Nov. 18, 1914	9.15	32.5	128.5	1.0570	98.18	4.0	......	13.6	3.2	.7	.3	.2	.0	4.4	9.2	Nov. 23, 1914	9.15	52.52	1.0367	8.4	......	2.199
4	42	....	....	1.0208	5.672	14.8	Oct. 14, 1914	9.00	32.5	128.5	1.0465	73.28	3.0	......	10.9	1.4	.0	+.1	−.1	.1	1.4	9.5	Oct. 19, 1914	9.00	53.104	1.0371	7.8	......	1.138
5	42	....	....	1.0203	5.616	14.0	Oct. 21, 1914	9.00	32.5	128.5	1.0480	78.62	3.6	......	11.7	2.5	.3	.2	.1	.1	3.1	8.6	Oct. 26, 1914	9.00	46.38	1.0340	8.2	......	1.533
6	42	....	....	1.0202	5.533	12.8	Nov. 4, 1914	9.00	32.5	128.5	1.0550	89.68	5.6	......	13.1	2.6	1.5	.9	2	.2	5.2	7.7	Nov. 9, 1914	9.00	34.14	1.0297	9.2	......	2.501
7	42	....	....	1.0200	5.673	14.0	Nov. 11, 1914	9.00	32.5	128.5	1.0503	81.82	5.0	......	12.3	3.9	1.2	.3	.2	.1	5.6	6.7	Nov. 16, 1914	9.00	28.16	1.0207	5.6	......	2.488

8	42			1.0234	6.088	16.0	Nov. 18, 1914	9.15	32.5	128.5	1.0504	81.28	5.6		12.1	3.2	1.5	.4	.2	.0	5.3	6.8	Nov. 23, 1914	9.15	29.28	1.0270	10.0		2.439
9	42			1.0235	6.067	15.5	Nov. 25, 1914	9.15	32.5	128.5	1.0587	96.88	5.6		14.4	4.2	1.8	.6	.1	.0	6.7	7.7	Nov. 30, 1914	9.15	33.84	1.0310	10.8		2.745
15	42	14.7		1.0224	6.113	17.4	Mar. 26, 1915	9.15	32.5	128.5	1.0489	44.144	6.6		12.1	3.2	1.1	.6	.4	.0	5.3	6.8	Mar. 31, 1915	9.15	35.44	1.0271	10.7		2.356
5	43			1.0203	5.616	14.0	Oct. 21, 1914	9.00	32.5	128.5	1.0456	78.04	3.6		11.4	3.4	1.0	.2	.2	.0	4.8	6.6	Oct. 26, 1914	9.00	34.68	1.0275	6.8		2.258
6	43			1.0218	5.604	12.0	Nov. 4, 1914	9.00	32.5	128.5	1.0460	79.10	3.2		11.6	3.8	2.2	.0	.2	.0	5.2	6.4	Nov. 9, 1914	9.00	31.82	1.0250	6.6		2.278
7	43			1.0195	5.660	13.0	Nov. 11, 1914	9.00	32.5	128.5	1.0492	85.50	4.6		12.1	3.7	1.1	.3	.1	.1	5.2	6.9	Nov. 16, 1914	9.00	34.02	1.0208	8.8		2.297
8	43			1.0234	6.088	16.0	Nov. 18, 1914	9.15	32.5	128.5	1.0470	79.32	3.6		11.3	3.4	1.2	.2	.1	.1	4.9	6.4	Nov. 23, 1914	9.15	32.34	1.0256	8.8		2.116
9	43			1.0235	6.067	15.5	Nov. 25, 1914	9.15	32.5	128.5	1.0584	101.16	6.0		14.3	4.2	1.7	.3	.2	.0	5.4	7.9	Nov. 30, 1914	9.15	41.72	1.0320	10.0		2.815
21	43			1.0223	6.143	16.0	June 18, 1915	9.15	32.5	128.5	1.0587	99.24	7.8	12.762	14.0	4.5	1.4	.5	+.1		6.3	7.7	June 22, 1915	9.15	40.26	1.0310	13.2	7.578	2.720
6	44			1.0218	5.604	12.0	Nov. 4, 1914	9.00	32.5	128.5	1.0558	77.02	4.0		13.4	3.2	1.7	.5	.2	.0	5.6	7.8	Nov. 9, 1914	9.00	42.18	1.0312	9.2		2.589
7	44			1.0195	5.660	13.0	Nov. 11, 1914	9.00	32.5	128.5	1.0430	77.98	3.6		10.6	3.7	.7	.1	.3	.1	4.8	5.8	Nov. 16, 1914	9.00	31.42	1.0229	6.4		2.258
8	44			1.0234	6.088	16.0	Nov. 18, 1914	9.15	32.5	128.5	1.0507	89.26	3.4		12.3	3.8	1.4	.2	.1	.0	5.5	6.8	Nov. 23, 1914	9.15	36.16	1.0273	8.0		2.536
9	44			1.0235	6.067	15.5	Nov. 25, 1914	9.15	32.5	128.5	1.0569	101.69	4.8		13.9	3.5	1.0	1.0	.5	.5	6.0	7.9	Nov. 30, 1914	9.15	45.44	1.0317	8.8		2.752
6	45			1.0218	5.604	12.0	Nov. 4, 1914	9.00	32.5	128.5	1.0498	82.20	1.2		12.2	3.2	1.6	.3	.2	.0	5.3	6.9	Nov. 9, 1914	9.00	29.90	1.0262	7.0		2.319
7	45			1.0195	5.660	13.0	Nov. 11, 1914	9.00	32.5	128.5	1.0306	61.40	2.4		9.6	2.3	.1	.2	.2	.2	2.8	6.8	Nov. 16, 1914	9.00	35.90	1.0268	8.0		1.217
8	45			1.0222	5.958	15.0	Nov. 18, 1914	9.15	32.5	128.5	1.0508	84.68	2.4		12.3	3.4	1.9	.1	.1	.0	5.5	6.8	Nov. 23, 1914	9.15	31.74	1.0270	8.8		2.595
9	45			1.0235	6.067	15.5	Nov. 25, 1914	9.15	32.5	128.5	1.0558	92.40	4.0		13.5	4.1	1.8	.1	.1	.0	6.1	7.4	Nov. 30, 1914	9.15	32.38	1.0295	8.8		2.632
21	45			1.0223	6.143	16.0	June 18, 1915	9.15	32.5	128.5	1.0635	102.624	6.8	13.12	15.0	4.0	2.0	.5	.2		6.7	8.3	June 22, 1915	9.15	37.80	1.0333	12.4	7.916	2.990
6	46			1.0218	5.604	12.0	Nov. 4, 1914	9.00	32.5	128.5	1.0535	72.72	5.4		12.8	2.2	1.5	1.0	.5	.1	5.2	7.6	Nov. 9, 1914	9.00	20.68	1.0303	11.2		2.548
7	46			1.0195	5.660	13.0	Nov. 11, 1914	9.00	32.5	128.5	1.0405	55.00	4.8		10.4	1.8	.1	.1	.1	.1	2.1	8.3	Nov. 16, 1914	9.00	35.99	1.0327	8.6		1.089
8	46			1.0222	5.958	15.0	Nov. 18, 1914	9.15	32.5	128.5	1.0476	64.384	4.4		11.6	2.9	1.3	.4	.3	.0	4.9	6.7	Nov. 23, 1914	9.15	18.40	1.0257	12.8		2.226
9	46			1.0234	5.843	16.4	Nov. 25, 1914	9.15	32.5	128.5	1.0469	63.10	2.5		11.5	3.4	1.1	.4	.1	.3	5.0	6.5	Nov. 30, 1914	9.15	16.96	1.0257	12.0		2.130
7	47			1.0200	5.673	14.0	Nov. 11, 1914	9.00	32.5	128.5	1.0479	73.744	2.0		11.8	2.6	1.4	.7	.4	.2	5.1	6.5	Nov. 16, 1914	9.00	23.10	1.0261	7.3		2.485
8	47			1.0222	5.958	15.0	Nov. 18, 1914	9.15	32.5	128.5	1.0525	75.88	2.6		12.4	3.0	1.4	.6	.2	.1	5.2	7.2	Nov. 23, 1914	9.15	25.90	1.0276	8.4		2.321
9	47			1.0234	5.843	16.4	Nov. 25, 1914	9.15	32.5	128.5	1.0540	81.80	2.8		13.3	3.8	1.7	.6	.1	.0	6.2	7.1	Nov. 30, 1914	9.15	25.16	1.0283	9.0		2.713
21	47			1.0223	6.143	16.0	June 18, 1915	9.15	32.5	128.5	1.0600	88.544	7.6	12.137	14.4	4.6	1.2	.6	.0		6.4	8.0	June 22, 1915	9.15	27.84	1.0318	14.2	7.390	2.830
8	48			1.0222	5.958	15.0	Nov. 18, 1914	9.15	32.5	128.5	1.0448	69.776	2.2		11.1	3.1	1.6	.1	.0	.0	4.8	6.3	Nov. 23, 1914	9.15	26.44	1.0246	8.0		2.186
9	48			1.0234	5.843	16.4	Nov. 25, 1914	9.15	32.5	128.5	1.0544	88.47	3.4		13.2	3.2	1.9	.5	.2	.0	5.8	7.4	Nov. 30, 1914	9.15	33.62	1.0298	8.8		2.588
10	48			1.0243	6.170	18.6	Jan. 21, 1915	9.15	32.5	128.5	1.0488	79.16	4.4	9.638	12.1	3.3	1.1	.3	.2	.1	4.9	7.2	Jan. 26, 1915	9.15	32.40	1.0287	8.0	6.237	2.070
9	49			1.0234	5.843	16.4	Nov. 25, 1914	9.15	32.5	128.5	1.0417	57.728	3.3		10.5	3.3	.5	.9	+.3	.0	4.4	6.1	Nov. 30, 1914	9.15	19.84	1.0251	8.8		1.707
10	49			1.0243	6.170	18.6	Jan. 21, 1915	9.15	32.5	128.5	1.0384	52.40	5.6	7.329	9.9	2.4	1.4	.1	.0	.1	3.9	6.0	Jan. 26, 1915	9.15	16.48	1.0239	10.0	5.021	1.514
10	50			1.0243	6.170	18.6	Jan. 21, 1915	9.15	32.5	128.5	1.0495	94.92	3.2	10.301	12.1	3.1	.3	+.1	−.2	.0	3.5	8.6	do.	9.15	56.28	1.0341	7.0	7.207	1.4707
11	50		22.0	1.0262	5.398	26.4	Feb. 11, 1915	9.15	32.5	128.5	1.0543	97.936	2.4	12.325	13.3	3.0	.5	.2	.2		3.9	9.4	Feb. 16, 1915	9.15	61.74	41.0392	7.2	9.490	1.578
14	50		22.5	1.0235	5.784	24.5	Mar. 18, 1915	9.15	32.5	128.5	1.0440	83.38	2.8	9.190	11.0	2.9	.4	.3	+.2		3.4	7.6	Mar. 23, 1915	9.15	51.26	41.0302	5.6	6.438	1.320
17	55	11.4		1.0216	5.922	18.7	Apr. 15, 1915	9.15	32.5	128.5	1.0470	64.48	3.2	9.426	11.8	3.6	1.5	.3	.0		5.4	6.4	Apr. 20, 1915	9.15	14.74	1.0245	8.4	5.603	2.382
17	55	11.4		1.0216	5.922	18.7	do.	9.15	32.5	128.5	1.0454	62.44	3.0	9.115	11.4	3.5	1.5	.2	.2		5.4	6.0	do.	9.15	13.76	1.0237	8.8	5.347	2.315
16	55	13.9	18.5	1.0223	6.167	26.2	Apr. 1, 1915	9.15	32.5	128.5	1.0498	58.12	2.6	9.266	12.2	3.5	1.5	.2	.1		5.3	6.9	Apr. 6, 1915	9.15	10.04	1.0274	8.0	5.971	2.311
16	55	13.9	18.5	1.0223	6.167	26.2	do.	9.15	32.5	128.5	1.0478	56.40	2.5	9.564	11.9	3.3	1.6	.2	+.1		5.2	6.7	do.	9.15	10.28	1.0269	7.6	5.783	2.259
18	55	11.4		1.0210	6.009	22.3	May 6, 1915	9.15	32.5	128.5	1.0498	59.74	3.2	10.422	12.2	3.7	1.3	−.3	+.2	−.1	5.1	7.1	May 11, 1915	9.15	10.64	1.0275	7.6	6.289	2.224
16	56	13.9	18.5	1.0223	6.167	26.2	Apr. 1, 1915	9.15	32.5	128.5	1.0514	65.20	4.0	9.567	12.4	3.4	1.6	.5	.1	.1	5.6	6.8	Apr. 6, 1915	9.15	14.54	1.0270	8.6	5.842	2.390
16	56	13.9	18.5	1.0223	6.167	26.2	do.	9.15	32.5	128.5	1.0509	64.60	4.0	8.858	12.4	3.1	1.7	.6	.2		5.6	6.8	do.	9.15	14.42	1.0268	8.6	5.848	2.395
17	56	11.4		1.0216	5.922	18.7	Apr. 15, 1915	9.15	32.5	128.5	1.0475	57.344	2.4	9.428	12.0	3.1	1.8	.2	.1		5.2	6.8	Apr. 20, 1915	9.15	10.22	1.0268	7.6	5.873	2.259
17	56	11.4		1.0216	5.922	18.7	do.	9.15	32.5	128.5	1.0498	60.10	2.6	9.979	12.4	3.4	1.7	.1	.0		5.2	7.2	do.	9.15	11.00	1.0278	7.4	6.160	2.345
18	56	11.4		1.0210	6.009	22.3	May 6, 1915	9.15	32.5	128.5	1.0487	66.52	4.4	11.110	12.3	3.7	1.5	.3	.0	.1	5.7	6.6	May 11, 1915	9.15	14.60	1.0262	11.2	6.070	2.543
20	56	13.1		1.0230	5.650	18.0	June 10, 1915	9.15	32.5	128.5	1.0429	56.904	4.5	8.606	10.7	3.6	1.1	.2	.0		4.9	5.8	June 15, 1915	9.15	12.92	1.0227	9.6	5.278	1.968
20	56	13.1		1.0230	5.650	18.0	do.	9.15	32.5	128.5	1.0542	71.288	4.8	10.750	13.1	3.4	1.8	.7	.1		6.0	7.1	do.	9.15	16.24	1.0287	12.0	6.493	2.590
17	57	11.4		1.0216	5.922	18.7	Apr. 15, 1915	9.15	32.5	128.5	1.0529	70.24	2.7	10.614	13.1	4.0	1.5	.3	.1		5.9	7.2	Apr. 20, 1915	9.15	13.54	1.0279	7.4	6.264	2.558
17	57	11.4		1.0216	5.922	18.7	do.	9.15	32.5	128.5	1.0509	66.32	2.4	10.076	12.5	3.5	1.7	.3	.2		5.7	6.8	do.	9.15	13.78	1.0263	7.4	6.023	2.543
18	57	11.4		1.0210	6.009	22.3	May 6, 1915	9.15	32.5	128.5	1.0463	62.02	2.8	9.962	11.5	3.9	1.2	.2	+.1	−.1	5.2	6.3	May 11, 1915	9.15	12.76	1.0247	7.6	5.781	2.318
18	57	11.4		1.0210	6.009	22.3	do.	9.15	32.5	128.5	1.0400	52.26	2.4	8.705	10.0	3.7	.9	.2	+.1	.0	4.7	5.3	do.	9.15	11.24	1.0213	6.0	4.948	1.099
19	57	12.9		1.0232	5.541	16.5	May 13, 1915	9.15	32.5	128.5	1.0474	60.984	3.0	8.539	11.7	3.6	1.3	.4	.1		5.4	6.3	May 18, 1915	9.15	12.86	1.0240	8.8	5.805	2.266
19	57	12.9		1.0232	5.541	16.5	do.	9.15	32.5	128.5	1.0472	60.476	3.0	8.465	11.5	3.3	1.5	.4	.0		5.2	6.3	do.	9.15	12.48	1.0246	8.8	5.951	2.274

TABLE 3.—*Fermentation record*—Continued.

Fermentation No.	Cook No.	Yeast. Seed yeast. Brix.	Yeast. Seed yeast. Acidity.	Yeast. 96-hour yeast. Sp. gr. at 15° C.	Yeast. 96-hour yeast. Alcohol (per cent by weight).	Yeast. 96-hour yeast. Acidity.	Fermenter set. Date.	Fermenter set. Hour.	Hours filling fermenter.	Hours fermenting, including time of filling.	Mash before fermentation. Sp. gr. at 15° C.	Mash before fermentation. Reducing sugars (grams per liter).	Mash before fermentation. Acidity.	Mash before fermentation. Total solids (per cent).	Mash before fermentation. Brix.	Brix record (decrease in Brix). First day.	Brix record. Second day.	Brix record. Third day.	Brix record. Fourth day.	Brix record. Fifth day.	Attenuation (degrees).	Beer. Brix fourth day.	Beer. Distillation. Date.	Beer. Distillation. Hour.	Beer. Reducing sugars (grams per liter).	Beer. Sp. gr. at 15° C.	Beer. Acidity.	Beer. Total solids (per cent by weight).	Beer. Alcohol (per cent by weight).
								a. m.																*a. m.*					
18	58	11.4	....	1.0210	6.009	22.3	May 6, 1915	9.15	32.5	128.5	1.0468	75.81	3.2	10.996	11.7	3.8	1.3	0.1	0.0	0.0	5.2	6.5	May 11, 1915	9.15	29.26	1.0258	7.2	6.204	2.218
18	58	11.4	....	1.0210	6.009	22.3	.....do.....	9.15	32.5	128.5	1.0497	81.48	2.6	11.006	12.4	3.9	1.4	.1	.0	.0	5.4	7.0	.....do.....	9.15	31.12	1.0275	6.3	6.484	2.117
19	58	12.9	....	1.0232	5.541	16.5	May 13, 1915	9.15	32.5	128.5	1.0523	83.152	3.0	9.679	12.7	3.5	1.4	.4	.1	.....	5.4	7.3	May 18, 1915	9.15	32.28	1.0285	7.8	7.196	2.421
19	58	12.9	....	1.0232	5.541	16.5	.....do.....	9.15	32.5	128.5	1.0540	87.192	3.0	10.508	13.3	3.5	1.5	.6	.1	.....	5.7	7.6	.....do.....	9.15	34.12	1.0300	9.2	7.453	2.500
20	58	13.1	....	1.0230	5.650	18.0	June 10, 1915	9.15	32.5	128.5	1.0553	87.792	2.5	11.180	13.2	3.2	1.8	.6	.1	.....	5.7	7.5	June 15, 1915	9.15	33.80	1.0300	10.0	7.063	2.456
18	59	11.4	....	1.0210	6.009	22.3	May 6, 1915	9.15	32.5	128.5	1.0502	57.96	3.4	8.716	10.0	3.2	1.3	.2	.0	.1	4.7	5.3	May 11, 1915	9.15	14.96	1.0206	6.2	4.832	1.843
19	59	12.9	....	1.0232	5.541	16.5	May 13, 1915	9.15	32.5	128.5	1.0440	63.48	2.8	8.381	10.8	3.4	1.3	.3	.0	.....	5.0	5.8	May 18, 1915	9.15	16.04	1.0223	7.2	5.725	2.147
19	59	12.9	....	1.0232	5.541	16.5	.....do.....	9.15	32.5	128.5	1.0477	67.40	2.7	8.812	11.5	3.5	1.5	.4	.1	.....	5.5	6.0	.....do.....	9.15	17.16	1.0245	7.2	5.802	2.382
20	59	13.1	....	1.0230	5.650	18.0	June 10, 1915	9.15	32.5	128.5	1.0552	80.512	4.0	11.220	13.3	3.2	2.1	.7	.2	.....	6.2	7.1	June 15, 1915	9.15	21.64	1.0282	11.2	6.558	2.694
19	60	12.9	....	1.0232	5.541	16.5	May 13, 1915	9.15	32.5	128.5	1.0464	68.048	4.2	8.778	11.2	3.6	1.2	.3	.0	.....	5.1	6.1	May 18, 1915	9.15	19.68	1.0241	9.2	5.849	2.246
19	60	12.9	....	1.0232	5.541	16.5	.....do.....	9.15	32.5	128.5	1.0439	64.72	4.2	8.152	10.8	3.3	1.4	.2	.0	.....	4.9	5.9	.....do.....	9.15	18.60	1.0230	8.0	5.690	2.072
20	60	13.1	....	1.0230	5.650	18.0	June 10, 1915	9.15	32.5	128.5	1.0532	77.34	4.1	10.750	12.9	3.4	1.8	.4	.1	.....	5.7	7.2	June 15, 1915	9.15	31.44	1.0286	13.3	6.713	2.469
20	60	13.1	....	1.0230	5.650	18.0	.....do.....	9.15	32.5	128.5	1.0500	72.16	4.0	10.650	12.2	3.1	1.8	.4	.1	.....	5.5	6.7	.....do.....	9.15	23.06	1.0265	12.0	6.264	2.474
21	60	....	....	1.0223	6.143	16.0	June 18, 1915	9.15	32.5	128.5	1.0513	77.48	4.4	11.035	12.6	4.5	1.0	.3	.0	.....	5.8	6.8	June 22, 1915	9.15	24.40	1.0269	11.2	6.439	2.517
20	61	13.1	....	1.0230	5.650	18.0	June 10, 1915	9.15	32.5	128.5	1.0480	70.432	2.2	9.440	11.7	3.6	1.5	.3	.2	.....	5.6	6.1	June 15, 1915	9.15	26.12	1.0246	7.8	5.810	2.381
20	61	13.1	....	1.0230	5.650	18.0	.....do.....	9.15	32.5	128.5	1.0470	86.464	1.8	8.233	11.5	3.5	1.8	.1	.1	.....	5.5	6.0	.....do.....	9.15	20.20	1.0241	7.8	5.702	2.229
21	61	....	....	1.0223	6.143	16.0	June 18, 1915	9.15	32.5	128.5	1.0512	75.00	3.2	10.691	12.3	4.7	.8	.2	.1	.....	5.8	6.5	June 22, 1915	9.15	20.70	1.0260	8.0	6.172	2.493
21	61	....	....	1.0223	6.143	16.0	.....do.....	9.15	32.5	128.5	1.0519	94.616	3.6	10.777	12.4	3.9	1.5	.4	+.1	.....	5.7	6.7	.....do.....	9.15	21.52	1.0264	8.8	6.164	2.595
22	62	12.0	22.5	1.0253	5.93	27.2	Oct. 29, 1915	9.15	....	.....	1.0470	60.08	5.0	9.87	11.5	1.4	.5	.3	.0	.1	2.2	9.3	Nov. 2, 1915	9.15	36.00	1.0363	11.4	7.387	1.061
23	62	11.0	26.0	1.0259	5.907	25.2	Nov. 4, 1915	9.15	....	.....	1.0480	63.60	5.4	9.227	11.8	2.3	.4	.1	+.1	.0	2.7	9.1	Nov. 9, 1915	9.15	36.76	1.0365	11.6	7.42	1.119
24	62	14.2	24.0	1.0310	6.052	32.8	Nov. 11, 1915	9.15	....	.....	1.0537	68.98	8.0	10.75	13.0	2.6	.1	.1	.2	.0	3.0	10.0	Nov. 16, 1915	9.15	41.56	1.0414	13.4	8.802	1.095
25	62	15.2	28.0	1.0346	6.089	34.0	Nov. 18, 1915	9.15	....	.....	1.0380	49.88	5.0	8.69	9.9	2.3	.2	.1	.0	.0	2.6	7.3	Nov. 23, 1915	9.15	27.98	1.0292	10.0	6.062	0.991
22	63	12.0	22.5	1.0253	5.93	27.2	Oct. 29, 1915	9.15	....	.....	1.0471	61.58	5.2	9.82	11.6	2.6	1.9	.6	.1	+.1	5.2	6.4	Nov. 2, 1915	9.15	15.84	1.0256	11.2	5.869	2.184
23	63	11.0	26.0	1.0259	5.907	25.2	Nov. 4, 1915	9.15	....	.....	1.0531	70.38	4.4	10.481	12.9	3.9	1.6	.1	.1	.0	5.7	7.2	Nov. 9, 1915	9.15	17.98	1.0284	11.0	6.578	2.450
24	63	14.2	24.0	1.0310	6.052	32.8	Nov. 11, 1915	9.15	....	.....	1.0504	63.23	4.8	10.277	11.8	4.1	.9	.1	.0	.0	5.1	6.7	Nov. 16, 1915	9.15	16.22	1.0268	11.0	6.264	2.172
25	63	15.2	28.0	1.0346	6.089	34.0	Nov. 18, 1915	9.15	....	.....	1.0460	60.72	4.0	10.49	11.8	4.5	.5	.4	.0	.0	5.4	6.4	Nov. 23, 1915	9.15	15.48	1.0248	10.4	5.79	2.244
26	63	15.0	....	1.0366	6.029	39.2	Dec. 2, 1915	9.15	....	.....	1.0472	61.26	5.0	9.34	11.5	4.2	.9	.0	+.1	.....	5.0	6.5	Dec. 7, 1915	9.15	13.72	1.0262	11.6	5.85	2.105
29	63	9.6	17.6	1.0204	5.155	20.0	Jan. 13, 1916	9.15	....	.....	1.0308	40.04	2.4	5.98	7.5	1.4	.1	.2	.0	.....	1.7	5.8	Jan. 18, 1916	9.15	22.42	1.0234	6.8	5.00	0.694
22	64	12.0	22.5	1.0253	5.93	27.2	Oct. 29, 1915	9.15	....	.....	1.0564	81.38	3.4	11.79	13.8	2.7	1.9	1.3	.6	.0	6.5	7.3	Nov. 2, 1915	9.15	21.22	1.0292	10.0	6.669	2.852
23	64	11.0	26.0	1.0259	5.907	25.2	Nov. 4, 1915	9.15	....	.....	1.0558	82.77	4.2	11.789	13.8	4.0	2.0	.6	.1	.0	6.7	7.1	Nov. 9, 1915	9.15	19.96	1.0282	11.5	6.972	2.908
24	64	14.2	24.0	1.0310	6.052	32.8	Nov. 11, 1915	9.15	....	.....	1.0473	66.88	3.8	9.675	11.6	4.0	1.3	.0	.2	.0	5.5	6.1	Nov. 16, 1915	9.15	16.32	1.0243	10.0	5.85	2.284

25	64	15.2	28.0	1.0346	6.089	34.0	Nov. 18, 1915	9.15	....	.....	1.0645	90.616	4.4	14.21	15.4	4.0	2.1	.8	.2	.1	7.1	8.3	Nov. 23, 1915	9.15	23.64	1.0334	10.8	7.85	83.222
22	65	12.0	22.5	1.0253	5.93	27.2	Oct. 29, 1915	9.15	....	.....	1.0549	84.92	2.8	11.18	13.4	3.5	1.5	1.0	.0	.0	6.0	7.4	Nov. 2, 1915	9.15	28.38	1.0291	8.0	6.50	82.585
23	65	11.0	26.0	1.0259	5.907	25.2	Nov. 4, 1915	9.15	....	.....	1.0498	77.92	2.8	10.66	12.3	4.3	1.2	.1	.0	.0	5.6	6.7	Nov. 9, 1915	9.15	25.98	1.0262	8.0	6.34	92.358
24	65	14.2	24.0	1.0310	6.052	32.8	Nov. 11, 1915	9.15	....	.....	1.0540	82.304	4.0	11.54	12.8	4.0	1.5	.1	.0	.1	5.6	7.2	Nov. 16, 1915	9.15	27.40	1.0287	9.6	6.57	92.382
25	65	15.2	28.0	1.0346	6.089	34.0	Nov. 18, 1915	9.15	....	.....	1.0595	90.736	4.2	12.38	14.7	4.7	1.8	.3	.0	.0	6.8	7.9	Nov. 23, 1915	9.15	30.94	1.0319	10.0	7.55	42.815
26	65	15.0	....	1.0366	6.029	39.2	Dec. 2, 1915	9.15	....	.....	1.0570	86.416	4.5	11.31	13.7	4.4	1.5	.3	.0	.....	6.2	7.5	Dec. 7, 1915	9.15	28.06	1.0315	5.6	5.65	2.709
27	65	13.5	32.0	1.0331	5.982	39.0	Dec. 16, 1915	9.15	....	.....	1.0519	77.98	4.0	10.79	12.6	4.6	1.0	.2	.0	.....	5.8	6.8	Dec. 21, 1915	9.15	24.80	1.0269	8.8	6.45	2.361
29	65	9.6	17.6	1.0204	5.155	20.0	Jan. 13, 1916	9.15	....	.....	1.0428	67.24	3.6	8.51	11.2	3.7	1.4	.1	.1	.....	4.3	5.9	Jan. 18, 1916	9.15	20.94	1.0239	8.0	5.50	2.197
22	66	12.0	22.5	1.0253	5.93	27.2	Oct. 29, 1915	9.15	....	.....	1.0524	76.49	2.8	15.85	13.0	3.9	2.2	.3	.1	.0	6.5	6.5	Nov. 2, 1915	9.15	21.00	1.0258	8.4	6.09	52.769
23	66	11.0	26.0	1.0259	5.907	25.2	Nov. 4, 1915	9.15	....	.....	1.0479	69.75	3.4	9.315	11.9	4.0	1.7	.2	.1	.0	6.0	5.9	Nov. 9, 1915	9.15	15.34	1.0233	8.1	5.58	72.482
24	66	14.2	24.0	1.0310	6.052	32.8	Nov. 11, 1915	9.15	....	.....	1.0518	74.76	4.0	10.526	12.6	4.3	1.6	.2	.0	.C	6.1	6.5	Nov. 16, 1915	9.15	16.28	1.0262	10.8	6.34	82.563
22	67	12.0	22.5	1.0253	5.93	27.2	Oct. 29, 1915	9.15	....	.....	1.0570	84.60	3.0	13.34	13.9	2.3	2.3	1.2	.7	.1	6.5	7.4	Nov. 2, 1915	9.15	25.16	1.0298	8.6	6.82	22.836
23	67	11.0	26.0	1.0259	5.907	25.2	Nov. 4, 1915	9.15	....	.....	1.0509	76.19	3.4	10.00	12.4	3.6	1.9	.4	.1	.0	6.0	6.4	Nov. 9, 1915	9.15	19.34	1.0252	8.8	5.99	2.599
24	67	14.2	24.0	1.0310	6.052	32.8	Nov. 11, 1915	9.15	....	.....	1.0527	78.184	3.0	10.584	12.6	3.0	1.7	.8	.3	.0	5.8	6.8	Nov. 16, 1915	9.15	18.92	1.0272	10.0	6.53	2.560
25	67	15.2	28.0	1.0346	6.089	34.0	Nov. 18, 1915	9.15	....	.....	1.0514	74.496	3.8	11.68	12.8	4.0	1.6	6	.1	+.1	6.3	6.5	Nov. 23, 1915	9.15	19.56	1.0254	9.6	5.76	62.589
26	67	15.0	....	1.0366	6.029	39.2	Dec. 2, 1915	9.15	....	.....	1.0518	92.928	4.4	10.49	12.5	4.0	1.6	.3	.1	.....	6.0	6.5	Dec. 7, 1915	9.15	19.16	1.0267	9.6	6.24	2.640
27	67	13.5	32.0	1.0331	5.982	39.0	Dec. 16, 1915	9.15	....	.....	1.0518	73.44	3.5	10.62	12.6	4.2	1.5	.4	.....	.....	6.1	6.5	Dec. 21, 1915	9.15	18.12	1.0257	8.0	6.30	2.681
28	67	13.3	20.0	1.0228	5.377	23.5	Jan. 6, 1915	9.15	....	.....	1.0504	71.84	3.7	10.89	12.3	4.2	1.5	.2	.1	.....	6.0	6.3	Jan. 11, 1916	9.15	18.62	1.0254	10.0	6.03	2.379
22	68	12.0	22.5	1.0253	5.93	27.2	Oct. 29, 1915	9.15	....	.....	1.0416	61.12	2.0	9.29	10.4	2.9	1.2	.6	.3	.0	5.1	5.3	Nov. 2, 1915	9.15	17.12	1.0206	7.2	4.96	32.126
23	68	11.0	26.0	1.0259	5.907	25.2	Nov. 4, 1915	9.15	....	.....	1.0461	68.98	2.8	9.003	11.4	3.4	1.7	.6	.1	.1	5.6	5.8	Nov. 9, 1915	9.15	17.56	1.0225	7.6	5.40	12.396
24	68	14.2	24.0	1.0310	6.052	32.8	Nov. 11, 1915	9.15	....	.....	1.0541	81.72	3.0	10.693	13.4	3.9	1.5	.7	2	.1	6.3	7.1	Nov. 16, 1915	9.15	23.06	1.0283	10.4	6.83	2.562
25	68	15.2	28.0	1.0346	6.089	34.0	Nov. 18, 1915	9.15	....	.....	1.0487	72.65	2.6	10.86	12.0	3.6	1.7	.4	.1	.0	5.8	6.2	Nov. 23, 1915	9.15	19.32	1.0244	8.0	6.12	32.528
26	68	15.0	....	1.0366	6.029	39.2	Dec. 2, 1915	9.15	....	.....	1.0467	68.75	3.4	9.46	11.4	3.6	1.5	.5	.0	.....	5.6	5.8	Dec. 7, 1915	9.15	17.98	1.0246	8.4	4.69	2.352
27	68	13.5	32.0	1.0331	5.982	39.0	Dec. 16, 1915	9.15	....	.....	1.0519	76.36	3.6	10.75	12.7	3.8	1.7	.5	.2	.0	6.2	6.5	Dec. 21, 1915	9.17	20.56	1.0257	7.2	6.43	2.691
28	68	13.3	20.0	1.0228	5.377	23.5	Jan. 6, 1915	9.15	....	.....	1.0294	41.384	2.0	6.26	7.1	1.2	1.4	.2	.1	.....	2.9	4.2	Jan. 11, 1916	9.15	13.88	1.0168	7.2	3.72	1.283
23	69	11.0	26.0	1.0259	5.907	25.2	Nov. 4, 1915	9.15	....	.....	1.0490	88.30	3.6	9.642	11.9	2.7	2.0	.5	.1	.1	5.2	6.7	Nov. 9, 1915	9.15	22.72	1.0267	8.6	5.99	72.162
24	69	14.2	24.0	1.0310	6.052	32.8	Nov. 11, 1915	9.15	....	.....	1.0590	109.27	5.2	11.263	14.3	3.7	1.7	.4	.3	0	6.1	8.2	Nov. 16, 1915	9.15	34.80	1.0328	14.8	7.93	2.498
25	69	15.2	28.0	1.0346	6.089	34.0	Nov. 18, 1915	9.15	....	.....	1.0528	78.376	3.2	11.39	13.0	3.5	1.6	.5	.1	.0	5.7	7.3	Nov. 23, 1915	9.15	25.72	1.0290	9.2	6.81	82.507
26	69	15.0	....	1.0366	6.029	39.2	Dec. 2, 1915	9.15	....	.....	1.0580	83.856	4.8	12.00	14.1	4.0	1.7	.4	.2	.....	6.3	7.8	Dec. 7, 1915	9.15	26.80	1.0328	10.7	6.48	2.609
27	69	13.5	32.0	1.0331	5.982	39.0	Dec. 16, 1915	9.15	....	.....	1.0507	73.55	3.2	10.28	12.3	3.3	1.5	.4	.2	.0	5.4	6.9	Dec. 21, 1915	9.15	23.74	1.0273	8.4	6.67	2.219
28	69	13.3	20.0	1.0228	5.377	23.5	Jan. 6, 1916	9.15	....	.....	1.0442	62.58	4.0	8.65	10.9	3.5	1.1	.1	.1	.....	4.8	6.1	Jan. 11, 1916	9.15	19.86	1.0241	9.6	5.67	1.943
29	69	9.6	17.6	1.0204	5.155	20.0	Jan. 13, 1916	9.15	....	.....	1.0520	75.152	4.0	9.96	12.5	2.8	1.9	.6	.3	.....	5.6	6.9	Jan. 18, 1916	9.15	23.08	1.0282	9.2	6.55	2.373
25	70	15.2	28.0	1.0346	6.089	34.0	Nov. 18, 1915	9.15	....	.....	1.0395	78.04	2.8	8.99	10.2	4.0	.9	.1	0	+.1	5.0	5.2	Nov. 23, 1915	9.15	24.88	1.0202	9.0	4.96	22.014
26	70	15.0	....	1.0366	6.029	39.2	Dec. 2, 1915	9.15	....	.....	1.0572	83.784	4.4	11.87	13.9	4.1	1.5	.8	.1	.....	6.5	7.4	Dec. 7, 1915	9.15	28.48	1.0304	8.8	6.30	2.421
27	70	13.5	32.0	1.0331	5.982	39.0	Dec. 16, 1915	9.15	....	.....	1.0339	60.20	2.6	8.76	10.2	4.1	.8	.1	.....	.....	5.0	5.2	Dec. 21, 1915	9.15	19.00	1.0205	6.4	5.06	1.940
26	71	15.0	....	1.0366	6.029	39.2	Dec. 2, 1915	9.15	....	.....	1.0590	86.344	5.2	12.03	14.1	3.6	1.8	.9	.4	.....	6.7	7.4	Dec. 7, 1915	9.15	24.18	1.0308	10.0	7.33	2.949
27	71	13.5	32.0	1.0331	5.982	39.0	Dec. 16, 1915	9.15	....	.....	1.0510	75.416	2.8	10.90	12.2	3.8	1.5	.5	.1	.0	5.9	6.3	Dec. 21, 1915	9.15	19.92	1.0221	8.0	6.28	2.624
28	71	13.3	20.0	1.0228	5.377	23.5	Jan. 6, 1916	9.15	....	.....	1.0495	73.064	3.6	10.51	11.9	3.6	1.4	.7	.1	.....	5.8	6.1	Jan. 11, 1916	9.15	19.38	1.0247	10.0	5.85	2.356
29	71	9.6	17.6	1.0204	5.155	20.0	Jan. 13, 1916	9.15	....	.....	1.0408	60.70	3.8	8.03	12.4	5.1	1.6	.6	.1	.....	7.4	5.0	Jan. 18, 1916	9.15	14.42	1.0202	8.0	4.61	2.073
30	71	10.0	18.0	1.0201	5.264	20.5	Jan. 19, 1916	9.15	....	.....	1.0528	79.27	3.5	11.73	13.0	3.8	1.8	.7	2	.....	6.5	6.5	Jan. 24, 1916	9.15	20.88	1.0247	8.4	5.93	2.752
31	71	11.8	18.8	1.0212	5.204	20.8	Feb. 2, 1916	9.15	....	.....	1.0510	81.41	4.0	11.23	13.6	3.3	1.8	1.4	.....	.....	6.5	7.1	Feb. 9, 1916	9.15	23.00	1.0284	10.8	6.80	2.786
32	71	10.3	18.0	1.0206	5.168	19.2	Feb. 16, 1916	9.15	....	.....	1.0565	82.79	4.0	12.56	13.6	3.9	1.7	.9	.1	.....	6.6	7.0	Feb. 21, 1916	9.15	22.56	1.0280	10.4	6.86	2.709
26	72	15.0	....	1.0366	6.029	39.2	Dec. 2, 1915	9.15	32.5	138.5	1.0591	91.408	4.4	11.90	14.2	3.1	1.2	.5	.1	.....	4.9	9.3	Dec. 7, 1915	9.15	36.08	1.0388	9.6	8.99	2.097
27	72	13.5	32.0	1.0331	5.982	39.0	Dec. 16, 1915	9.15	32.5	138.5	1.0501	67.34	3.7	11.86	12.1	2.9	.7	.4	.0	.....	4.0	8.1	Dec. 21, 1915	9.15	30.32	1.0322	8.7	7.37	1.725
28	72	13.3	20.0	1.0228	5.377	23.5	Jan. 6, 1916	9.15	32.5	138.5	1.0494	67.38	4.0	10.48	11.9	3.1	.8	.....	.1	.....	4.0	7.9	Jan. 11, 1916	9.15	29.76	1.0325	8.6	7.56	1.584
30	72	10.0	18.0	1.0201	5.264	20.5	Jan. 19, 1916	9.15	32.5	138.5	1.0490	65.73	3.4	10.63	11.9	2.6	1.2	.1	.1	.....	4.0	7.9	Jan. 24, 1916	9.15	29.02	1.0314	8.2	6.45	1.753
31	72	11.8	18.8	1.0212	5.204	20.8	Feb. 2, 1916	9.15	32.5	138.5	1.0547	73.96	4.2	11.178	13.4	3.0	1.0	.2	.3	.....	4.5	8.9	Feb. 7, 1916	9.15	33.44	1.0359	10.4	8.33	1.911
33	72	15.3	22.0	1.0336	5.815	27.4	Mar. 30, 1916	9.15	32.5	138.5	1.0491	68.66	3.0	10.36	12.0	3.6	.4	.....	.....	.....	4.0	8.0	Mar. 6, 1916	9.15	30.42	1.0321	4.8	7.34	1.690
27	73	13.5	32.0	1.0331	5.982	39.0	Dec. 16, 1915	9.15	32.5	138.5	1.0528	75.904	4.8	10.42	12.6	2.1	.3	.1	.1	.....	2.6	10.0	Dec. 21, 1915	9.15	50.12	1.0401	10.4	8.91	1.086
28	73	13.3	20.0	1.0228	5.377	23.5	Jan. 6, 1916	9.15	32.5	138.5	1.0479	66.82	5.0	9.76	11.5	2.0	.2	.....	.1	.....	2.3	9.2	Jan. 11, 1916	9.15	43.10	1.0378	9.2	8.40	0.988
29	73	9.6	17.6	1.0204	5.155	20.0	Jan. 13, 1916	9.15	32.5	138.5	1.0485	68.608	5.4	9.35	11.8	2.1	.4	.1	.0	.....	2.6	9.2	Jan. 18, 1916	9.15	43.26	1.0380	8.8	8.27	1.118
30	73	10.0	18.0	1.0201	5.264	20.5	Jan. 19, 1916	9.15	32.5	138.5	1.0503	69.96	5.6	10.64	12.2	2.2	.4	.....	+.1	.....	2.5	9.7	Jan. 24, 1916	9.15	45.57	1.0385	10.0	7.64	1.103

TABLE 3.—*Fermentation record*—Continued.

Fermentation No.	Cook No.	Yeast: Seed yeast: Brix.	Yeast: Seed yeast: Acidity.	Yeast: 96-hour yeast: Sp. gr. at 15° C.	Yeast: 96-hour yeast: Alcohol (per cent by weight).	Yeast: 96-hour yeast: Acidity.	Fermenter set: Date.	Fermenter set: Hour.	Hours filling fermenter.	Hours fermenting, including time of filling.	Mash before fermentation: Sp. gr. at 15° C.	Mash before fermentation: Reducing sugars (grams per liter).	Mash before fermentation: Acidity.	Mash before fermentation: Total solids (per cent).	Mash before fermentation: Brix.	Brix record (decrease in Brix): First day.	Brix record: Second day.	Brix record: Third day.	Brix record: Fourth day.	Brix record: Fifth day.	Attenuation (degrees).	Beer: Brix fourth day.	Beer: Distillation: Date.	Beer: Distillation: Hour.	Beer: Reducing sugars (grams per liter).	Beer: Sp. gr. at 15° C.	Beer: Acidity.	Beer: Total solids (per cent by weight).	Beer: Alcohol (per cent by weight).
31	73	11.8	18.8	1.0212	5.204	20.8	Feb. 2, 1916	*a. m.* 9.15	32.5	138.5	1.0490	68.31	4.8	10.43	11.8	1.8	0.2	.....	0.3	.....	2.3	9.5	Feb. 7, 1916	*a. m.* 9.15	45.32	1.0378	10.0	8.36	1.008
32	73	10.3	18.0	1.0206	5.168	19.2	Mar. 16, 1916	9.15	32.5	138.5	1.0438	60.78	4.6	9.01	10.9	2.1	.2	.....	.....	.....	2.3	8.6	Feb. 21, 1916	9.15	40.42	1.0342	10.0	7.54	0.952
28	74	13.3	20.0	1.0228	5.377	23.5	Jan. 6, 1916	9.15	32.5	138.5	1.0508	71.944	3.1	10.45	12.4	3.0	1.6	1.0	.4	0.1	6.0	6.4	Jan. 11, 1916	9.15	18.38	1.0254	10.0	6.41	2.521
29	74	9.6	17.6	1.0204	5.155	20.0	Jan. 13, 1916	9.15	32.5	138.5	1.0531	75.952	4.0	10.03	12.9	2.7	2.0	1.2	.5	.0	6.4	6.5	Jan. 18, 1916	9.15	18.72	1.0266	10.2	6.23	2.698
30	74	10.0	18.0	1.0201	5.264	20.5	Jan. 19, 1916	9.15	32.5	138.5	1.0510	72.72	3.8	10.86	12.3	3.4	1.9	.7	.1	.....	6.1	6.2	Jan. 24, 1916	9.15	15.00	1.0252	9.6	5.69	2.634
31	74	11.8	18.8	1.0212	5.204	20.8	Feb. 2, 1916	9.15	32.5	138.5	1.0520	71.90	4.2	11.00	12.6	3.1	1.4	.8	.6	.....	5.9	6.7	Feb. 7, 1916	9.15	19.76	1.0268	9.6	6.52	2.568
32	74	10.3	18.0	1.0206	5.168	19.2	Feb. 16, 1916	9.15	32.5	138.5	1.0523	74.45	3.6	12.17	12.6	3.4	1.5	.9	.3	.....	6.1	6.5	Feb. 21, 1916	9.15	18.64	1.0257	10.5	6.30	2.574
33	74	15.3	22.0	1.0336	5.815	27.4	Feb. 30, 1916	9.15	32.5	138.5	1.0490	69.43	4.2	......	12.1	4.3	1.5	.2	.....	.....	6.0	6.1	Mar. 6, 1916	9.15	15.52	1.0240	5.2	5.84	2.603
34	74	11.3	21.3	1.0336	5.771	24.6	Mar. 8, 1916	9.15	32.5	138.5	1.0510	73.06	4.7	11.31	12.4	3.9	1.5	.6	.2	.....	6.2	6.2	Mar. 13, 1916	9.15	16.42	1.0248	8.4	5.94	2.591
28	75	13.3	20.0	1.0228	5.377	23.5	Jan. 6, 1916	9.15	32.5	138.5	1.0540	73.936	4.8	10.91	12.9	2.8	.7	.0	.1	.....	3.6	9.3	Jan. 11, 1916	9.15	37.88	1.0380	12.0	8.18	1.474
29	75	9.6	17.6	1.0204	5.155	20.0	Jan. 13, 1916	9.15	32.5	138.5	1.0513	71.384	5.2	9.64	12.4	2.5	.5	.2	.1	.....	3.3	9.1	Jan. 18, 1916	9.15	39.38	1.0377	9.6	8.50	1.450
30	75	10.0	18.0	1.0201	5.264	20.5	Jan. 19, 1916	9.15	32.5	138.5	1.0509	70.04	5.8	10.78	12.6	3.0	.5	.1	.1	.....	3.7	8.9	Jan. 24, 1916	9.15	34.14	1.0362	12.8	7.25	1.534
31	75	11.8	18.8	1.0212	5.204	20.8	Feb. 2, 1916	9.15	32.5	138.5	1.0498	66.77	8.6	10.42	12.2	2.7	.2	.2	.3	.....	3.4	8.8	Feb. 7, 1916	9.15	35.42	1.0358	12.0	7.79	1.448
32	75	10.3	18.0	1.0206	5.168	19.2	Feb. 16, 1916	9.15	32.5	138.5	1.0521	70.76	6.0	11.63	12.7	2.9	.5	.....	.1	.....	3.5	9.2	Feb. 21, 1916	9.15	46.06	1.0372	10.4	8.19	1.423
33	75	15.3	22.0	1.0336	5.815	27.4	Mar. 30, 1916	9.15	32.5	138.5	1.0372	48.80	4.6	7.66	9.2	2.3	.3	+.2	.1	.....	2.5	6.7	Mar. 6, 1916	9.15	25.48	1.0265	4.4	5.75	1.140
29	76	9.6	17.6	1.0204	5.155	20.0	Jan. 13, 1916	9.15	32.5	138.5	1.0451	63.16	4.0	8.46	11.1	1.1	.3	.1	.1	.....	1.6	9.5	Jan. 18, 1916	9.15	48.28	1.0387	8.0	7.91	.582
30	76	10.0	18.0	1.0201	5.264	20.5	Jan. 19, 1916	9.15	32.5	138.5	1.0503	71.76	5.2	10.77	12.3	1.1	.3	.1	.....	.....	1.5	10.8	Jan. 24, 1916	9.15	52.72	1.0442	9.2	8.47	.709
31	76	11.8	18.8	1.0212	5.204	20.8	Feb. 2, 1916	9.15	32.5	138.5	1.0486	64.24	6.0	9.382	11.5	.8	.1	.2	.2	.....	1.3	10.2	Feb. 7, 1916	9.15	51.38	1.0115	12.0	8.97	.576
32	76	10.3	18.0	1.0206	5.168	19.2	Feb. 16, 1916	9.15	32.5	138.5	1.0483	67.80	6.0	10.53	11.9	1.3	.1	.....	.2	.....	1.6	10.3	Feb. 21, 1916	9.15	53.78	1.0423	8.9	9.41	.528
31	77	11.8	18.8	1.0212	5.204	20.8	Feb. 2, 1916	9.15	32.5	138.5	1.0524	70.78	3.6	10.645	12.3	2.7	.6	.2	.1	.....	3.6	8.7	Feb. 7, 1916	9.15	35.88	1.0350	9.2	7.86	1.575
32	77	10.3	18.0	1.0206	5.168	19.2	Feb. 16, 1916	9.15	32.5	138.5	1.0509	71.57	5.3	11.06	12.4	3.2	.4	.0	.1	.....	3.7	8.7	Feb. 21, 1916	9.15	35.62	1.0351	8.6	7.96	1.623
33	77	16.0	22.0	1.0336	5.815	27.4	Mar. 1, 1916	9.15	32.5	138.5	1.0568	79.34	4.2	11.84	13.7	3.7	.2	.2	.1	.....	4.2	9.5	Mar. 6, 1916	9.15	38.70	1.0385	4.2	8.82	1.743
34	77	11.3	21.3	1.0336	5.771	24.6	Mar. 8, 1916	9.15	32.5	138.5	1.0518	71.58	4.5	10.89	12.6	3.5	.2	.2	.1	.....	4.0	8.6	Mar. 13, 1916	9.15	34.24	1.0351	8.0	7.78	1.565
32	78	10.3	18.0	1.0206	5.168	19.2	Feb. 16, 1916	9.15	32.5	138.5	1.0489	72.13	3.6	10.78	11.9	1.7	.3	.1	.....	.....	2.1	9.8	Feb. 21, 1916	9.15	49.48	1.0396	8.0	9.04	.971
33	78	16.0	22.0	1.0336	5.815	27.4	Mar. 1, 1916	9.15	32.5	138.5	1.0529	77.02	4.4	11.26	12.8	1.8	.4	.1	.....	.....	2.3	10.5	Mar. 6, 1916	9.15	54.09	1.0425	4.6	9.24	.988
34	78	11.3	21.3	1.0336	5.771	24.6	Mar. 8, 1916	9.15	32.5	138.5	1.0483	69.22	6.0	10.41	11.8	1.9	.1	.1	.1	.....	2.2	9.6	Mar. 13, 1916	9.15	47.10	1.0390	8.3	8.69	1.059
32	79	10.3	18.0	1.0206	5.168	19.2	Feb. 16, 1916	9.15	32.5	138.5	1.0486	64.20	6.0	10.97	11.9	1.9	.....	.5	.1	.....	2.5	9.4	Feb. 21, 1916	9.15	39.80	1.0375	10.0	8.30	.973
33	79	16.0	22.0	1.0336	5.815	27.4	Mar. 1, 1916	9.15	32.5	138.5	1.0480	61.98	3.2	9.99	11.7	2.1	.2	.1	.....	.....	2.4	9.3	Mar. 6, 1916	9.15	38.40	1.0376	5.2	8.27	1.070
34	79	11.3	21.3	1.0336	5.771	24.6	Mar. 8, 1916	9.15	32.5	138.5	1.0498	63.62	7.0	6.94	12.1	2.1	.2	.1	.1	.....	2.5	9.6	Mar. 13, 1916	9.15	39.12	1.0392	10.8	8.21	1.039
35	79	11.4	....	1.0237	5.939	18.0	Mar. 15, 1916	9.15	32.5	138.5	1.0517	68.66	7.8	10.15	12.6	2.4	.3	.....	.1	.....	2.8	9.8	Mar. 20, 1916	9.15	39.89	1.0409	10.8	8.56	1.148
36	79	12.2	18.8	1.236	5.549	20.4	Apr. 9, 1916	9.15	32.5	138.5	1.0321	39.78	4.4	6.57	7.9	1.4	.2	.....	.....	.....	1.6	6.3	.....	.....	23.56	1.0248	8.0	5.04	.727

33	80	16.0	22.0	1.0336	5.815	27.4	Mar. 1, 1916	9.15	32.5	138.5	1.0487	73.18	6.8	10.03	11.8	2.5	.3	.....	.1	.....	2.9	8.9	Mar. 6, 1916	9.15	43.76	1.0362	6.7	7.80	1.293
34	80	11.3	21.3	1.0336	5.771	24.6	Mar. 8, 1916	9.15	32.5	138.5	1.0534	76.14	7.6	11.02	13.0	2.8	.3	.....	.1	.....	3.2	10.8	Mar. 13, 1916	9.15	53.80	1.0432	11.0	9.35	.872
35	80	11.4	....	1.0237	5.939	18.0	Mar. 15, 1916	9.15	32.5	138.5	1.0529	74.02	8.4	10.39	12.8	1.5	.3	.1	.....	.....	1.9	10.9	Mar. 20, 1916	9.15	54.21	1.0450	12.0	9.32	.919
36	80	12.2	18.8	1.0236	5.549	20.4	Mar. 19, 1916	9.15	32.5	138.5	1.0541	74.736	8.6	11.00	13.3	1.2	.....	.7	.1	.....	2.0	11.3	Mar. 14, 1916	9.15	56.49	1.0465	16.0	9.29	.616
33	81	16.0	22.0	1.0336	5.815	27.4	Mar. 1, 1916	9.15	32.5	138.5	1.0498	74.47	8.0	10.22	12.3	2.7	.3	.1	.....	.....	3.1	9.2	Mar. 6, 1916	9.15	45.32	1.0373	6.8	8.20	1.190
34	81	11.3	21.3	1.0336	5.771	24.6	Mar. 8, 1916	9.15	32.5	138.5	1.0493	74.30	8.0	10.58	12.1	2.7	.3	.1	+.1	.....	3.0	9.1	Mar. 13, 1916	9.15	44.64	1.0363	12.8	7.97	1.336
35	81	11.4	....	1.0237	5.939	18.0	Mar. 15, 1916	9.15	32.5	138.5	1.0520	76.02	10.0	10.34	12.7	2.9	.2	.2	.1	.....	3.2	9.5	Mar. 20, 1916	9.15	45.84	1.0395	13.2	8.49	1.390
36	81	12.2	18.8	1.0236	5.549	20.4	Apr. 9, 1916	9.15	32.5	138.5	1.0412	59.52	8.2	11.18	10.2	2.2	.2	.2	.....	.....	2.6	7.6	Apr. 14, 1916	9.15	36.12	1.0308	10.0	6.26	.956
36	82	12.2	18.8	1.0236	5.549	20.4	Apr. 9, 1916	9.15	32.5	128.5	1.0429	61.66	9.2	8.95	10.6	1.8	.3	.1	.....	.....	2.2	8.4	Apr. 4, 1916	9.15	42.92	1.0338	13.2	6.97	.899
37	82	11.7	....	1.0235	5.915	22.0	Apr. 25, 1916	9.15	32.5	128.5	1.0510	79.66	11.2	9.52	12.8	1.4	.7	.3	.1	.....	2.5	10.3	Apr. 30, 1916	9.15	56.36	1.0424	12.0	8.90	.955
38	82	11.7	16.8	1.0247	6.065	21.0	May 3, 1916	9.15	32.5	128.5	1.0503	76.85	10.0	10.31	12.4	1.7	.....	.6	.1	.....	2.4	10.0	May 8, 1916	9.15	42.39	1.0417	16.0	8.38	.888
39	82	10.5	20.6	1.0224	5.210	28.8	May 10, 1916	9.15	32.5	128.5	1.0415	63.21	8.9	8.65	10.4	1.7	.2	.....	1	.....	2.0	8.4	May 15, 1916	9.15	43.10	1.0332	12.0	6.90	.784
40	82	....	16.7	1.0269	5,848	19.2	May 24, 1916	9.15	32.5	128.5	1.0446	67.22	9.8	8.59	....	.....	.....	.....	.....	.....	....	....	May 29, 1916	9.15	46.56	1.0367	12.5	7.38	.829
44	83	7.5	21.2	1.0203	6.011	20.2	Aug. 2, 1916	9.15	32.5	128.5	1.0500	54.80	8.4	10.32	....	.....	.....	.....	.....	.....	....	....	Aug. 7, 1916	9.15	20.24	1.0333	11.2	6.61	Lost.
43	83	11.6	22.0	1.0207	6,329	22.0	July 19, 1916	9.15	32.5	128.5	1.0469	52.80	8.4	9.84	....	.....	.....	.....	.....	.....	....	....	July 4, 1916	9.15	23.32	1.0330	11.0	7.50	1.413
36	83	12.2	18.8	1.0236	5.549	20.4	Apr. 9, 1916	9.15	32.5	128.5	1.0539	61.98	8.8	11.01	13.2	3.0	.9	.2	.....	.....	4.1	9.1	Apr. 14, 1916	9.15	24.70	1.0369	14.4	7.59	1.664
37	83	11.7	....	1.0235	5.915	22.0	Apr. 25, 1916	9.15	32.5	128.5	1.0592	68.23	10.0	10.50	14.5	2.4	1.5	.3	.2	.....	4.4	10.1	Apr. 30, 1916	9.15	27.20	1.0413	10.8	8.80	1.714
38	83	11.7	16.8	1.0247	6.065	21.0	May 3, 1916	9.15	32.5	128.5	1.0528	60.06	8.0	10.19	12.9	2.5	.....	1.3	.1	.....	3.9	9.0	May 8, 1916	9.15	24.46	1.0367	14.2	7.71	1.664
39	83	10.5	20.6	1.0224	5.210	28.8	May 10, 1916	9.15	32.5	128.5	1.0475	57.26	9.0	10.01	12.1	2.6	.7	.3	.1	.....	3.7	8.4	May 15, 1916	9.15	22.54	1.0336	12.8	7.02	1.514
40	83	....	16.7	1.0267	5,848	19.2	May 24, 1916	9.15	32.5	128.5	1.0540	62.65	8.4	10.08	....	.....	.....	.....	.....	.....	....	....	May 29, 1916	9.15	26.22	1.0385	12.0	7.90	51.743
4f	83	13.5	16.8	1.0210	5,915	22.0	June 7, 1916	9.15	32.5	128.5	1.0516	57.48	7.2	10.63	....	.....	.....	.....	.....	.....	....	....	June 12, 1916	9.15	33.32	1.0349	13.6	7.03	1.497
42	83	6.1	19.8	1.0187	6,170	19.2	July 12, 1916	9.15	32.5	128.5	1.0524	81.78	8.8	9.19	....	.....	.....	.....	.....	.....	....	....	July 17, 1916	9.15	22.84	1.0308	10.2	7.46	2.415
36	84	12.2	18.8	1.0236	5,549	20.4	Apr. 9, 1916	9.15	32.5	128.5	1.0496	59.64	3.4	8.59	9.7	2.8	1.5	.1	.2	.....	4.6	5.1	Apr. 14, 1916	9.15	17.96	1.0205	8.0	4.66	51.886
37	84	11.7	....	1.0235	5.915	22.0	Apr. 25, 1916	9.15	32.5	128.5	1.0524	83.57	5.0	9.67	13.1	2.6	2.4	.9	.2	.....	6.1	7.0	Apr. 30, 1916	9.15	22.34	1.0282	5.4	6.75	2,597
38	84	11.7	16.8	1.0247	6.065	21.0	May 3, 1916	9.15	32.5	128.5	1.0486	75.56	4.0	10.14	12.0	3.3	.....	2.2	.1	.....	5.6	6.4	May 8, 1916	9.15	23.04	1.0258	10.0	5.97	2.333
39	84	10.5	20.6	1.0224	5.210	28.8	May 10, 1916	9.15	22.5	128.5	1.0518	79.58	5.6	10.92	12.7	3.3	1.7	.8	.1	.....	5.9	6.8	May 15, 1916	9.15	24.98	1.0262	10.8	6.37	2.553
41	84	13.5	16.8	1.0210	5,915	22.0	June 7, 1916	9.15	22.5	128.5	1.0305	46.20	2.4	14.35	....	.....	.....	.....	.....	.....	....	....	June 7, 1916	9.15	11.96	1.0110	8.4	3.57	1.642
37	85	11.7	....	1.0235	5.915	22.0	Apr. 25, 1916	9.15	32.5	128.5	1.0329	60.64	3.0	6.40	8.8	3.5	.5	.1	.1	.....	4.2	4.6	Apr. 30, 1916	9.15	21.86	1.0179	3.8	4.33	1.704
38	85	11.7	16.8	1.0247	6.055	21.0	May 8, 1916	9.15	32.5	128.5	1.0526	91.10	4.2	11.44	12.8	3.9	.....	1.8	.1	.....	5.8	7.0	May 8, 1916	9.15	21.00	1.0282	10.0	6.56	2.310
39	85	10.5	20.6	1.0224	5.210	28.8	May 10, 1916	9.15	32.5	128.5	1.0519	89.16	5.2	11.28	12.8	4.0	1.5	.3	.0	.....	5.8	7.0	May 15, 1916	9.15	35.90	1.0274	8.0	6.58	2.385
40	85	....	16.7	1.0267	5,848	19.2	May 24, 1916	9.15	32.5	128.5	1.0533	93.02	5.2	10.38	....	.....	.....	.....	.....	.....	....	....	May 29, 1916	9.15	36.74	1.0285	8.6	6.63	2.591
41	85	13.5	16.8	1.0210	5.915	22.0	June 7, 1916	9.15	32.5	128.5	1.0569	77.76	5.0	12.62	....	.....	.....	.....	.....	.....	....	....	June 7, 1916	9.15	39.36	1.0202	9.8	7.14	2.842
38	86	11.7	16.8	1.0247	6.065	21.0	May 3, 1916	9.15	32.5	128.5	1.0438	65.94	4.0	9.30	10.9	3.2	.....	2.2	.1	.....	5.5	5.4	May 8, 1916	9.15	14.54	1.0218	8.2	5.05	52.175
39	86	10.5	20.6	1.0224	5.210	28.8	May 10, 1916	9.15	32.5	128.5	1.0520	77.72	4.4	10.87	512.8	3.5	2.0	.8	.1	.....	6.4	6.4	May 15, 1916	9.15	16.84	1.0235	9.2	6.03	2.716
40	86	....	16.7	1.0267	5.848	19.2	May 24, 1916	9.15	32.5	128.5	1.0478	70.99	4.0	8.88	11.8	3.4	2.2	.3	.1	.....	6.0	5.8	May 29, 1916	9.15	15.46	1.0232	8.4	5.38	2.502
41	86	13.5	16.8	1.0210	5,915	22.0	June 7, 1916	9.15	32.5	128.5	1.0544	104.80	6.2	11.45	14.2	3.7	1.5	1.2	.5	.....	7.9	6.3	June 7, 1916	9.15	17.56	1.0266	8.2	6.09	2.785
38	87	11.7	16.8	1.0247	6.065	21.0	May 3, 1916	9.15	32.5	128.5	1.0504	75.78	6.8	10.52	11.9	4.3	.....	1.0	.2	.....	5.5	6.4	May 8, 1916	9.15	20.56	1.0260	12.0	5.95	2.532
39	87	10.5	20.6	1.0224	5.210	28.8	May 10, 1916	9.15	32.5	128.5	1.0524	77.75	7.0	10.71	12.8	3.9	1.6	.5	.1	.....	6.1	6.7	May 15, 1916	9.15	21.64	1.0267	12.0	6.35	2.615
40	87	....	16.7	1.0267	5.848	19.2	May 24, 1916	9.15	32.5	128.5	1.0437	60.98	5.8	8.29	10.9	2.3	1.7	.5	.0	.....	4.5	6.4	May 29, 1916	9.15	19.92	1.0259	10.2	5.80	2.407
41	87	13.5	16.8	1.0210	5,915	22.0	June 7, 1916	9.15	32.5	128.5	1.0541	81.20	8.0	17.34	14.3	2.7	2.3	1.8	.2	.....	7.0	7.3	June 7, 1916	9.15	23.62	1.0270	10.0	6.71	2.493
42	87	6.1	19.8	1.0187	6.170	19.2	July 12, 1916	9.15	32.5	128.5	1.0494	60.72	7.6	8.74	11.9	2.4	1.6	1.5	+ .1	.....	5.4	6.5	July 17, 1916	9.15	19.68	1.0238	8.2	5.59	1.650
29	88	10.5	20.6	1.0224	5.210	28.8	May 10, 1916	9.15	32.5	128.5	1.0525	85.76	7.0	11.20	12.9	2.0	.6	.3	.1	.....	3.0	9.9	May 5, 1916	9.15	54.23	1.0400	8.9	8.70	1.231
40	88	....	16.7	1.0267	5.848	19.2	May 24, 1916	9.15	32.5	128.5	1.0443	68.44	5.4	18.59	10.9	2.0	.2	.1	.1	.....	2.4	8.5	May 29, 1916	9.15	48.89	1.0348	8.0	7.31	1.1067
40	89	....	16.7	1.0267	5.848	19.2	May 24, 1916	9.15	32.5	128.5	1.0527	39.72	12.1	10.05	12.6	+ .1	.0	.0	.3	.....	.3	12.3	May 29, 1916	9.15	37.66	1.0518	14.0	10.06	.171
41	89	13.5	16.8	1.0210	5.915	22.0	June 7, 1916	9.15	32.5	128.5	1.0900	69.68	24.6	8.02	20.9	.1	.2	+ .1	.5	.....	.6	20.3	June 7, 1916	9.15	69.02	1.0900	25.6	17.00	.128
42	89	6.1	19.8	1.0187	6.170	19.2	July 12, 1916	9.15	32.5	128.5	1.0836	67.68	25.6	16.31	20.5	.5	.1	.2	.0	.....	.6	19.9	July 17, 1916	9.15	70.80	1.0763	22.4	16.10	.056
40	90	....	16.7	1.0267	5.848	19.2	May 24, 1916	9.15	32.5	128.5	1.0520	52.78	10.8	9.49	12.6	.2	.0	.....	.1	.....	.4	12.2	May 29, 1916	9.15	51.16	1.0502	12.0	9.77	.0802
41	90	13.5	16.8	1.0210	5.915	22.0	June 7, 1916	9.15	32.5	128.5	1.0819	94.48	20.4	17.76	20.4	.1	.0	.0	.0	.....	.1	20.3	June 12, 1916	9.15	92.88	1.0830	11.6	17.29	......
42	90	6.1	19.8	1.0187	6.170	19.2	July 12, 1916	9.15	32.5	128.5	1.0870	90.76	20.6	15.21	20.8	.5	+ .1	.0	.0	.0	.0	20.8	July 17, 1916	9.15	93.48	1.0833	18.6	15.56	.147
43	90	11.6	22.0	1.0207	6.329	22.0	July 19, 1916	9.15	32.5	128.5	1.0875	95.36	18.8	17.66	20.6	.0	.2	.0	+.1	.....	....	20.7	July 24, 1916	9.15	97.60	1.0865	21.6	18.78	.152
41	91	13.5	16.8	1.0210	5.915	22.0	June 7, 1916	9.15	32.5	128.5	1.0865	112.92	12.4	18.82	20.3	.3	.....	.0	.0	.....	.3	20.0	June 12, 1916	9.15	113.84	1.0850	20.0	19.12	.074
43	91	11.6	22.0	1.0207	6.329	22.0	July 19, 1916	9.15	32.5	128.5	1.0488	64.04	4.8	11.04	12.0	.5	.3	.1	.3	.....	1.2	10.8	July 24, 1916	9.15	63.88	1.0444	8.0	10.16	.063

TABLE 3.—*Fermentation record*—Continued.

Fermentation No.	Cook No.	Yeast. Seed yeast. Brix.	Yeast. Seed yeast. Acidity.	Yeast. 96-hour yeast. Sp. gr. at 15° C.	Yeast. 96-hour yeast. Alcohol (per cent by weight).	Yeast. 96-hour yeast. Acidity.	Fermenter set. Date.	Fermenter set. Hour.	Hours filling fermenter.	Hours fermenting, including time of filling.	Mash before fermentation. Sp. gr. at 15° C.	Mash before fermentation. Reducing sugars (grams per liter).	Mash before fermentation. Acidity.	Mash before fermentation. Total solids (per cent).	Mash before fermentation. Brix.	Brix record (decrease in Brix). First day.	Brix record. Second day.	Brix record. Third day.	Brix record. Fourth day.	Brix record. Fifth day.	Attenuation (degrees).	Brix fourth day.	Beer. Distillation. Date.	Beer. Distillation. Hour.	Beer. Reducing sugars (grams per liter).	Beer. Sp. gr. at 15° C.	Beer. Acidity.	Beer. Total solids (per cent by weight).	Beer. Alcohol (per cent by weight).
								a. m.																*a. m.*					
42	92	6.1	19.8	1.0187	6.170	19.2	July 12, 1916	9.15	32.5	128.5	1.0540	79.52	12.8	10.03	13.0	0.5	+0.2	0.0	0.0	0.0	0.3	12.7	July 17, 1916	9.15	76.04	1.0505	10.8	9.46	0.790
43	92	11.6	22.0	1.0207	6.329	22.0	July 19, 1916	9.15	32.5	128.5	1.0528	80.80	10.2	11.55	13.0	.5	.0	.0	.0	.....	.4	12.6	July 24, 1916	9.15	76.44	1.0508	13.4	11.45	.324
44	92	7.5	21.2	1.0203	6.011	20.2	Aug. 2, 1916	9.15	32.5	128.5	1.0496	73.64	10.0	10.72	12.3	.8	.0	.1	.0	.....	.7	11.6	Aug. 7, 1916	9.15	66.44	1.0470	12.2	9.46	.223
45	92	8.7	20.0	1.0209	5.965	21.2	Aug. 23, 1916	9.15	32.5	128.5	1.0498	72.92	14.4	10.11	12.3	.8	.....	.0	.2	.....	1.0	11.3	Aug. 28, 1916	9.15	64.48	1.0456	12.8	9.70	.282
46	92	....	14.0	1.0186	5.772	16.0	Sept. 20, 1916	9.15	32.5	128.5	1.0477	71.84	10.4	10.02	12.6	5.9	.0	.0	.1	.....	6.0	6.6	Sept. 25, 1916	9.15	47.60	1.0273	13.2	10.11	2.24
42	93	6.1	19.8	1.0187	6.170	19.2	July 12, 1916	9.15	32.5	128.5	1.0846	92.68	25.0	16.64	20.0	.2	+ .1	.0	.0	20.1	.0	20.0	July 17, 1912	9.15	85.36	1.0832	21.6	14.55	......
44	93	7.5	21.2	1.0203	6.011	20.2	Aug. 2, 1916	9.15	32.5	128.5	1.0720	76.80	18.0	14.06	17.4	.1	.0	.1	.0	.....	.1	17.3	Aug. 7, 1916	9.15	76.72	1.0699	22.4	13.71	.0571
45	93	8.7	20.0	1.0209	5.965	21.2	Aug. 23, 1916	9.15	32.5	128.5	1.0856	91.12	26.8	16.79	20.7	.3	.2	+ .3	.2	.....	.4	20.3	Aug. 28, 1916	9.15	90.68	1.0858	26.4	17.04	.0552
46	93	....	14.0	1.0186	5.772	16.0	Sept. 28, 1916	9.15	32.5	128.5	1.0480	67.84	13.6	9.441	11.8	.0	.0	.0	.0	.....	.0	11.8	Sept. 25, 1916	9.15	60.12	1.0478	14.2	9.217	.137
55	93	....	21.6	1.0200	6.141	17.3	Jan. 30, 1916	9.15	32.5	128.5	1.0489	51.92	17.6	9.674	12.0	.1	+1.0	.0	.1	.1	.1	11.9	Feb. 5, 1917	9.15	50.76	1.0480	16.6	10.060	.024
42	94	6.1	19.8	1.0187	6.170	19.2	July 12, 1916	9.15	32.5	128.5	1.0208	67.60	6.0	10.77	12.0	.8	.0	.0	11.0	.2	1.0	11.0	July 17, 1916	9.15	51.52	1.0360	11.2	8.37	.522
43	94	11.6	22.0	1.0207	6.329	22.0	July 19, 1916	9.15	32.5	128.5	1.0488	48.52	8.4	10.31	11.9	.7	.1	.2	.0	.....	1.1	10.8	July 29, 1916	9.15	51.20	1.0429	8.4	9.45	.584
44	94	7.5	21.2	1.0203	6.011	20.2	Aug. 2, 1916	9.15	32.5	128.5	1.0497	66.68	5.2	10.48	12.1	.8	.0	.0	.1	.....	.9	11.2	Aug. 7, 1916	9.15	56.56	1.0453	10.6	9.31	.331
45	94	8.7	20.0	1.0209	5.965	21.2	Aug. 23, 1916	9.15	32.5	128.5	1.0470	64.84	7.6	9.33	12.6	1.5	.2	.0	+.2	.....	1.3	11.3	Aug. 28, 1916	9.15	58.00	1.0459	12.0	9.02	.449
46	94	....	14.0	1.0186	5.772	16.0	Sept. 20, 1916	9.15	32.5	128.5	1.0517	69.36	6.6	8.894	12.4	.4	.0	.0	.0	.....	.4	12.0	Sept. 25, 1916	9.15	63.96	1.0497	7.6	10.01	.354
55	95	....	21.6	1.0200	6.141	17.3	Jan. 30, 1916	9.15	32.5	128.5	1.0689	90.84	8.0	14.000	16.4	.5	.0	.3	.0	.4	.4	16.0	Feb. 5, 1917	9.15	86.24	1.0674	13.0	14.560	.160
42	95	6.1	19.8	1.0187	6.170	19.2	July 12, 1916	9.15	32.8	128.5	1.0494	50.08	8.0	10.57	12.2	.2	.0	.0	.0	.0	.0	12.2	July 17, 1916	9.15	47.40	1.0490	8.4	8.94	.247
43	95	11.6	22.0	1.0207	6.329	22.0	July 19, 1916	9.15	32.5	128.5	1.0499	48.52	8.4	12.54	12.1	.3	.0	.0	.0	.....	.1	12.0	July 29, 1916	9.15	44.76	1.0472	10.4	10.14	.334
44	95	7.5	21.2	1.0203	6.011	20.2	Aug. 2, 1916	9.15	32.5	128.5	1.0509	48.72	9.0	10.02	12.1	.2	+ .1	.0	.0	.....	.1	12.0	Aug. 7, 1916	9.15	45.72	1.0497	9.0	9.35	.228
45	95	8.7	20.0	1.0209	5.965	21.2	Aug. 23, 1916	9.15	32.5	128.5	1.0538	52.00	12.4	10.42	13.5	.5	.0	.0	.0	.....	.5	13.0	Aug. 28, 1916	9.15	51.08	1.0536	9.4	10.40	.0284
46	95	....	14.0	1.0186	5.772	16.0	Sept. 20, 1916	9.15	32.5	128.5	1.0490	48.88	10.0	9.955	12.5	.4	.0	.1	.0	.....	.4	12.1	Sept. 25, 1916	9.15	46.08	1.0497	13.4	9.579	.123
53	95	....	20.4	1.0198	6.115	18.4	Jan. 16, 1917	9.15	32.5	128.5	1.0499	85.76	14.8	10.520	12.2	.0	.0	+ .1	.0	.....	.0	12.2	Jan. 22, 1917	9.15	47.80	1.0490	16.4	10.432	.067
54	95	....	19.2	1.0216	6.104	16.2	Jan. 25, 1917	9.15	32.5	128.5	1.0548	48.56	15.6	10.444	13.5	.2	+ .1	.1	.0	.0	.3	13.2	Jan. 29, 1917	9.15	49.04	1.0536	18.0	10.032	.014
55	96	....	21.6	1.0200	6.141	17.3	Jan. 30, 1916	9.15	32.5	128.5	1.0420	36.64	11.4	10.552	10.5	.2	+ .1	.1	.0	.0	.0	10.5	Feb. 5, 1917	9.15	38.80	1.0426	12.0	11.288	.216
43	96	11.6	22.0	1.0207	6.329	22.0	July 19, 1916	9.15	32.5	128.5	1.0559	93.12	8.0	8.08	13.7	1.1	.4	1.1	+.1	.....	2.5	11.2	July 29, 1916	9.15	91.52	1.0410	11.8	8.32	.259
44	96	7.5	21.2	1.0203	6.011	21.2	Aug. 2, 1916	9.15	32.5	128.5	1.0518	86.36	8.4	11.56	12.4	.3	2.8	1.5	1.3	.....	5.9	6.5	Aug. 7, 1916	9.15	29.08	1.0263	15.2	6.22	2.145
46	97	....	14.0	1.0186	5.772	16.0	Sept. 25, 1916	9.15	32.5	128.5	1.0495	77.52	9.2	10.354	11.9	3.7	1.2	.7	.1	.....	5.7	6.2	Sept. 25, 1916	9.15	23.08	1.0250	13.6	5.896	2.356
44	97	7.5	21.2	1.0203	6.011	21.2	Aug. 2, 1916	9.15	32.5	128.5	1.0549	82.80	8.0	11.78	13.2	1.6	1.3	2.6	+.1	.....	5.4	7.8	Aug. 7, 1916	9.15	31.84	1.0304	10.8	6.86	2.182
45	97	8.5	20.0	1.0209	5.965	21.2	Aug. 23, 1916	9.15	32.5	128.5	1.0569	82.61	10.4	12.39	14.1	1.6	1.0	.9	1.2	.....	4.6	9.5	Aug. 28, 1916	9.15	41.76	1.0376	14.8	8.16	2.029
46	97	....	14.0	1.0186	5.772	16.0	Sept. 20, 1916	9.15	32.5	128.5	1.0472	71.16	6.4	10.00	11.8	2.7	2.3	.0	.0	.....	5.2	6.6	Sept. 25, 1916	9.15	23.72	1.0264	9.2	5.94	1.890
49	97	....	22.8	1.0205	6.229	25.6	Nov. 21, 1916	9.15	32.5	128.5	1.0508	76.76	10.4	11.116	12.6	4.0	1.0	.7	.0	.....	5.7	6.9	Nov. 27, 1916	9.15	25.52	1.0297	13.2	6.716	2.199

50	97	....	21.6	1.0219	.....	22.4	Dec. 5, 1916	9.15	32.5	128.5	1.0472	73.04	9.6	11.032	12.1	.5	.1	.2	.0	.1	.8	11.3	Dec. 11, 1916	9.15	66.48	1.0440	10.4	6.236 .366
51	97	....	17.6	1.0149	5.842	14.0	Dec. 12, 1916	9.15	32.5	128.5	1.0523	77.40	11.6	10.488	12.8	3.8	.9	.8	.1	.1	5.6	7.2	Dec. 18, 1916	9.15	23.52	1.0288	11.8	6.604 2.185
52	97	....	17.6	1.0199	6.180	20.0	Jan. 9, 1917	9.15	32.5	128.5	1.0473	72.00	9.0	10.072	11.6	4.3	.6	.4	.2	.0	5.0	6.6	Jan. 15, 1917	9.15	26.12	1.0260	12.8	6.204 2.203
53	97	....	20.4	1.0198	6.115	18.4	Jan. 16, 1917	9.15	32.5	128.5	1.0548	46.92	10.8	12.688	13.5	1.5	2.5	1.1	.5	.....	5.6	7.9	Jan. 22, 1917	9.15	32.04	1.0324	16.6	7.652 2.460
54	97	....	19.2	1.0211	6.104	16.2	Jan. 25, 1917	9.15	32.5	128.5	1.0360	55.40	7.0	7.788	8.9	3.0	.6	.1	+.1	.2	3.6	5.3	Jan. 29, 1917	9.15	16.96	1.0206	11.2	4.552 1.646
45	99	8.7	20.0	1.0209	5.965	21.2	Aug. 23, 1916	9.15	32.5	128.5	1.0499	70.88	7.6	10.68	10.8	2.4	1.8	+.2	.0	.....	4.2	6.6	Aug. 28, 1916	9.15	26.50	1.0273	14.2	6.19 2.472
46	99	....	14.0	1.0186	5.772	16.0	Sept. 30, 1916	9.15	32.5	128.5	1.0507	72.16	8.0	10.39	11.6	3.1	1.5	.9	+.1	.....	5.4	6.2	Sept. 25, 1916	9.15	19.32	1.0276	8.0	5.865 2.482
49	99	....	22.8	1.0205	6.229	25.6	Nov. 21, 1916	9.15	32.5	128.5	1.0447	64.36	8.0	12.150	11.2	4.1	.7	.2	.3	.....	5.3	5.9	Nov. 27, 1916	9.15	16.56	1.0205	14.0	5.696 1.989
50	99	....	21.6	1.0219	.....	22.4	Dec. 3, 1916	9.15	32.5	128.5	1.0472	66.08	11.6	12.512	11.6	3.2	.7	1.1	.4	.....	5.4	6.2	Dec. 11, 1916	9.15	18.48	1.0240	12.4	5.720 28.26
45	100	8.7	20.0	1.0209	5.965	21.2	Aug. 26, 1916	9.15	32.5	128.5	1.0531	83.56	8.0	11.34	12.0	3.6	.7	1.2	.0	.....	5.5	6.5	Aug. 28, 1916	9.15	34.28	1.0269	10.8	6.46 2.785
46	100	....	14.0	1.0186	5.772	16.0	Sept. 20, 1916	9.15	32.5	128.5	1.0480	79.56	6.0	10.51	11.6	3.1	1.5	.9	+.1	.....	5.5	6.1	Sept. 25, 1916	9.15	24.80	1.0242	10.0	6.17 2.44
49	100	....	22.8	1.0205	6.229	25.6	Nov. 21, 1916	9.15	32.5	128.5	1.0528	87.56	7.8	11.110	12.9	3.5	1.9	.9	.2	.0	6.4	6.5	Nov. 25, 1916	9.15	26.16	1.0249	12.4	6.695 2.869
50	100	....	21.6	1.0219	.....	22.4	Dec. 3, 1916	9.15	32.5	128.5	1.0470	76.92	7.6	11.216	11.6	3.6	1.1	.9	.1	.1	5.7	5.9	Dec. 11, 1916	9.15	23.24	1.0230	12.4	5.800 2.745
51	100	....	17.6	1.0149	5.842	14.0	Dec. 12, 1916	9.15	32.5	128.5	1.0485	56.96	8.4	9.836	12.0	4.6	1.1	.1	.2	.....	6.0	6.0	Dec. 18, 1916	9.15	26.96	1.0233	11.2	5.896 2.537
52	100	7.3	17.6	1.0199	6.180	20.0	Jan. 9, 1917	9.15	32.5	128.5	1.0468	77.88	7.4	10.000	11.6	4.7	.7	.3	.1	.1	5.8	5.8	Jan. 15, 1917	9.15	25.84	1.0234	11.0	5.776 2.482
53	100	7.4	20.4	1.0198	6.115	18.4	Jan. 16, 1917	9.15	32.5	128.5	1.0618	97.92	10.8	16.304	14.8	4.0	2.0	.7	.2	.....	6.9	7.9	Jan. 22, 1917	9.15	34.40	1.0280	17.0	8.104 3.366
54	100	8.5	19.2	1.0216	6.104	16.2	Jan. 25, 1917	9.15	32.5	128.5	1.0417	68.60	7.0	9.072	10.5	4.5	.7	.0	.1	+.1	5.3	5.2	Jan. 29, 1917	9.15	20.76	1.0206	11.4	7.348 2.383
49	101	....	22.8	1.0205	6.229	25.6	Nov. 21, 1916	9.15	32.5	128.5	1.0448	88.60	7.2	11.048	11.1	4.2	1.1	.4	.1	.0	5.8	5.3	Nov. 27, 1916	9.15	33.68	1.0200	8.6	6.020 2.551
50	101	....	21.6	1.0219	.....	22.4	Dec. 3, 1916	9.15	32.5	128.5	1.0540	81.56	8.0	13.400	13.0	4.4	1.6	.8	.0	.1	6.8	6.2	Dec. 11, 1916	9.15	41.68	1.0230	11.2	6.872 2.368
51	101	....	17.6	1.0149	5.842	14.0	Dec. 12, 1916	9.15	32.5	128.5	1.0461	87.88	8.0	13.016	11.4	4.4	1.1	.2	.1	.0	5.8	5.6	Dec. 18, 1916	9.15	36.24	1.0197	8.8	5.960 2.241
52	101	7.3	17.6	1.0199	6.180	20.0	Jan. 9, 1917	9.15	32.5	128.5	1.0368	74.32	5.8	8.936	9.8	4.5	.4	+.1	.3	.1	5.1	4.7	Jan. 15, 1917	9.15	30.16	1.0168	9.6	7.412 2.156
53	101	7.4	20.4	1.0198	6.115	18.4	Jan. 16, 1917	9.15	32.5	128.5	1.0500	101.84	8.2	13.616	13.1	3.8	1.8	.5	.3	.....	6.4	6.7	Jan. 22, 1917	9.15	44.52	1.0260	15.2	7.788 3.049
54	101	8.5	19.2	1.0216	6.104	16.2	Jan. 25, 1917	9.15	32.5	128.5	1.0587	105.84	3.2	13.964	13.6	4.9	1.5	1.2	+1.0	.2	6.6	7.0	Jan. 29, 1917	9.15	45.08	1.0279	13.8	7.264 3.197
55	101	6.5	21.6	1.0200	6.141	17.3	Jan. 30, 1917	9.15	32.5	128.5	1.0675	104.32	10.8	12.928	16.3	3.6	2.7	1.1	.5	.2	7.9	8.4	Feb. 5, 1917	9.15	59.56	1.0542	15.4	9.760 3.478
49	102	....	22.8	1.0205	6.229	25.6	Nov. 21, 1916	9.15	32.5	128.5	1.0472	95.28	9.2	12.099	11.4	3.4	1.5	.1	.1	.0	5.1	6.3	Nov. 27, 1916	9.15	43.00	1.0209	13.2	7.264 2.286
50	102	....	21.6	1.0219	.....	22.4	Dec. 3, 1916	9.15	32.5	128.5	1.0460	90.44	10.0	11.892	11.3	3.7	1.2	.3	.0	.1	5.2	6.1	Dec. 11, 1916	9.15	42.88	1.0243	11.2	7.216 2.368
51	102	....	17.6	1.0149	5.842	14.0	Dec. 12, 1916	9.15	32.5	128.5	1.0510	98.68	8.8	12.064	12.2	1.9	2.1	1.3	.0	.0	5.3	6.9	Dec. 18, 1916	9.15	41.76	1.0274	10.4	7.696 2.355
52	102	7.3	17.6	1.0199	6.180	20.0	Jan. 9, 1917	9.15	32.5	128.5	1.0574	103.52	14.0	14.636	13.9	1.1	1.6	1.9	1.3	.5	5.9	8.0	Jan. 15, 1917	9.15	54.08	1.0320	16.0	9.276 2.849
53	102	7.4	20.4	1.0198	6.115	18.4	Jan. 16, 1917	9.15	32.5	128.5	1.0512	100.56	13.2	13.924	13.0	2.8	1.3	1.3	.3	.....	5.4	7.6	Jan. 22, 1917	9.15	48.96	1.0277	17.2	8.652 2.545
54	102	8.5	19.2	1.0216	6.104	16.2	Jan. 25, 1917	9.15	32.5	128.5	1.0587	103.76	11.6	14.424	14.1	1.9	2.6	1.4	.2	.2	6.1	8.0	Jan. 29, 1917	9.15	49.72	1.0320	20.4	8.792 2.676
49	103	....	22.8	1.0205	6.229	25.6	Nov. 21, 1916	9.15	32.5	128.5	1.0457	65.56	10.4	9.699	11.3	3.1	1.8	.3	.0	.0	5.2	6.1	Nov. 27, 1916	9.15	17.56	1.0219	11.2	5.776 2.255
50	103	....	21.6	1.0219	.....	22.4	Dec. 3, 1916	9.15	32.5	128.5	1.0700	98.48	16.6	14.87	17.2	3.3	+.1	1.2	2.1	.8	6.5	10.7	Dec. 11, 1916	9.15	34.72	1.0444	20.0	10.006 2.521
51	103	....	17.6	1.0149	5.842	14.0	Dec. 12, 1916	9.15	32.5	128.5	1.0426	60.00	8.8	8.596	10.5	3.8	.7	.1	.1	.1	4.7	5.8	Dec. 18, 1916	9.15	16.56	1.0220	13.2	5.236 2.004
52	103	7.3	17.6	1.0199	6.180	20.0	Jan. 9, 1917	9.15	32.5	128.5	1.0459	67.28	11.9	10.412	11.6	4.4	.7	+.4	+.2	.1	5.3	6.3	Jan. 15, 1917	9.15	32.12	1.0245	16.2	5.924 2.306
53	103	7.4	20.4	1.0195	6.115	18.4	Jan. 16, 1917	9.15	32.5	128.5	1.0483	71.28	13.6	11.036	12.3	4.0	1.1	1.4	.7	.....	5.6	6.7	Jan. 22, 1917	9.15	21.44	1.0250	17.8	6.512 2.416
54	103	8.5	19.2	1.0216	6.104	16.2	Jan. 25, 1917	9.15	32.5	128.5	1.0516	73.64	12.0	10.272	12.4	4.5	.9	.2	+.1	.1	5.5	6.9	Jan. 29, 1917	9.15	20.52	1.0218	19.6	6.280 2.402
55	103	6.5	21.6	1.0200	6.141	17.3	Jan. 30, 1917	9.15	32.5	128.5	1.0707	97.36	18.6	11.408	17.2	3.0	2.1	2.1	.2	.4	7.4	9.8	Feb. 5, 1917	9.15	34.44	1.0398	25.0	9.672 3.195
49	104	....	22.8	1.0205	6.229	25.6	Nov. 21, 1916	9.15	32.5	128.5	1.0520	91.28	10.6	11.032	12.6	4.2	1.0	.6	.5	.1	6.3	6.3	Nov. 27, 1916	9.15	33.20	1.0249	16.2	6.504 2.802
50	104	....	21.6	1.0219	.....	22.4	Dec. 3, 1916	9.15	32.5	128.5	1.0183	104.24	14.8	17.792	19.4	3.4	.3	2.1	1.1	1.7	6.9	12.5	Dec. 11, 1916	9.15	67.44	1.0512	28.3	12.304 3.107
51	104	....	17.6	1.0149	5.842	14.0	Dec. 12, 1916	9.15	32.5	128.5	1.0483	83.52	10.0	10.112	11.8	4.3	1.2	.5	+.1	.0	5.9	5.9	Dec. 18, 1916	9.15	29.68	1.0220	10.2	5.760 2.630
52	104	7.3	17.6	1.0199	6.180	20.0	Jan. 9, 1917	9.15	32.5	128.5	1.0490	86.72	12.2	11.376	12.2	5.1	.7	.1	.2	.0	6.1	6.1	Jan. 15, 1917	9.15	19.00	1.0245	14.8	6.096 2.641
53	104	7.4	20.4	1.0198	6.115	18.4	Jan. 16, 1917	9.15	32.5	128.5	1.0573	89.72	14.2	13.428	13.8	3.7	1.8	.9	+.1	.....	6.3	7.5	Jan. 22, 1917	9.15	38.96	1.0268	19.2	7.576 3.179
54	104	8.5	19.2	1.0216	6.104	16.2	Jan. 25, 1917	9.15	32.5	128.5	1.0519	93.16	10.8	11.220	12.6	4.6	1.2	.2	+.1	.2	5.9	6.7	Jan. 29, 1917	9.15	32.56	1.0260	17.2	5.992 2.916
55	104	6.5	21.6	1.0200	6.141	17.3	Jan. 30, 1917	9.15	32.5	128.5	1.0493	88.36	9.2	10.936	12.3	4.6	1.4	.4	+.2	+.1	6.2	6.1	Feb. 5, 1917	9.15	32.36	1.0248	17.0	6.536 2.674
51	107	7.4	17.6	1.0149	5.842	14.0	Dec. 12, 1916	9.15	32.5	128.5	1.0505	54.00	4.4	8.816	12.3	2.1	.4	.8	.0	.0	3.3	9.0	Dec. 18, 1916	9.15	20.48	1.0338	7.4	6.26 1.699
52	107	7.3	17.6	1.0199	6.180	20.0	Jan. 9, 1917	9.15	32.5	128.5	1.0479	52.40	4.8	8.940	11.5	2.7	.1	.1	.4	.2	3.3	8.2	Jan. 15, 1917	9.15	21.56	1.0342	7.6	6.176 1.677
51	108	7.4	17.6	1.0149	5.842	14.0	Dec. 12, 1916	9.15	32.5	128.5	1.0548	86.72	5.2	10.852	13.3	3.3	.8	1.1	+.2	.0	5.1	8.2	Dec. 18, 1916	9.15	34.28	1.0325	14.0	7.160 2.166
52	108	7.3	17.6	1.0199	6.180	20.0	Jan. 9, 1917	9.15	32.5	128.5	1.0528	83.16	8.2	......	12.8	4.5	.6	+.1	.1	+.1	5.2	7.6	Jan. 15, 1917	9.15	35.64	1.0325	11.2	7.224 2.365
53	108	7.4	20.4	1.0198	6.115	18.4	Jan. 16, 1917	9.15	32.5	128.5	1.0480	97.28	8.0	12.612	13.6	3.8	1.0	.3	.0	.....	5.1	8.5	Jan. 22, 1917	9.15	37.60	1.0333	12.4	7.884 2.115
54	108	8.5	19.2	1.0216	6.104	16.2	Jan. 25, 1917	9.15	32.5	128.5	1.0547	85.88	6.0	11.62	13.1	4.0	.4	.4	.1	.1	4.9	8.2	Jan. 29, 1917	9.15	33.80	1.0333	12.0	6.988 2.330
55	108	6.5	21.6	1.0200	6.141	17.3	Jan. 30, 1917	9.15	32.5	128.5	1.0665	49.72	8.0	14.48	16.2	3.0	2.5	.6	.1	.1	6.2	10.0	Feb. 5, 1917	9.15	45.24	1.0408	12.6	9.792 4.585

TABLE 3.—*Fermentation record*—Continued.

Fermentation No.	Cook No.	Yeast. Seed yeast. Brix.	Yeast. Seed yeast. Acidity.	Yeast. 96-hour yeast. Sp. gr. at 15° C.	Yeast. 96-hour yeast. Alcohol (per cent by weight).	Yeast. 96-hour yeast. Acidity.	Fermenter set. Date.	Fermenter set. Hour.	Hours filling fermenter.	Hours fermenting, including time of filling.	Mash before fermentation. Sp. gr. at 15° C.	Mash before fermentation. Reducing sugars (grams per liter).	Mash before fermentation. Acidity.	Mash before fermentation. Total solids (per cent).	Mash before fermentation. Brix.	Brix record (decrease in Brix). First day.	Brix record. Second day.	Brix record. Third day.	Brix record. Fourth day.	Brix record. Fifth day.	Attenuation (degrees).	Brix fourth day.	Beer. Distillation. Date.	Beer. Distillation. Hour.	Beer. Reducing sugars (grams per liter).	Beer. Sp. gr. at 15° C.	Beer. Acidity.	Beer. Total solids (per cent by weight).	Beer. Alcohol (per cent by weight).
10	51-1	....	....	1.0243	6.170	18.6	Jan. 21, 1915	*a. m.* 9.15	32.5	128.5	1.0502	62.28	6.2	9.069	12.2	2.6	1.0	1.0	1.0	0.4	4.6	7.6	Jan 26, 1915	*a. m.* 9.15	17.40	1.0262	12.0	5.744	1.910
11	51-1	....	22.0	1.0262	5.398	26.4	Feb. 11, 1915	9.15	32.5	128.5	1.0508	61.70	2.4	10.520	12.5	3.6	1.4	.3	.2	.....	5.5	7.0	Feb. 16, 1915	9.15	11.74	1.0280	9.6	6.195	2.267
10	51-2	....	....	1.0243	6.170	18.6	Jan. 21, 1915	9.15	32.5	128.5	1.0482	61.56	4.4	8.824	11.9	3.6	1.3	.2	.1	.0	5.2	6.7	Jan. 26, 1915	9.15	11.88	1.0277	11.2	5.996	2.233
11	51-2	....	22.0	1.0262	5.398	26.4	Feb. 11, 1915	9.15	32.5	128.5	1.0509	66.04	4.4	11.470	12.5	3.8	1.5	.3	.0	.....	5.6	6.9	Feb. 16, 1915	9.15	11.74	1.0270	10.4	6.327	2.313
10	51-3	....	....	1.0243	6.170	18.6	Jan. 21, 1915	9.15	32.5	128.5	1.0492	59.52	6.4	9.100	12.1	3.6	1.3	.1	.1	.0	5.1	7.0	Jan. 26, 1915	9.15	17.08	1.0273	12.5	6.019	2.171
11	51-3	....	22.0	1.0262	5.398	26.4	Feb. 11, 1915	9.15	32.5	128.5	1.0480	60.24	6.0	9.927	11.8	3.6	1.1	.4	.0	.....	5.1	6.7	Feb. 16, 1915	9.15	15.00	1.0279	11.2	6.165	2.152
10	51-4	....	....	1.0243	6.170	18.6	Jan. 21, 1915	9.15	32.5	128.5	1.0486	62.12	3.6	9.104	12.0	3.7	1.1	.2	.0	.0	5.0	7.0	Jan. 26, 1915	9.15	18.52	1.0286	11.4	6.653	2.129
11	51-4	....	22.0	1.0262	5.398	26.4	Feb. 11, 1915	9.15	32.5	128.5	1.0521	68.704	4.0	11.580	12.7	3.7	1.2	.3	.1	.....	5.3	7.4	Feb. 16, 1915	9.15	18.88	1.0296	9.6	7.156	2.360
10	51-5	....	....	1.0243	6.170	18.6	Jan. 21, 1915	9.15	32.5	128.5	1.0488	57.28	2.4	9.305	12.1	3.0	1.0	.2	.0	.1	4.2	7.9	Jan. 26, 1915	9.15	17.86	1.0304	10.4	6.237	1.844
11	51-5	....	22.0	1.0262	5.398	26.4	Feb. 11, 1915	9.15	32.5	128.5	1.0532	62.28	3.8	11.765	13.0	3.2	1.0	.4	.1	.....	4.6	8.4	Feb. 16, 1915	9.15	18.92	1.0338	10.0	7.709	1.949
12	53-d	....	....	1.0270	5.574	27.0	Mar. 4, 1915	9.15	32.5	128.5	1.0515	62.376	3.9	10.039	12.3	2.3	1.8	.4	.4	.....	3.9	8.4	Mar. 9, 1915	9.15	23.52	1.0337	12.0	7.030	1.625
13	53-d	....	19.8	1.0309	5.510	30.2	Mar. 11, 1915	9.15	32.5	128.5	1.0506	61.92	8.0	9.850	12.2	2.9	1.8	.4	.1	.....	5.2	7.0	Mar. 16, 1915	9.15	10.84	1.0284	12.2	5.905	2.188
12	53-1	....	....	1.0270	5.574	27.0	Mar. 4, 1915	9.15	32.5	128.5	1.0497	62.12	3.8	9.870	12.3	1.6	+ .2	− .1	.1	.....	1.4	10.9	Mar. 9, 1915	9.15	44.70	1.0422	7.0	8.500	.648
13	53-1	....	19.8	1.0390	5.510	30.2	Mar. 11, 1915	9.15	32.5	128.5	1.0460	55.12	6.8	8.948	11.4	2.1	.1	.0	.0	.....	2.2	9.2	Mar. 16, 1915	9.15	33.86	1.0367	8.0	6.859	.897
12	53-2	....	....	1.2070	5.574	27.0	Mar. 4, 1915	9.15	32.5	128.5	1.0473	57.08	3.6	9.328	11.6	2.6	.7	.7	.0	.....	4.0	7.6	Mar. 9, 1915	9.15	18.72	1.0298	10.8	6.220	1.690
13	53-2	....	19.8	1.0309	5.510	30.2	Mar. 11, 1915	9.15	32.5	128.5	1.0510	63.92	9.1	10.120	12.6	3.3	1.7	.3	.1	.....	4.4	7.2	Mar. 16, 1915	9.15	11.74	1.0284	12.4	6.054	2.266
12	53-3	....	....	1.0270	5.574	27.0	Mar. 4, 1915	9.15	32.5	128.5	1.0495	59.52	3.7	9.660	12.1	3.2	1.6	.2	.1	.....	5.1	7.0	Mar. 9, 1915	9.15	10.04	1.0275	12.1	6.000	2.087
13	53-3	....	19.8	1.0390	5.510	30.2	Mar. 11, 1915	9.15	32.5	128.5	1.0520	61.96	8.8	10.125	12.6	1.4	.2	.6	.3	.....	2.5	10.1	Mar. 16, 1915	9.15	35.30	1.0401	11.8	7.491	1.019
12	53-4	....	....	1.0270	5.574	27.0	Mar. 4, 1915	9.15	32.5	128.5	1.0508	57.74	4.3	9.970	12.4	3.4	1.3	.3	.1	.....	5.1	7.3	Mar. 9, 1915	9.15	10.68	1.0287	12.8	6.293	2.090
13	53-4	....	19.8	1.0309	5.510	30.2	Mar. 11, 1915	9.15	32.5	128.5	1.0502	57.34	9.2	9.670	12.1	1.3	1.6	1.1	.5	.....	4.5	7.6	Mar. 12, 1915	9.15	12.36	1.0299	12.4	6.192	1.913
12	53-5	....	....	1.0270	5.574	27.0	Mar. 4, 1915	9.15	32.5	128.5	1.0515	54.76	3.9	9.940	12.6	2.5	1.0	.7	.3	.....	4.5	8.1	Mar. 9, 1915	9.15	13.12	1.0321	12.9	6.700	1.836
13	53-5	....	19.8	1.0309	5.510	30.2	Mar. 11, 1915	9.15	32.5	128.5	1.0388	58.34	8.6	10.260	13.1	1.0	.3	.1	.1	.....	11.6	1.5	Mar. 16, 1915	9.15	41.16	1.0475	11.4	8.654	.549
14	53-5	....	22.5	1.0235	5.784	24.5	Mar. 18, 1915	9.15	32.5	128.5	1.0504	53.22	8.0	8.881	12.4	.6	.5	1.4	1.7	.4	4.2	8.2	Mar. 23, 1915	9.15	15.24	1.0329	12.4	6.679	1.646
12	53-6	....	....	1.0270	5.574	27.0	Mar. 4, 1915	9.15	32.5	128.5	1.0456	32.52	3.3	10.660	13.2	2.8	1.4	.3	.1	.....	4.6	8.6	Mar. 9, 1915	9.15	7.84	1.0343	12.2	7.127	2.016
13	53.6	....	19.8	1.0309	5.510	30.2	Mar. 11, 1915	9.15	32.5	128.5	1.0490	47.38	4.4	9.364	12.0	3.1	1.0	.2	+ .1	.....	4.2	7.8	Mar. 16, 1915	9.15	8.14	1.0308	11.0	6.380	1.790
14	53-6	....	22.5	1.0235	5.784	24.5	Mar. 18, 1915	9.15	32.5	128.5	1.0515	49.56	6.0	9.204	12.5	3.0	1.2	.2	.0	.....	4.4	8.1	Mar. 23, 1915	9.15	8.28	1.0324	10.0	6.702	1.951
12	53-7	....	....	1.0270	5.574	27.0	Mar. 4, 1915	9.15	32.5	128.5	,.0576	53.04	4.1	11.349	13.9	3.0	1.0	.3	.2	.....	4.5	9.4	Mar. 9, 1915	9.15	8.48	1.0371	12.4	7.850	1.851
13	53-7	....	19.8	1.0309	5.510	30.2	Mar. 11, 1915	9.15	32.5	128.5	1.0496	46.192	3.8	9.583	12.2	3.0	.8	.1	.1	.....	4.0	8.2	Mar. 16, 1915	9.15	8.00	1.0326	11.2	6.674	1.724
14	53-7	....	22.5	1.0235	5.784	24.5	Mar. 18, 1915	9.15	32.5	128.5	1.0481	43.76	6.4	8.639	11.7	2.7	.9	.1	.0	.....	3.7	8.0	Mar. 23, 1915	9.15	7.78	1.0314	11.0	6.456	1.682
14	53-8	....	22.5	1.0235	5.784	24.5	Mar. 18, 1915	9.15	32.5	128.5	1.0547	47.32	3.6	10.061	2.3	1.3	.3	.1	.1	.....	4.0	9.4	Mar. 23, 1915	9.15	9.00	1.0380	12.0	7.780	1.772
15	53-8	14.7	....	1.0224	6.113	17.4	Mar. 26, 1915	9.15	32.5	128.5	1.0519	44.144	6.6	8.785	12.6	2.6	.8	.2	.1	.1	3.7	8.9	Mar. 31, 1915	9.15	8.52	1.0357	10.8	7.311	1.685
16	53-8	13.9	18.5	1.0223	6.167	26.2	Apr. 1, 1915	9.15	32.5	128.5	1.0489	42.46	6.4	9.0 5	12.1	2.7	.7	.2	.1	.....	3.7	8.4	Apr. 6, 1915	9.15	7.56	1.0338	12.0	6.914	1.610

TABLE 4.—*Digester record.*

Species of wood.	Cook No.	Cooking conditions.							Digester charge.				Digester discharge.					Sugar yield.						
		Minutes to reach desired pressure.	Cooking pressure (atmospheres).	Time cooked (minutes).	Maximum temperature during cook (° F.).	Total time steam on digester (minutes).	Blow-off treatment.	Time required for blow-off (minutes).	Water to wood ratio (per cent).	Acid (100 per cent) to wood ratio (per cent).	Dry weight of wood charged (pounds).	Moisture in wood as charged.	Digested sawdust (pounds).	Digested liquor (pounds).	Moisture in digested sawdust (per cent).	Dry weight digested sawdust (pounds).	Original wood obtained as digested sawdust (per cent).	Reducing sugars in digested sawdust (per cent).	Reducing sugars in digested liquor (grams per liter).	Reducing sugars (per cent of dry digested sawdust).	Reducing sugars (per cent of original dry wood).	Reducing sugars dry digested sawdust compared with original dry wood.	Total soluble solids (per cent original dry wood).	Total reducing sugars (per cent of total soluble solids).
White spruce	21	28.5	7.5	0	.....	28.5	Cond.	73	300	1.85	98.65	17.89	204.45	98.03 144.55	61.44	78.84	79.91	4.152	61.16 60.84	28.98	23.16	125.13	28.21	82.08
	22	21.0	7.5	0	.....	21.0	...do..	80	250	1.82	103.25	14.78	207.74	99.86 89.75	59.83	83.45	80.82	5.104	75.28 77.36	29.39	23.75	123.75	28.23	84.13
	23	13.5	[1]115	10	.....	23.5	...do..	90	112	1.40	98.78	18.63	271.11	....	65.78	92.77	93.92	8.544	......	25.07	23.55	106.45	25.85	91.10
	24	22.5	[1]110	10	.....	22.5	Open.	....	127	1.84	110.22	10.92	322.85	....	68.81	100.70	91.36	8.161	......	26.06	23.81	109.45	28.00	85.04
	25	17.0	[1]110	10	.....	17.0	...do..	....	100	1.83	103.07	10.96	271.45	....	64.78	95.60	92.76	9.496	......	26.96	25.01	107.80	26.28	95.17
	26	20.0	7.5	0	.....	20.0	Cond.	75	400	1.80	103.24	10.30	213.93	163.44 97.82 31.34	60.50	84.50	81.85	3.556	51.56 52.76 56.84	27.17	22.24	122.17	34.22	64.99
Shortleaf pine	27	19.0	[1]115	10	.....	19.0	Open.	8	127	1.80	98.80	33.96	264.90	25.06	66.44	88.90	89.98	5.816	84.80	20.64	18.57	111.15	19.63	94.60
	28	19.0	7.5	0	345	19.0	Cond.	72	400	1.80	99.53	32.22	207.71	268.78 93.95	53.68	96.21	96.66	0.696	10.70 11.02	5.52	5.34	103.3	14.04	38.03
	29	19.5	7.5	10	346	29.5	...do..	110	250	1.80	97.65	30.03	190.38	130.51 91.42	55.32	85.06	87.11	2.864	47.76 47.60	18.79	16.37	114.78	23.22	70.50
White spruce	30	20.25	7.5	0	346	20.2	...do..	75	100	1.80	103.55	9.94	271.20	....	64.19	97.12	93.79	8.049	......	22.49	21.09	106.64	25.77	81.84
	31	19.5	7.5	0	345	19.5	...do..	80	125	2.50	102.08	9.105	290.93	....	68.87	90.57	88.72	7.524	......	24.18	21.45	112.73	23.48	91.35
	32	20.25	7.5	10	346	30.2	...do..	93	125	2.50	108.60	8.74	316.64	....	69.45	96.73	89.07	7.312	......	23.94	21.32	112.29	21.32	100.00
	33	20.25	7.5	0	344	20.2	...do..	71	125	1.40	108.07	8.47	304.96	....	66.71	101.52	93.94	8.021	......	24.66	23.17	106.43	24.13	96.02
	34	20.5	7.5	0	340	20.5	...do..	99	125	1.80	100.68	9.15	288.06	....	67.37	93.99	93.36	7.675	......	23.52	21.96	107.10	23.12	94.98
	35	20.0	7.5	0	243	20.0	...do..	92	125	1.00	97.53	8.725	281.51	....	67.21	92.31	94.64	7.516	......	22.91	21.68	105.67	25.99	83.42
	36	19.5	7.5	0	341	19.5	...do..	103	125	4.00	99.52	8.54	284.85	....	69.47	86.96	87.38	7.408	......	24.15	21.10	114.45	26.99	78.18
	37	20.75	7.5	0	343	20.7	...do..	94	125	.75	102.21	8.59	288.93	....	66.40	97.08	94.98	7.616	......	22.98	21.83	105.36	24.00	90.96
	38	19.5	7.5	0	341	19.5	...do..	73	125	.50	99.95	8.83	288.05	....	66.30	97.07	97.12	6.044	......	17.94	17.42	102.98	23.20	75.08
	39	19.25	7.5	0	341	19.2	Open.	8	125	1.40	102.35	8.85	285.00	....	65.01	99.72	97.43	8.033	......	22.96	22.37	102.64	25.37	88.18
	40	18.5	7.5	0	340	18.5	Cond.	65	125	1.40	101.98	10.69	293.47	....	66.25	99.05	97.12	8.216	......	24.44	23.74	102.95	27.40	86.64
	41	20.5	7.5	10	340	30.5	...do..	65	125	1.40	102.94	9.52	296.61	....	67.52	96.34	93.59	8.009	......	24.67	23.09	106.84	26.48	87.20
	42	20.0	7.5	30	340	50.0	...do..	90	125	1.40	115.89	10.59	343.85	....	69.00	106.59	91.98	7.524	......	24.28	22.34	108.68	23.91	93.43
	43	23.0	7.5	0	340	23.0	...do..	60	100	1.40	118.54	10.95	300.59	....	62.93	111.43	94.00	8.604	......	23.23	21.84	106.36	26.65	81.95
	44	20.75	7.5	0	337	20.7	...do..	60	200	1.40	101.14	10.42	368.61	....	73.48	97.76	96.65	6.308	......	23.80	23.00	103.48	26.06	88.26

[1] Pounds.

TABLE 4.—*Digester record*—Continued.

Species of wood.	Cook No.	Cooking conditions.							Digester charge.				Digester discharge.					Sugar yield.						
		Minutes to reach desired pressure.	Cooking pressure (atmospheres).	Time cooked (minutes).	Maximum temperature during cook (° F.).	Total time steam on digester (minutes).	Blow-off treatment.	Time required for blow-off (minutes).	Water to wood ratio (per cent).	Acid (100 per cent) to wood ratio (per cent).	Dry weight of wood charged (pounds).	Moisture in wood as charged.	Digested sawdust (pounds).	Digested liquor (pounds).	Moisture in digested sawdust (per cent).	Dry weight digested sawdust (pounds).	Original wood obtained as digested sawdust (per cent).	Reducing sugars in digested sawdust (per cent).	Reducing sugars in digested liquor (grams per liter).	Reducing sugars (per cent of dry digested sawdust).	Reducing sugars (per cent of original dry wood).	Reducing sugars dry digested sawdust compared with original dry wood.	Total soluble solids (per cent original dry wood).	Total reducing sugars (per cent of total soluble solids).
White spruce—(Con.)	45	20.0	7.5	0	337	20.0	Cond.	70	125	2.50	103.38	10.59	298.83	....	66.25	100.86	97.56	7.888	......	23.34	22.77	102.50	29.14	78.14
	46	20.0	7.5	20	338	40.0	...do..	85	125	2.50	103.20	11.04	306.02	....	69.71	92.64	89.82	7.916	......	26.29	23.61	111.35	29.06	81.24
	47	19.0	7.5	10	336	29.0	...do..	72	125	2.50	97.54	10.00	294.83	....	69.37	90.31	92.58	7.704	......	25.28	23.40	108.03	23.91	97.87
Shortleaf pine......	48	20.5	7.5	10	336	30.5	...do..	73	125	2.50	95.90	11.90	295.12	....	67.35	96.36	100.48	5.572	......	17.07	17.15	99.53	21.31	80.48
	49	19.5	7.5	10	336	29.5	...do..	83	125	4.00	91.64	12.04	283.42	....	67.78	91.32	99.65	4.500	......	14.07	14.02	100.35	21.45	65.36
Western larch......	50	20.0	7.5	10	332	30.0	...do..	75	125	1.80	113.09	21.375	292.01	65.05	68.89	90.84	80.33	8.976	119.84	37.00	29.72	124.50	35.18	84.48
White spruce.......	51	21.0	7.5	15	336	36.0	None.	290	125	2.50	169.76	8.80	477.30	25.00	70.92	138.79	81.76	4.360	127.60	17.18	14.05	122.28	26.82	63.06
	52	21.0	7.5	15	.....	36.0	...do..	......	125	2.50	167.55	7.95	468.38	....	68.53	147.40	87.97	9.227	......	29.50	25.95	113.68	32.73	79.29
	53	20.0	7.5	15	.....	36.0	...do..	......	125	2.50	168.43	10.22	501.40	....	70.71	146.86	87.19	5.696	......	19.58	17.07	114.70	21.97	77.68
	54	20.0	7.5	15	.....	35.0	...do..	......	125	2.50	159.83	8.98	469.91	153.67	62.90	174.34	109.07	4.944	67.46	19.13	20.87	91.66	32.91	63.42
	55	19.0	7.5	90	.....	109.0	Cond.	104	125	2.50	104.22	9.615	314.68	44.82	72.28	87.23	83.70	5.406	67.32	21.58	18.06	119.49	22.14	81.57
	56	19.0	7.5	45	.....	64.0	...do..	75	125	2.50	108.30	9.85	354.68	....	74.15	91.68	84.66	6.575	......	25.78	21.56	119.57	23.66	91.12
	57	20.0	9.0	15	.....	35.0	...do..	95	125	2.50	99.55	10.075	319.38	....	72.92	86.49	86.88	6.574	......	24.26	21.08	115.09	22.50	93.69
	58	20.0	6.0	15	.....	35.0	...do..	45	125	2.50	107.87	9.32	330.73	....	69.53	100.77	93.42	7.460	......	24.43	22.82	106.86	21.75	104.92
White spruce (fine chips).	59	20.0	7.5	15	.....	35.0	...do..	75	125	2.50	98.18	9.81	333.47	....	82.08	59.76	60.86	5.931	......	33.21	20.21	164.32	21.62	93.47
White spruce (large chips).	60	20.0	7.5	115	.....	35.0	...do..	84	125	2.50	101.40	9.64	294.53	35.44	71.19	84.85	83.68	6.090	70.76	25.10	21.005	119.50	21.19	99.13
White spruce (dust and chips).	61	20.0	7.5	15	.....	35.0	...do..		125	2.50	101.50	9.28	329.43	....	70.3	97.9	96.2	6.719	......	22.6	21.75	103.9	23.50	96.2
Birch..............	62	20.0	7.5	20	332	40.0	...do..	60 to 120	125	2.50	72.87	9.18	124.0	104.0	58.8	51.1	70.1	5.256	80.70	29.3	20.53	142.8	21.36	96.4
Western white pine	63	20.0	7.5	20	310	40.5	...do..		125	2.50	106.48	9.55	315.58	....	69.85	95.1	89.4	7.088	......	23.5	21.00	112.0	23.81	88.2
Red spruce.........	64	20.5	7.5	20.5	327	41	...do..	......	125	2.50	100.60	10.55	308.89	....	72.63	73.7	73.2	6.670	......	28.0	20.48	136.4	18.20	88.9
Douglas fir, Montana.	65	18	7.5	20	330	38	...do..	......	125	2.50	135.71	31.41	385.59	....	67.87	123.9	91.4	7.428	......	23.1	21.10	109.6	26.63	79.2
White pine.........	66	20	7.5	20	330	40	...do..	......	125	2.50	93.08	9.32	288.11	....	72.63	78.9	84.8	6.468	......	23.6	20.02	118.0	21.08	95.1
Longleaf pine......	67	20	7.5	19.5	300	39.5	...do..	......	125	2.50	104.83	48.30	298.64	....	62.04	113.3	[2] 108.2	8.090	......	21.3	23.06	92.5	31.65	74.0
	68	20	7.5	20	329	40	...do..	......	125	2.50	108.60	45.53	309.80	....	60.89	121.0	129.9	8.150	......	17.9	23.25	77.0	23.46	99.1
Lodge pole pine....	69	20	7.5	20	328	40	...do..	......	125	2.50	126.52	18.92	366.05	....	70.19	109.15	86.3	7.580	......	25.4	21.93	115.7	24.05	91.0
Norway pine (chips).	70	20	7.5	20	332	40	...do..	......	125	2.50	66.52	10.62	108.52	227.87	52.05	56.50	84.9	3.816	58.68	30.1	25.62	117.3	21.10	82.4

Red spruce	71	22	7.5	20	330	42	..do..	......	125	2.50	101.83	9.45	313.95	....	68.40	99.20	92.4	7.156	......	23.9	22.06	108.2	23.40	94.3
Western larch	72	20	7.5	20	332	40	...do..	......	125	2.50	128.93	12.72	383.23	....	66.65	127.95	92.0	8.818	......	27.7	25.44	108.8	31.71	80.3
Hard maple	73	21	7.5	20	328	41	...do..	......	125	2.50	110.10	9.39	198.75	123.38	56.70	86.0	78.0	5.442	85.17	24.3	18.93	128.3	20.38	93.0
Douglas fir, coast	74	19	7.5	20	326	39	...do..	......	125	2.50	124.95	16.06	355.57	....	68.52	112.0	89.7	7.424	......	23.5	21.13	111.4	21.25	99.3
Silver maple	75	20	7.5	20	326	40	...do..	......	125	2.50	93.20	9.36	295.58	....	73.40	78.5	84.0	6,540	......	24.7	20.74	118.6	21.65	95.5
Beech	76	20	7.5	22.5	330	42.5	...do..	......	125	2.50	53.94	9.97	203.66	115.0	57.06	38.65	71.7	4.190	69.41	29.6	21.24	139.1	23.15	91.7
White Oak	77	20.5	7.5	22	322	42.5	...do..	......	125	2.50	153.13	9.72	351.52	66.87	63.45	128.4	83.8	6.040	82.35	20.7	17.30	116.0	21.43	80.8
Red oak	78	19	7.5	20	328	39	...do..	......	125	2.50	102.22	9.26	162.50	135.79	55.99	71.5	69.9	5,525	75.27	26.3	18.38	143.1	19.47	95.1
Sycamore	79	20	7.5	20	329	40	...do..	......	125	2.50	96.41	9.58	159.46	254.54	57.13	100.0	103.7	3,216	50.72	17.7	18.30	97.0	24.40	75.0
Slippery elm	80	21	7.5	20	330	41	...do..	......	125	2.50	61.75	10.48	186.89	42.62	71.55	53.1	86.1	4,548	67.24	19.3	16.60	116.1	23.95	69.4
Red gum	81	20	7.5	20	327	40	...do..	......	125	2.50	100.10	45.72	277.77	26.40	69.76	84.0	83.9	6.522	93.90	24.4	20.42	119.0	21.75	93.9
Cottonwood	82	20	7.5	20	323	40	...do..	......	125	2.50	92.31	13.87	277.96	....	67.35	90.7	98.4	6,040	......	18.5	18.19	101.7	23.38	77.8
Western larch	83	20	7.5	40	327	60	...do..	......	125	2.50	103.75	12.22	279.54	176.57	68.39	88.4	85.3	6,066	87.17	35.8	30.52	118.1	36.92	82.8
White spruce	84	17	7.5	20	328	37	...do..	......	125	2.50	77.85	34.90	255.40	....	70.52	75.2	96.7	6,740	......	22.8	22.11	103.2	22.80	97.9
White spruce and park.	85	21	7.5	20	326	41	...do..	......	125	2.50	109.70	28.30	352.91	....	69.59	107.3	97.9	7.277	......	23.0	22.49	102.5	23.95	94.0
Hemlock	86	20	7.5	20	328	40	...do..	60–120	125	2.50	104.21	43.04	323.40	....	70.88	94.5	90.1	6.506	......	23.4	21.15	110.6	24.05	87.9
White spruce and bark.	87	19	7.5	21	.....	40	...do..	......	125	2.50	107.34	26.12	319.09	....	70.49	94.10	87.6	6.594	......	22.5	19.60	114.6	20.07	97.6
Spruce bark	88	20	7.5	20	328	40	...do..	......	125	2.50	57.25	9.96	132.80	72.85	62.37	49.9	87.1	5.304	62.10	19.6	17.07	114.7	24.42	69.9
White spruce	89	19.5	7.5	20.5	328	40	...do..	......	125	[3] 2.50	121.35	27.34	346.19	....	70.37	102.8	84.8	5.967	......	20.1	17.02	118.2	25.18	67.8
White spruce	90	20	7.5	20	329	40	...do..	......	125	[3] 1.80	120.47	27.88	344.69	....	70.23	102.4	85.0	6.882	......	23.2	19.69	118.2	22.38	87.8
Longleaf pine and spruce.	91	23	7.5	20	.....	43	...do..	......	125	[4] 1.00; [5] .599	162.50	14.43	451.06	....	65.24	156.8	96.4	5.380	......	15.0	14.93	100.5	20.58	72.8
White spruce	92	20	7.5	20	331	40	...do..	......	125	[4] 1.80; [5] .599	122.86	23.32	366.67	....	67.99	117.3	95.7	6.848	......	21.4	20.44	104.5	23.61	86.4
	93	20	7.5	10	327	30	...do..	......	100	[3] 1.80	126.15	19.72	342.09	....	70.38	101.7	81.8	6.730	......	22.3	18.25	122.1	24.32	75.2
	94	20	7.5	20	331	40	...do..	......	125	[4] 1.80; [5] 1.20	118.60	21.38	350.42	....	67.39	115.5	92.5	7.142	......	21.0	19.44	107.9	25.80	75.3
	95	20	7.5	20	328	40	...do..	......	100	[6] 1.17	127.71	22.37	374.64	....	69.70	113.6	88.3	6.624	......	22.1	19.59	112.8	23.58	83.3
	96	20	7.5	20	327	40	...do..	......	125	[4] 1.60; .35	126.51	22.52	363.76	....	68.66	114.0	90.25	7.031	......	22.6	20.34	110.9	20.40	99.9
	97	20	7.5	20	332	40	...do..	......	125	[4] 1.90; [7] 2.38	131.85	19.29	386.81	....	67.59	125.03	93.25	7.308	......	23.0	21.45	107.0	24.65	87.2
Digested spruce	98	19	7.5	20	333	39	...do..	......	125	[4] 2.5	66.82	40.08	257.91	....	73.08	69.40	104.0	1.668	......	6.3	6.56	96.0	......	......
Sugar pine	99	20	7.5	20	333	40	...do..	......	150	[4] 2.5	109.10	58.25	338.17	....	73.14	90.80	83.22	5.819	......	21.7	18.03	120.0	20.80	87.5
	100	20	7.5	20	331	40	...do..	......	125	[4] 1.8; [8] .1	136.30	19.75	381.82	....	69.55	116.2	85.30	7.540	......	24.8	21.12	117.4	23.43	90.0
	101	20	7.5	20	330	40	...do..	......	125	[4] .9; [8] .9	131.12	16.00	372.29	....	65.70	127.29	97.10	7.340	......	21.5	20.86	103.0	21.81	95.8
	102	20	7.5	20	328	40	...do..	......	125	[8] 1.8	134.14	15.10	381.58	....	66.85	126.51	94.20	6.808	......	20.6	19.37	106.3	24.80	78.2
	103	21	7.5	20	326	41	...do..	......	125	[4] 2.5	107.13	53.15	265.40	....	60.87	104.0	97.2	7.632	......	21.5	20.84	103.0	26.52	78.8
White spruce	104	20	7.5	20	328	40	...do..	......	125	[4] 1.8; [9] .1	134.55	13.86	381.41	....	68.46	120.2	89.25	7.560	......	24.0	21.42	112.0	23.21	92.3
	105	19	7.5	20	330	39	...do..	......	125	[4] 2.0	151.11	11.94	424.21	....	68.20	134.8	89.3	7.672	......	25.1	21.52	112.0	24.52	87.8
	106	18	7.5	20	328	38	...do..	......	125	[4] 2.0	134.55	15.35	385.40	....	66.20	130.1	96.8	7.322	......	21.6	20.92	103.5	25.78	81.3
	107	20	7.5	20	331	40	...do..	......	125	([10])	145.1	13.60	411.85	....	66.70	137.3	94.6	6.336	......	18.9	17.93	105.7	21.82	82.4
	108	20	7.5	20	324	40	...do..	......	125	[4] .9; [11] .9	146.3	13.51	411.81	....	64.69	145.2	98.0	6.939	......	19.9	19.47	102.0	26.92	72.5

[2] Cook No. 67 was not uniformly cooked; cook No. 68 was made as a check.
[3] HCL.
[4] H_2SO_4.
[5] NaCl.
[6] $KClO_3+H_2SO_4$.
[7] $KClO_3$.
[8] H_3PO_4.
[9] $FeSO_4$.
[10] Niter cake=1.8 H_2SO_4.
[11] Niter cake.

LIST OF PATENTS.

Patent.	No.	Date.	Name.	Title.
United States.	101783	Apr. 12, 1870	Sten Sternberg	Improvement in the manufacture of sugar and alcohol from lichens.
Do	244902	July 26, 1881	S. H. Johnson	Production of saccharine substances.
Do	278562	May 29, 1883	A. C. Landry, Chas. Lauga.	Method of and apparatus for converting amylaceous and ligneous substances into grape sugar.
Do	607091	July 12, 1898	E. Simonsen	Treatment of materials containing cellulose.
Do	647805	Apr. 17, 1900	A. Classen	Process of converting wood into fermentable sugars.
Do	654518	July 24, 1900	do	Process of converting cellulose into sugar.
Do	695795	Mar. 18, 1902	do	Do.
Do	696800	Apr. 1, 1902	do	Do.
Do	700616	May 20, 1902	do	Process of converting cellulose into fermentable sugar.
Do	[1] 12108 [1] 707903	May 5, 1903 Aug. 26, 1902	do	Process of converting wood into sugar.
Do	[1] 12069 [1] 654518	Dec. 30, 1902 July 24, 1900	do	Process of converting cellulose into sugar.
Do	707903	Aug. 26, 1902	do	Process of converting wood into sugar.
Do	745675	Dec. 1, 1903	H. R. Zeutzen, L. Roth.	Process of making glucose.
Do	755390	Mar. 22, 1904	G. Reynaud	Manufacture of dextrine.
Do	761542	May 31, 1904	do	Process of making achro-o-dextrose.
Do	763472	June 22, 1904	M. F. Ewen, G. H. Tomlinson.	Process of converting wood cellulose.
Do	807250	Dec. 12, 1905	C. F. Gross	Manufacture of sugar from cellulose.
Do	825808	July 10, 1906	A. Classen	Process of converting cellulose of wood into fermentable sugars.
Do	930274	Aug. 3, 1909	H. W. Doughty, F. E. Wetees.	Method of treating wood during distillation.
Do	938308	Oct. 26, 1909	M. F. Ewen, G. H. Tomlinson.	Process of producing fermentable sugar from ligno-cellulose.
Do	970029	Sept. 13, 1910	Gista Ekström	Process of making grape sugar.
Do	985725	Feb. 28, 1911	W. P. Cohoe	Method of making a fermentable product from cellulosic and ligneous materials.
Do	985726	do	do	Method of making a glucoselike product from cellulosic and ligneous materials.
Do	1031088	July 2, 1902	A. F. Richter	Combination-digester.
Do	1032392	July 16, 1912	M. F. Ewen, G. H. Tomlinson.	Process of producing fermentable sugar from ligno-cellulose.
Do	1032440	do	G. H. Tomlinson	Do.
Do	1032441	do	do	Process of feeding materials to digesters.
Do	1032442	do	do	Do.
Do	1032443	do	do	Process of treating ligno-cellulose for recovering turpentine and sugar.
Do	1032444	do	do	Apparatus for treating ligno-cellulose for recovering turpentine and sugar.
Do	1032445	do	do	Apparatus for feeding materials to digester.
Do	1032446	do	do	Apparatus for treating comminated ligno-cellulose.
Do	1032447	do	do	Process of treating comminated ligno-cellulose.
Do	1032448	do	do	Process of producing fermentable sugars from cellulosic materials.
Do	1032449	do	do	Apparatus for treating ligno-cellulose.
Do	1032450	do	do	Process of producing fermentable sugars.
Do	1033064		F. E. Gallagher, H. S. Mork.	Process of producing fermentable sugars from ligno-cellulose.
Do	1037185	Aug. 27, 1912	do	Process of producing fermentable sugars.
Do	1042332	Oct. 22, 1912	G. Ekström	Method of manufacturing alcohol from sulphite liquor.
Do	1046160	Dec. 3, 1912	do	Manufacture of ethyl alcohol by fermenting sulphite liquor.
Do	1050723	Jan. 14, 1913	do	Manufacturing alcohol from sulphite liquor.
Do	1056161	Mar. 18, 1913	F. E. Gallagher	Process of producing fermentable sugars.
Do	1056162	do	F. E. Gallagher, H. S. Mork.	Process of producing sugars from cellulose.
Do	1056163	do	F. E. Gallagher	Process of producing fermentable sugars.
Do	1087356	Feb. 17, 1914	G. Ekström	Method of removing organic constiuents from residues obtained in producing alcohol from waste sulphite cellulose lyes of similar liquid.
Do	1087743	do	do	Method of producing cellulose.
Do	1087744	do	do	Converting of cellulose into fermentable sugar.

[1] Reissue.

List of patents—Continued.

Patent.	No.	Date.	Name.	Title.
United States.	1091327	Mar. 24, 1914	F. E. Gallagher	Process of producing fermentable sugars.
Do	1096030	May 12, 1914	F. E. Gallagher, H. S. Mork.	Do.
Do	1101061	June 23, 1914	A. Classen	Conversion of wood or other cellulose material into glucose and other soluble and insoluble carbohydrates.
German	29025	Jan. 22, 1884	P. Fliessbach	Verfahren der Behandlung von Pülpe aus der Kartoffelstärkefabrikation zur Erzeugung von Dextrin, Traubenzucker, Syrup u. s. w.
Do	32388	Dec. 3, 1884	L. Aubert, V. Giraud	Von der Unwandlung von Stärke und Cellulose in Rohrzucker (Saccharose) unter Anwendlung von Elektrizität.
Do	66158	Nov. 15, 1891	C. Kappesser	Ver. zur Herstellung von zuckerhaltigen Flüssigkeiten und Alcohol aus Torf.
Do	77158	Aug. 22, 1891	C. Pieper	V. zur Darstellung von Traubenzucker u. Zuckersyrup unmittelbar aus Kartoffelreibse Kartoffelpülpe, Schlammstärke u. s. w.
Do	92079	Dec. 2, 1894	E. Simonsen	V. zur schnellen Umwandlung von Holz, Sagespähnen u. dgl. in Gahrfähige Products mit Hülfe von Säuren.
Do	111868	July 15, 1899	A. Classen	Verf. zur Ueberführung der Holzfaser in Dextrose.
Do	118540	Sept. 24, 1899	do	V. zur Ueberführung von Holz u. and. cellulosehaltigem Material in Zucker Dextrose.
Do	118541	Nov. 21, 1899	do	V. zur Ueberführung von Stärke, Stärke haltigen u. s. ähnlichen Material in Zucker Dextrose.
Do	118542	May 12, 1900	do	V. zur Uberf. von Holz u. s. w. in Zucker unter Aufschliessen mit Chlor.
Do	118543	May 1, 1900	do	Neuerung in Verf. zur Ueberf. von Holz u. s. w. in Zucker.
Do	118544	May 12, 1900	do	Neuerung in V. zur Ueberf. von Holz u. s. w. in Zucker.
Do	121869	Oct. 17, 1900	do	Verf. zur Ueberführung von Holzfaser in Dextrose.
Do	130980	June 9, 1901	do	Verf. zum Verzuckern von Holz durch schweflige Säure in Druckgefassen.
Do	123911	Oct. 17, 1900	do	Addition to Patent No. 121,869. Title same as 121,869. Specifies heating to 125°–135° C.
Do	147844a	May 26, 1901	R. Gentzen, L. Roth	Verf. zur Gewung von für die Spiritusfabrikation verwendbaren Maiselen aus Pflanzen und pflanzlichen Abfallstoffen.
Do	193112	Jan. 17, 1906	G. Ekström	Verf. zur Herstellung von Traubenzucker oder Ethyl Alcohol aus Zellulose haltigen Stoffen.
Do	207354	Aug. 8, 1907	do	Addition to Patent No. 193,112.
Do	318203	Oct. 9, 1902	Reynaud	Pour nouveau procédé de transformation de la cellulose des végétaux en glucose et ses derives.
English	358696	Mar. 3, 1906		Compagnie Industrielle des Alcools de L'Ardèche, France. Rotary apparatus for saccharifying wood.
Do	380358	Dec. 6, 1907	Ekström, G	Procédé pour la fabrication du sucre de raisin ou éventuellement de l'alcool ethylenigne, au moyen de matières contenant de la cellulose.
Do	358696	do		Compagnie Industrielle des Alcools de l'Ardèche. Rotary apparatus for saccharifying wood.
Do	393336	do	Bouchand Praceign	See Zeit. für Angw. Chemie, 1910, *23*, page 916.
French	405187	Dec. 22, 1909	J. J. D'Orlowski	Procédé pour la fabrication de l'alcool avec de la sciure de bois de la cellulose, de l'amidon et des matières amylacées.
Do	12872	1849	C. Montgomery	Brewing, distilling, and rectifying.
Do	34	1854	M. Poole	Processes for the manufacture of dextrine and glucose for distillation and application of the products thereof.
Do	1246	1854	H. Bordier	Manufacture of ligneous alcohol.
Do	2281	1854	R. H. Brooman	Obtaining alcohol from organic substances.
Do	2433	1856	T. F. Henley	Producing alcohol and food for cattle.
Do	1283	June 7, 1858	J. B. A. Lombard, X. T. Esquiron.	Obtaining saccharine substances from cereal and vegetable matters, etc.

List of patents—Continued.

Patent.	No.	Date.	Name.	Title.
English	268	Jan. 21, 1880	A. M. Clark	Obtaining glucose and alcohol from ligneous materials.
Do	4334	Oct. 23, 1880	S. H. Johnson	Production of saccharine substances.
Do	4514	Nov. 4, 1880	Wm. F. Nast	Manufacture of sugar, etc., from cellulose or ligneous materials.
Do	11407	Aug. 18, 1884	H. H. Lake	Improvements relating to apparatus for treating ligneous substances for the production of glucose.
Do	11557	Aug. 22, 1884	A. M. Clark	Improved apparatus for use in treating wood and other ligneous matters by means of hydrochloric acid gas, in order to obtain glucose therefrom.
Do	1767	Feb. 9, 1885	Adolph Behr	Improved apparatus and process for obtaining cellulose and glucose from wood and other vegetable matter.
Do	10164	Aug. 9, 1886	H. J. Hadden	Improvement in the treatment of Jerusalem artichoke to prepare it for use in distilling in the manufacture of glucose and similar industries.
Do	13653	Aug. 29, 1889	Paul Marix	A new or improved process for the purification of mineral oils and for producing alcohol.
Do	21059	Dec. 2, 1891	C. Kleyer, C. Kappesser	Improvements in the treatment of peat for the production of cellulose sugar and alcohol.
Do	13492	July 12, 1894	R. Zdarek	Improvements in the manufacture of alcohol.
Do	10762	May 30, 1895	E. Simonsen	An improved process for the treatment of materials containing cellulose for the production of spirits.
Do	21314	Nov. 11, 1895	A. L. Tedesco	Process for manufacturing pure dextrose.
Do	21878	Sept. 24, 1897	R. Zdarek	Improvements in the manufacture of ethyl alcohol.
Do	24013	Nov. 15, 1898	N. Basset	Method of treating cellulose.
Do	1035	June 16, 1899	C. F. Cross, J. S. Remington.	Improvement in the production of starch and saccharine matters.
Do	12 241	June 12, 1899	Paul Magnier, P. A. Brangier.	Improved process for convering wood, wood shavings, woody fiber, sawdust, and other substances into dextrine, glucose, and alcohol.
Do	258	Jan. 4, 1900	Alex Classen	Process for converting cellulose and starch into fermentable sugar.
Do	259	do	do	Process of converting wood into fermentable sugar.
Do	4199	Feb. 27, 1901	do	Improved process for converting cellulose into sugar (dextrose).
Do	12588	June 20, 1901	do	Process for converting wood and other cellulose materials into sugar.
Do	8545	Apr. 13, 1904	C. F. Cross	Treatment of cottonseed hulls to obtain useful products therefrom.
Do	11113	May 13, 1904	W. H. Wheatley	Method of preparing must for the manufacture of spirits of wine, the feeding of cattle, and the manufacture of dextrose.
Do	16262	July 22, 1904	Arno Börner	A new or improved process for the manufacture of starchlike or Amyloidlike substances and sugar.
Do	22709	Nov. 6, 1905	Alex Classen	Process for facilitating the fermentation of sugar solutions obtained from wood that contains tannin.
Do	16510	July 21, 1906	B. E. E. Newlands	Improvements in connection with the production of alcohol from wood.
Do	5128	Mar. 2, 1907	C. S. Lake	Improvements in and relating to the treatment of peat for the production of alcoholic and other products.
Do	24503	Nov. 5, 1907	Boren Hafner, Frank Krist.	Improved manufacture of fermentable sugar from materials containing starch or cellulose.
Do	18341	Aug. 13, 1907	G. Ekström	An improved process for making grape sugar (glucose) and ethyl alcohol from materials containing cellulose.
Do	5128	Mar. 2, 1907	H. H. Lake	Improvements in and relating to the treatment of peat for the production of alcoholic and other products.
Do	26619	Dec. 8, 1908		Compagnie Industrielle des Alcools de L'Ardèche. Improvements in or relating to apparatus for converting wood into fermentable sugars and other products.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 984

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H. C. TAYLOR, Chief

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THE NATIONAL INFLUENCE OF A SINGLE FARM COMMUNITY.

A Story of the Flow into National Life of Migration from the Farms.

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(Section of Farm Life Studies, C. J. Galpin, Economist in Charge.)

CONTENTS.

SOME NATIONAL ASPECTS OF FARM LIFE.

IT IS A HARD MATTER TO KEEP FARM LIFE AND CITY LIFE IN BALANCE.

It is to the best interest of a nation to keep its basic occupations in a practical equilibrium. In our own country, agriculture, manufacturing, transportation, merchandising, and professional service—strong competitors with one another for both capital and workers—are all expected to hold their own. But our most basic occupation, agriculture, seems to be in periodic danger of losing its grip on both capital and men and of allowing them to slip away into city industries.

Statesmen have always "viewed with alarm" the tip of the scales from farming to industry and from country life to city life. When the farm loses its balance to the city, national life is threatened with a food shortage, or with dependence upon foreign countries for food essentials; but the shortage of food is not the only danger. When the American farmer begins to lose ground, the stability of the nation is disturbed; and out of this disquieting situation grows a peril which menaces the very seed beds of national life.

FARM COMMUNITIES BREAK UP WHEN STRONG FAMILIES LEAVE.

The rural community, underlain by the occupation of farming, has always rightly been looked upon, in America at least, as the seed plot from which virile young humans are constantly being taken up by the roots and transplanted into national life and enterprise.

54705°—21—Bull. 984——1

"CAN country life be dug into so as to reveal important social facts and relations?"

I asked an American sociologist this question several years ago and he replied:

"No. Country life—farm life and all that goes with it—is too thin."

"You see," he continued presently, "it is all on the surface. Ride through the country, see the farmhouses, notice the workers in the fields—and you have the whole of it. There is nothing deeper to dig up."

This view—this shallow view of country life and rural society—could be brushed aside and let slip into oblivion if it were not for the fact that it is a view too commonly held in high quarters. The brutal verdict, "Nothing in it; nothing interesting in the life side of farming," is convincingly reversed by the results of the following study. Facts and relations of a highly social character have been "dug up." These facts prove not only interesting, but significant, not to say startling and sensational. Farm life is discovered to lie deep, and not "all on the surface." The farm community is bound up with the Nation at large. Romance links the farm to American history and American social development. Justifiable pride, the farmer's pride in his farm life, pride in his farm community, is the outcome.

Searching out the defects of country life has already gone far beyond the point of usefulness. The mounting mass of petty frailties and peccadillos, accumulated by shortsighted methods of country-life exploration, has obscured the body of excellencies native to farm populations. The chronic publicity of rural shortcomings has created a psychological situation fostering widespread pessimism about farm life. This cloud of doubt, far from remedying the defects, has tended to cast upon country life itself a shadow for which no legitimate cause exists.

The cure for this unfortunate situation is a policy of inventorying the better things in country life and spreading their story far and wide. These better things, like seeds, will take root and displace the worse things. Hope and contentment will revive, and pride in the part which farm communities play in national life will stop the unreasonable panic over the status of farm life.

C. J. GALPIN.

When agriculture, weighed in the balance over against city industry, is found wanting, as has sometimes happened in the history of older nations, it will be discovered that the seed beds of human life back in the country have begun to break up. Strong families, it will be found, have well-nigh disappeared by migration from farm community after farm community; and what is termed "folk depletion," an actual loss in the social stamina and morale of the rural community, is sure to be the penalty upon the Nation. It is incumbent upon the Nation, therefore, to be concerned about the upkeep of rural community life, and to try to maintain the balance, as far as possible, by legitimate checks upon the movement of capital and population away from the farms.

FAMILY LIFE ON THE FARM.

Family life on the farm is peculiar, in that farming is practically a partnership of the husband, the wife, and the child. This partnership, moreover, frequently reaches its maturity only when title to the farm passes from the father and mother to the child, who by that time will have reached manhood and have a family of his own. From this point of view the farm family, therefore, constitutes a social cycle a little larger than the group usually considered as a farm home.

The farm owned by the father and mother is likely to pass from management by the father through several stages, such as (1) management by the son, (2) tenancy by the son, (3) possibly part ownership by the son, and (4) complete ownership by the son, all within the father's lifetime. This close weaving of threads of family with those of land tenure has helped to constitute the family as the outstanding rural institution, and has naturally made domesticity the cardinal trait in country life. The sentiment of home, in all likelihood, gathers much of its meaning and sweet enchantment in the minds of men from the experience of youth in the farm household. And this sentiment is carried over into the pathetic makeshifts and substitutes for family life and home which city conditions often impose upon city people as a tax on city residence.

The Nation is largely dependent, therefore, upon farm life for the maintenance of the family as a national institution and a bulwark of national life.

UNANSWERED QUESTIONS ABOUT MIGRATION FROM THE FARMS.

Migration is essentially a transplanting of youth.—The transplanting of youth from farm life to city life appears to be not only a process highly essential to national virility, but an inevitable process. Migration from the farm is, therefore, a natural process in the Nation's organism, like many a necessary biological function, which must be guarded from overaction. For this reason it becomes important to make a beginning in the analysis and study of migration from the farms in order to answer some of the questions still unanswered.

What proportion of the people migrate from the farms?—There are as yet no conclusive data to determine whether every farm sends continually a quota of persons to city industry, or whether some farms surrender none and others surrender all, or nearly all. It is not known whether the proportion of the persons leaving the average farm community is, on the whole, relatively constant or greatly fluctuating. It is not known whether the proportion of persons in this stream of migration varies greatly from farm community to farm community. Do some farm communities furnish an oversupply, some an undersupply? Broadly speaking, no one knows.

The questions that relate to the proportion of persons who migrate from the farms lead into the problems of folk depletion and normal community growth.

Where do farm people migrate to?—Do they as a rule go by easy stages a few miles at a time away from the home farm in the same county; do they then move off into other counties of the State, then scatter through the Nation? No one can answer these questions for the country at large. Does migration radiate from farms in circles, and from farm communities in circles, wave after wave? Or does it go in streams, after the manner of river systems? Is there a set of migratory systems covering the Nation? No one seems to know. Is there a relatively fixed relation between the number of persons staying on the farm, the number moving into and remaining in the county, the number remaining in the State, the number remaining in the United States? No one knows.

If we are to understand the migration from farms we must find out where the people go after leaving the farms.

What occupations do migrants enter?—Do migrants from farms enter a few particular occupations, or do they scatter evenly among the principal occupations? Do certain farm communities favor certain occupations? Is there a relation between the type of farm community and the type of occupation which their migrants enter? Do migrants go where the highest pay is offered? Do they go upon direct inducement? Do they go upon order, as hotbed owners fill orders from their tomato beds, cabbage beds, celery beds? Do migrants go into the occupations of lower status in cities and finally work their way into other occupations of a higher status? Anyone with a knowledge of American country life may perhaps answer these questions for particular communities, but no one can answer them for the country as a whole.

It would seem necessary, in any thorough analysis of migration, to know what occupations migrants enter, and whether the road into an occupation is more or less direct from farm life or whether it is circuitous.

What achievements do migrants make?—Do farm migrants make achievements in the first generation, or must they wait for some necessary city amalgam until the second generation or third? Can certain farms be said to be the seed beds of achievers in national life? No one seems to know what the relation of migration is to distinguished service in the realm of art, education, invention, industry, and the like.

Not until migration is analyzed so far as to record how far and under what circumstances migration from farms is related to national achievement can we be said to know rural migration.

THE PRESENT STUDY.

An initial study of migration from farm life is presented in the following pages. Attention is centered minutely upon a single representative farm community, and the story of migration over a series of years is unrolled so that one may plainly see it at work on single farm units as well as in a single community unit.

STATEMENT OF THE PROBLEM.

As already stated, migration is a process natural to farm life and necessary to national life and very likely inevitable from either point of view. Danger to farm, to farm community, and to the Nation lies especially in too much migration. In our study, therefore, we shall consider migration as basically normal and good, rather than basically abnormal and evil.

At the present time (1920) the loss of workers from agriculture to city industry is so pronounced that one may be inclined to overlook the fact that migration is a normal condition of farm life. But it is hoped that in a study of the normal aspects of migration there will be disclosed some of the methods of preventing the evils of overmigration on the one hand and undermigration on the other.

The problem may be stated in this way: What are the facts surrounding and accompanying migration from the farms—especially with reference to the proportion of persons migrating; with reference to the character of the persons remaining; and to the conditions which render the farm community stable and prosperous in spite of its contribution of strong young people to the city; and with reference also to the occupations recruited from country-bred people; in fact, to the whole rôle in national life of the local farm community?

THE REMEDY FOR OVERMIGRATION.

It may quite possibly be found that the evils of migration from the farms result from a general lack of knowledge as to the conditions under which migration is normal and wholesome. A thorough recognition of the natural character of migration and an open handling of the whole question, in all likelihood, will make plain the special circumstances and emergencies under which overmigration takes place and the very fact of publicity may tend to correct the evil.

THE FARM THE MAKING PLACE OF CITIZENS.

A farm is a territorial unit of considerable stability. It keeps its line fences and boundaries with something of the same persistency that school districts, townships, counties, and cities keep their boundary lines. The land of the farm is not simply a solid surface to step on, to drive over; nor is the soil of the farm merely a laboratory for the play of chemical, physical, and biological forces, capable of being transformed into living plants and animals—wonderful as this may be—but it is the breeding ground of human beings, the making place of citizens. It furnishes the physical and psychical setting for the interpretation of the world of experience to these human beings. The farm quite obviously has a place of a manifold character in national life.

THE DANGER ARISING FROM MIGRATION IS IN DESTRUCTION OF ORIGINS.

The danger of migration is similar to the danger attending the upkeep of a fine herd. By excessive sale the original herd or flock may be depleted in number and in quality to such a point that it can not maintain its own vigorous character. When the selling of young stock endangers the original herd, it is known that ignorance exists as to the ordinary conditions of herd maintenance. So it is with the country family and community. If the farm family, and the community of families, are persistent and virile, migration is not an evil, but a part of a healthy normal process.

THE SELECTION OF A FARM COMMUNITY FOR STUDY.

The community which is the present subject of study was selected principally for the reason that it possessed in its academy (high-school grade) an institution having records relating to the families of the community running back nearly 100 years. It would be very difficult, if not practically impossible, to study migration in a community over a considerable period without such records.

Furthermore, the selection was made because the community shows few, if any, signs of depletion through migration. Community life is still strong. Family strains on the farms run far back and are still potent. Migration, such as there has been and wide as it is, seems to have been fairly normal.

The land is good limestone land, but not exceptional, either for New York State or for the United States.

That the community selected is representative enough in point of and, type of agriculture, and composition of population, fairly to set forth the ordinary farm community situation, and especially migratory tendencies in the United States, can scarcely be doubted. There seems to be one factor only in which this community differs materially from most other American communities, namely, in the possession of an educational institution of high-school grade for nearly a hundred years, under farmer control. The farmers' centralized high school of the present day is so widespread that it is by no means uncommon for a farm community to have a high-school history of several years, but a century of such annals is certainly exceptional.

METHOD OF STUDY.

An outline of the method of study will throw some light upon the results. An investigator visited the community and remained there for five months, making a collection of records, maps, histories, and newspaper accounts, covering the period studied. Every accessible source of information on the history of the farms and on the history of the families which had lived on the farms was used by the investigator.

A list of the names of all students who had attended the community academy was compiled. Each person on this list was traced to his home farm, and note was made of his family connections, his final residence, occupation, and achievements. It was found that these students had scattered to all parts of the country. (See fig. 1.)

This method of inquiry was in effect an historical analysis of the community, family by family, farm by farm, institution by institution.

DESCRIPTION OF THE COMMUNITY.

GEOGRAPHY OF THE COMMUNITY.

Belleville is a small agricultural village of not more than 500 people, situated in the township of Ellisburgh, 6 miles from a railroad, in Jefferson County, New York. (See fig. 2.) The country surrounding the village is a section of fine farming land, rolling in character, sandy in the west, clay loam in the center, and a slate loam in the east, all underlain close to the surface by limestone. It has long been a good dairy section.

SETTLEMENT AND EARLY HISTORY.

Settlements were made near the present site of the village about 1802. The spot afterwards named Belleville was favorably situated for milling purposes, and finally grew into a village. The first school was taught in a blacksmith shop in 1805. In 1807 a log schoolhouse was built, without floors, and with an elm-bark roof. Almost all of the settlers came from eastern New York State and New England. Vermont, Connecticut, Massachusetts, and Rhode Island furnished the greatest number. Few foreign-born persons have settled in the community, those coming being mainly of English or Irish extraction.

FIG. 1.—Map of the United States showing migration from the Belleville (N. Y.) community to other parts of the United States. The number of migrants from the farms of the larger community is given so as to show the distribution by residence. This map shows how wide may be the influence of a single farm community upon the Nation at large. Horatio Seymour, while Governor of New York, speaking from the academy steps to the community gathered to celebrate the fiftieth anniversary of Union Academy said: "You can take up the history of your State and trace your public men back through the schools and colleges as readily as you trace your railroads and highways upon the maps."

FIG. 2.—Map of larger and smaller Belleville communities, showing farms with farm numbers. Inside the heavy line is the smaller community, including 307 farms, which is practically the trade and church area of Belleville village. Outside the heavy line there are 621 farms, making a total of 928 farms in the larger Belleville community, which is the school area of Union Academy. In the text, farms are referred to by the numbers given them on the map.

54705°—21—Bull. 984. (To face page 9.)

UNION ACADEMY OF BELLEVILLE.

Some time prior to 1824 the Rev. Joshua Bradley made a persistent effort to interest the people in the vicinity of Belleville in the subject of schools, education, and even higher education. He canvassed the townships of Ellisburgh and Henderson again and again to influence the people to give from their limited means for the purpose of schooling their children. In the fall of 1824 Mr. Bradley opened a

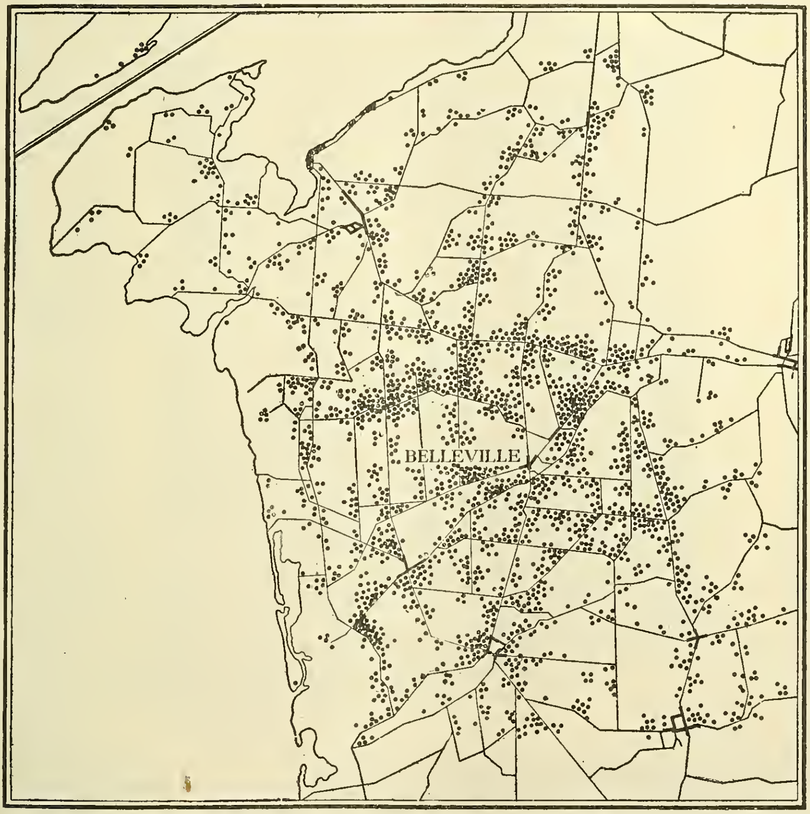


FIG. 3.—This map shows the distribution of persons from farms in the Belleville community who attended the academy at some time or other. Each dot a student. Students from hamlets and villages not shown.

school of higher grade in the upper part of a house, and employed a teacher. The prosperity of this school awakened the people to want an academic institution in Belleville.

Mr. Bradley presented a plan for a manual-labor school, and stock was subscribed sufficient to finance a building. A lot of 6 acres was given by Giles Hall to be "forever after used for school purposes." April 13, 1826, an act of incorporation was obtained and 24 farmers were constituted a body corporate, under the name "Union Literary Society," for the support of an academic school for both sexes. The number of their trustees was to be from 24 to 30. A stone school building was erected in 1828. This structure is still standing as a part of the present school plant. (See Pl. I.)

The regents of the University of the State of New York received the academy under their visitation in 1830. The academy flourished to

FIG. 4.—Farm homes contributing to the academy endowment fund. In 1875, at the fiftieth anniversary of Union Academy, a memorial endowment fund was established for the academy's maintenance by the people of the Belleville community. So strong has been the sentiment concerning this piece of community loyalty that it is actually not considered civil to die in this community without leaving something to the endowment fund, which has long since reached the $50,000 mark set by its originators. Plans are being made to bring the sum up to $100,000 at the hundredth anniversary of Union Academy in 1924. This map shows the farm homes of the community which have made contributions to this endowment fund. These farms have helped in a special way to prepare the community migrants for their place in National life.

a degree that justified the highest expectation of its friends. After a short trial of the manual-labor shop, that idea was abandoned, and the academy devoted itself to the usual classical type of education, supplemented by a department of music and fine arts and a business course. In 1901, by the gifts of the William Mather and George Mather families, a course in agriculture was added to the curriculum.

Union College furnished most of the principals and teachers of Belleville Academy in its early decades. Hamilton College, Amherst College, Colgate University, Cornell University, and Vassar College are other institutions that have been sources of teachers. The attendance of scholars in 1852 was 188; in 1855, 287; in 1862, 236; in 1866, 342—the high peak of attendance. Since 1880 the attendance, owing

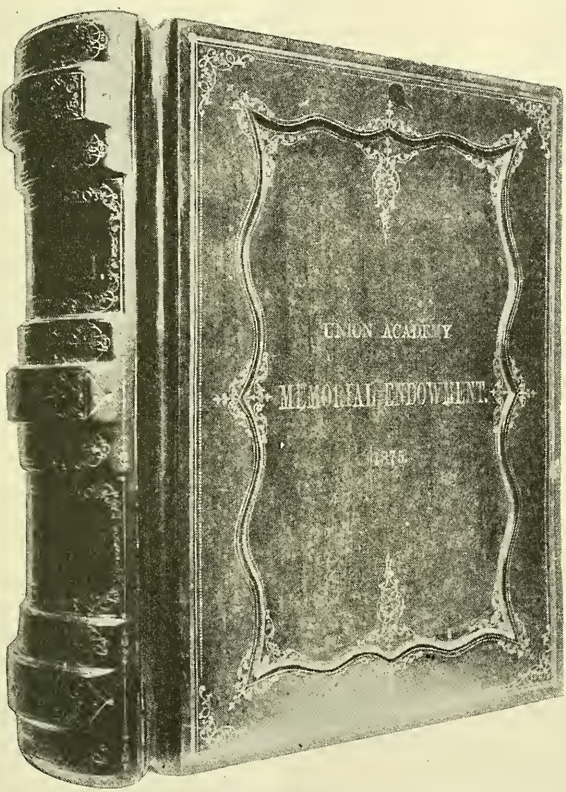


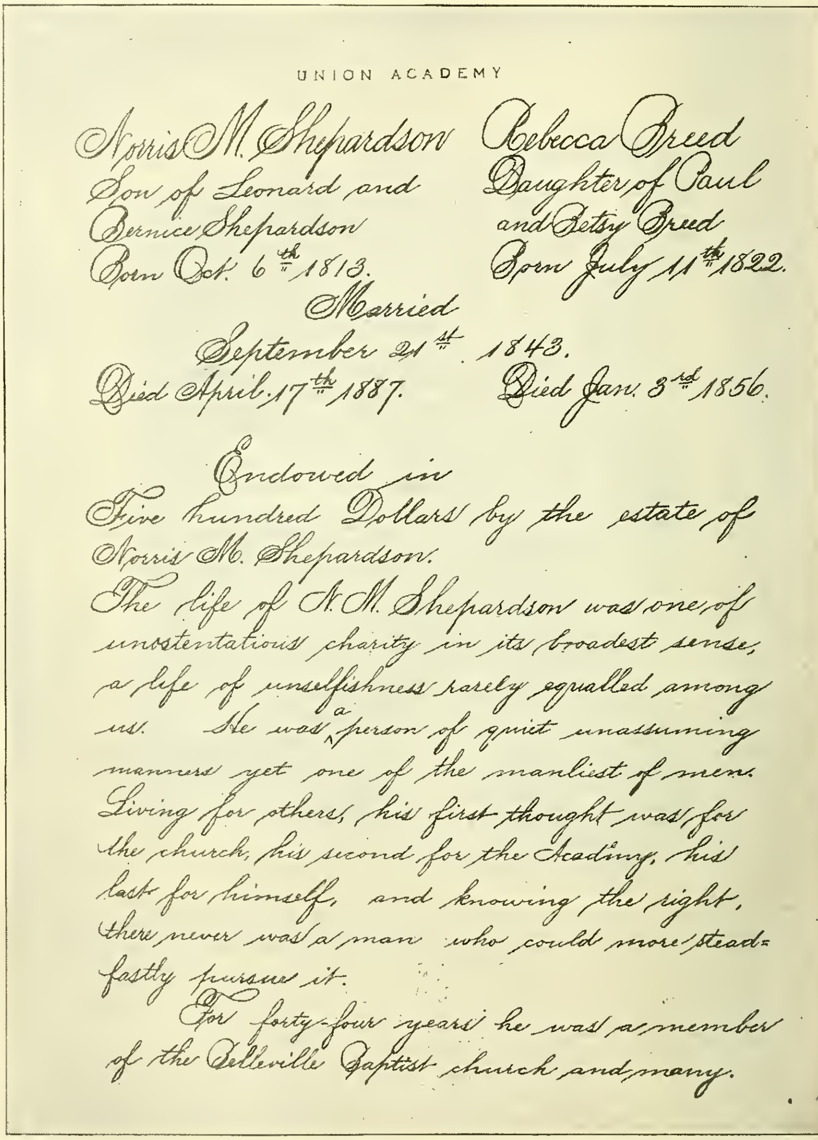
FIG. 5.—The Academy Memorial Endowment Book. The idea of making the Memorial Fund a monument to Major Barney originated with Norris Shepardson, poet-farmer.

to the establishment in the county of other institutions of high-school grade, has ranged between 150 and 100. (See fig. 3.)

THE FARMS AND UNION ACADEMY.

From its establishment Union Academy has been characterized as a farmers' institution. Its 30 trustees have been local men and women almost entirely from the farms. Two or three village merchants, the village physician, and the country lawyer have supplemented the farmer membership of the board.

The history of the financial support of the academy, the annals of the voluntary funds for buildings, the maintenance funds over and above the amount of annual tuition moneys, and the special funds for scholarships, library, and endowment show that local farmers in



UNION ACADEMY

Norris M. Shepardson
Son of Leonard and
Bernice Shepardson
Born Oct. 6th 1813.

Rebecca Breed
Daughter of Paul
and Betsy Breed
Born July 11th 1822.

Married
September 21st. 1843.

Died April. 17th 1887.

Died Jan. 3rd 1856.

Endowed in
Five hundred Dollars by the estate of
Norris M. Shepardson.

The life of N. M. Shepardson was one of unostentatious charity in its broadest sense, a life of unselfishness rarely equalled among us. He was a person of quiet unassuming manners yet one of the manliest of men. Living for others, his first thought was for the church, his second for the Academy, his last for himself, and knowing the right, there never was a man who could more steadfastly pursue it.

For forty-four years he was a member of the Belleville Baptist church and many.

FIG. 6.—Facsimile of one page of the Shepardson Memorial in the Memorial Endowment Book. Nearly every old farm family in the Belleville community has such a section in this remarkable book.

the community which was reached and influenced by the academy were the maintaining power of the institution. (See figs. 4, 5, 6, and 7.)

FIG. 1.—A VIEW OF ACADEMY STREET, BELLEVILLE. IN THE LEFT DISTANCE MAY BE SEEN THE STONE PART OF THE ACADEMY, BUILT IN 1826, AND STILL IN USE.

Sentiment for this old building is too strong to allow its being torn down. This is the building in which the great-grandfathers and great-grandmothers of the present young people of the community studied and frolicked together.

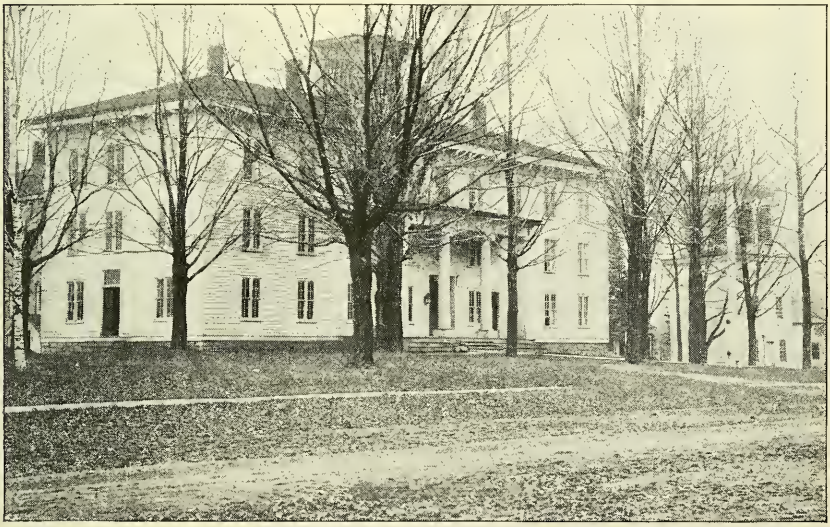
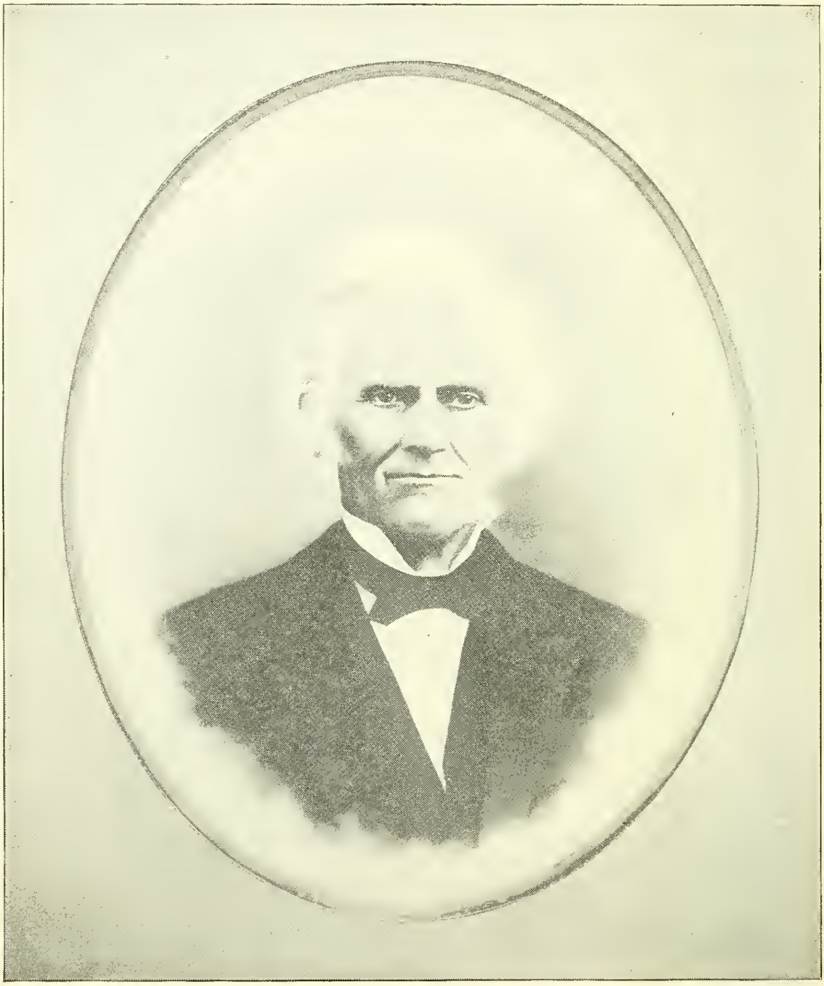
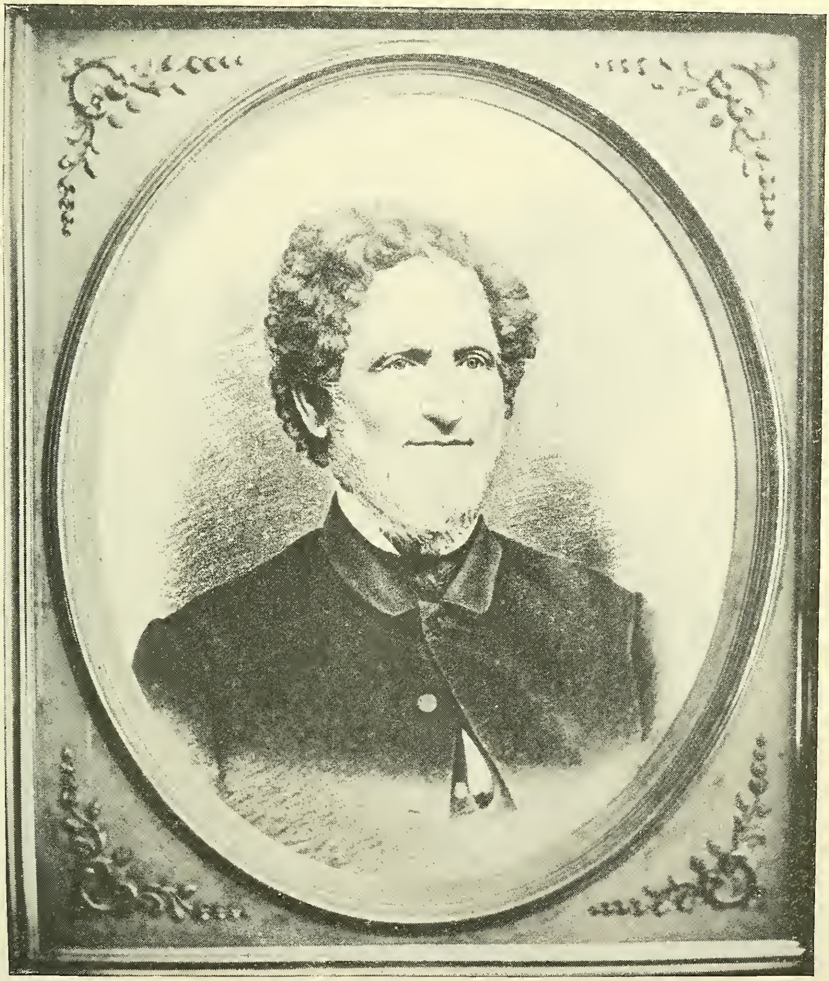


FIG. 2.—FRONT VIEW OF UNION ACADEMY. THE BELL TOWER APPEARS ON THE RIGHT.

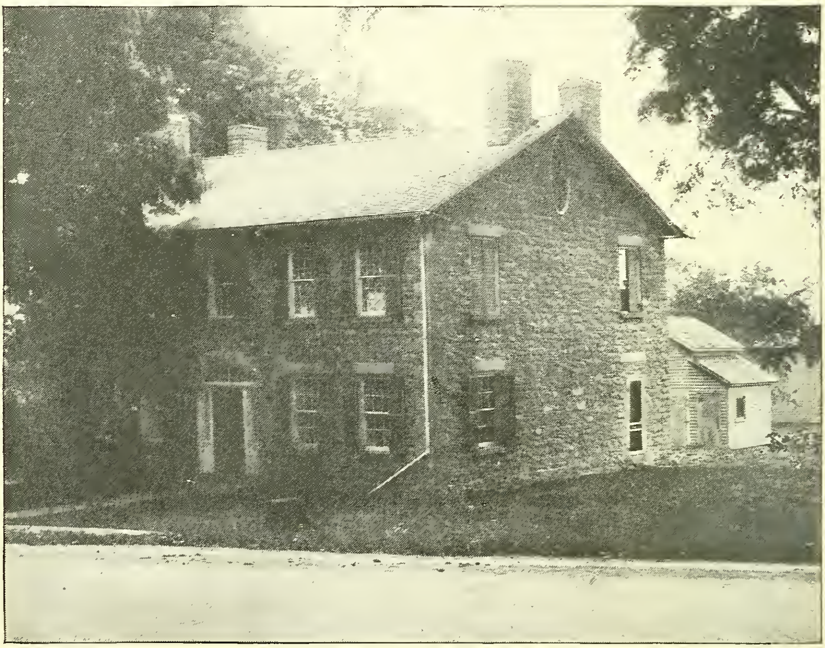


PORTRAIT OF CALVIN CLARK, HUNG AMONG THE PORTRAITS OF OTHER LOCAL WORTHIES IN THE MEMORIAL HALL OF THE ACADEMY.

Calvin Clark, living on farm No. 1, was one of the founders of the Academy, who was influential in keeping the Academy on a community and non-sectarian basis.



PORTRAIT OF GEORGE W. EATON, HANGING IN UNION ACADEMY MEMORIAL HALL. MR. EATON WAS THE ACADEMY'S SECOND PRINCIPAL AND AFTERWARDS BECAME PRESIDENT OF COLGATE UNIVERSITY.



BIRTHPLACE OF DANIEL BURNHAM, ARCHITECT.

This house, in Henderson village, built by Burnham's grandfather, is of the same substantial character as the old Academy built by the community in 1826.

TRANSCRIPT OF MEMORIAL ILLUSTRATED ON OPPOSITE PAGE.

Norris M. Shepardson	Rebecca Breed
Son of Leonard and	Daughter of Paul and
Bernice Shepardson	Betsy Breed.
Born, Oct. 6, 1813.	Born July 11, 1822.

Married,
September 21, 1843.

Died, April 17, 1887.	Died January 3, 1856.

Endowed in
Five-hundred Dollars by the Estate
of Norris M. Shepardson.

The Life of N. M. Shepardson was one of unostentatious Charity in its broadest sense, a life of unselfishness rarely equalled among us. He was a person of quiet unassuming manners yet one of the manliest of men. Living for others, his first thought was for the church, his second for the Academy, his last for himself and knowing the right, there never was a man who could more steadfastly pursue it.

For forty-four years he was a member of the Belleville Baptist church and many years its clerk. He was for forty-three years a member of the Board of Trustees of Union Academy and for six years its efficient president.

Deprived in his youth of the advantages of learning and culture, he was never-the-less a man of rare intelligence and fine literary tastes as his own poems will bear witness.

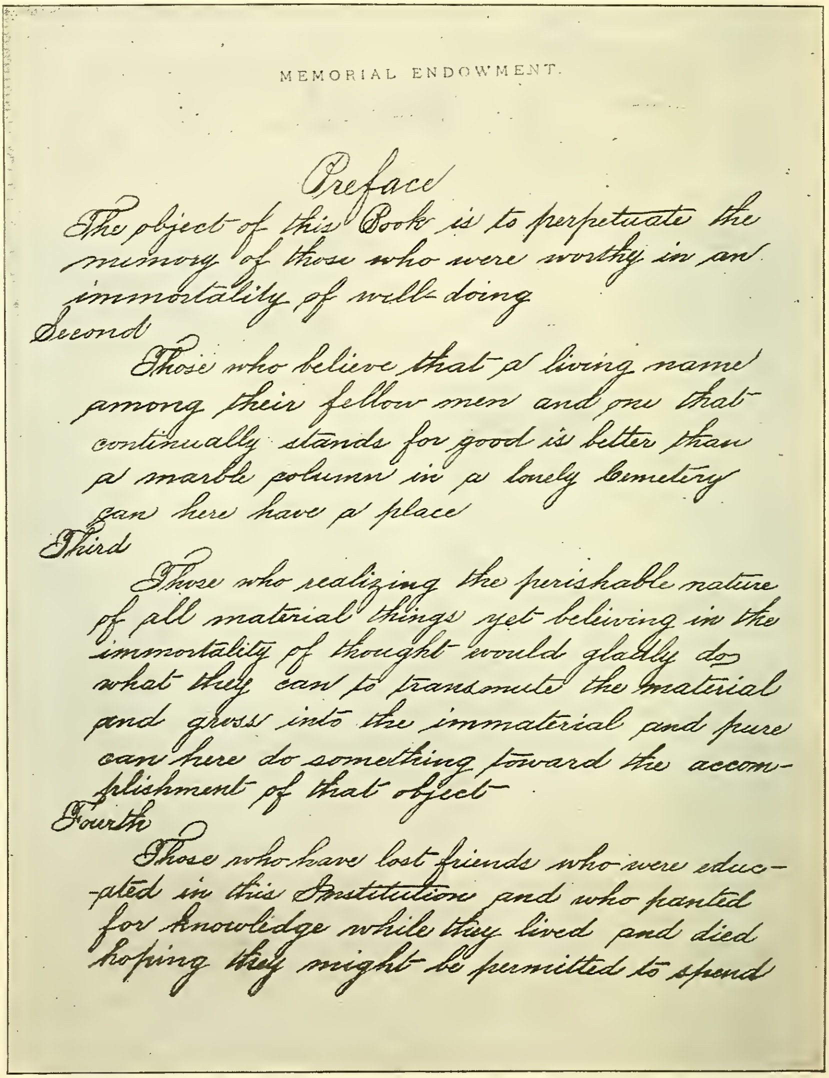
Desiring that others might not be deprived of the education he had lacked in youth, he gave generously of his time and means to promote the interests of the Academy and was especially desirous that Christian teachers should impart its instruction and direct its discipline.

While the Academy continues to do faithfully the work for which she was founded she will be his best monument. Always thinking and planning for others it was *his* busy brain that conceived and carried into execution the scheme of the Memorial Endowment which has given not hundreds but thousands of dollars to the Endowment fund of the Academy. The world at large has an inheritance in the lives of such good men as N. M. Shepardson, and when they are moved from it and the circle of their influence is broken by death, whole communities suffer. In his death the town lost one of its noblest citizens, one whose sympathies and counsel were ever on the side of virtue and morality. Who always labored to promote the best interests of the community in which he lived.

In times of darkness and discouragement he was a light, in danger he was undismayed, in reverses never despondent, a real and cheerful helper. N. M. Shepardson was an exemplification of his own words,—

"Men live not to themselves alone,
To themselves alone they do not die."

An analysis of the roll of students indicates not only that the majority of students all through the years were sons and daughters of farmers living on farms, but that every farm save 13 in the 25 square



MEMORIAL ENDOWMENT.

Preface

The object of this Book is to perpetuate the memory of those who were worthy in an immortality of well-doing

Second

Those who believe that a living name among their fellow men and one that continually stands for good is better than a marble column in a lonely Cemetery can here have a place

Third

Those who realizing the perishable nature of all material things yet beleiving in the immortality of thought would gladly do what they can to transmute the material and gross into the immaterial and pure can here do something toward the accomplishment of that object

Fourth

Those who have lost friends who were educated in this Institution and who panted for knowledge while they lived and died hoping they might be permitted to spend

FIG. 7.—Facsimile of first page of the preface of the Memorial Endowment Book, written by Judge Mullen, one of Union Academy's distinguished alumni. The penmanship is that of Ira Shepardson, who designed the book.

miles immediately surrounding Belleville furnished some students to the academy; while in a larger community of 225 square miles, which includes the smaller community, about 75 per cent of the farms furnished such students. In other words, there is a smaller community

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Fourth

Those who have lost friends who were educated in this Institution and who panted for knowledge while they lived and died hoping they might be permitted to spend an eternity in its acquisition can here embalm their memory in the shrine at which they worshipped

Fifth

Those who have lost children before the opening of those buds of promise which they so eagerly anticipated can here bid them live again and blossom and bring forth fruit to gladden their own hearts and bless the world

Sixth

Those whose parents amid the trials and privations of a newly settled country found heart and means to assist in building this Institution and by personal sacrifice gave them its advantages can here honour their father and their mother by showing that those sacrifices and advantages are appreciated

Seventh

Those who have lost friends who were lovers of learning and while they lived laboured for its advancement and would gladly honour their memory in still permitting them thus to labour can here fulfil their desires

Eighth

Those Children of Old Union and of their country who lived for the one and died for the other can here live again "more abundantly" for the Institution which they loved and the country for which they died

Ninth

Those whose hearts yearn for "Whatsoever things are true whatsoever things are honest whatsoever things are just whatsoever things are pure whatsoever things are lovely whatsoever things are of good report" can here lavish all their affections and know that they have been worthily bestowed

Belleville 1875

of farms of 25 square miles in extent, the relation of which to the academy is constantly such that the academy records are a good index of the adolescent life of the community. And in the larger community of 225 square miles, the academy records cover so large a percentage of the adolescent life on the farms that it is a fair index of the character and movements of its adolescents. Because of this intimate relation of the farms to the academy from 1826 to 1920, it is deemed

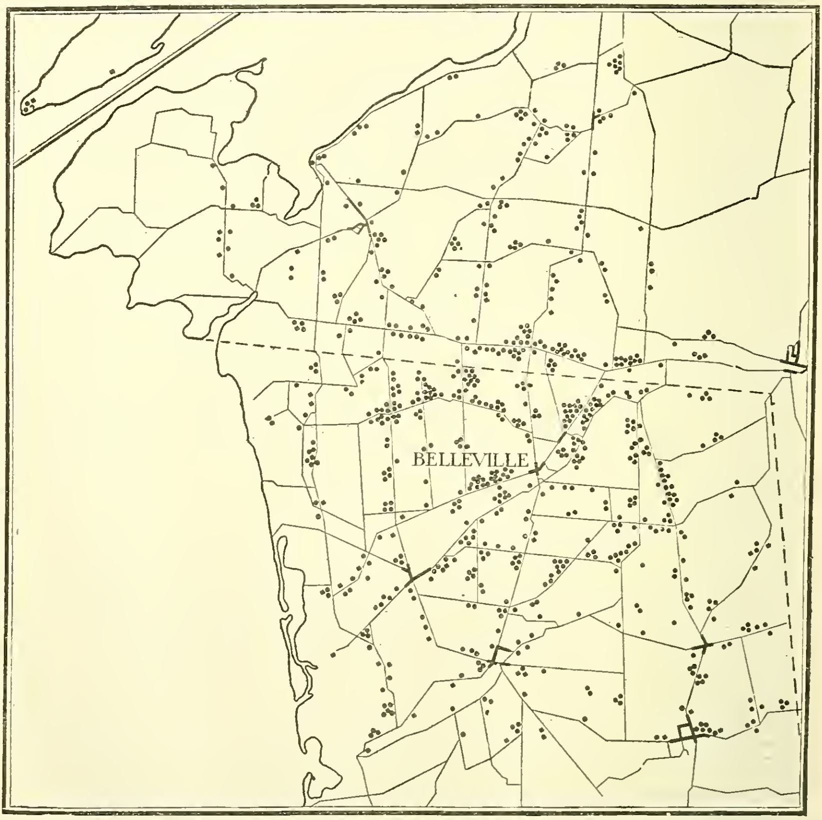


FIG. 8.—Home farm distribution of students from farms who migrated from Belleville community after attending the academy. Migrants to county, State, Nation, and foreign lands are included. The migrants represented here are, for the most part, young men and women in late teens or early twenties at the time of leaving the community. Their tastes, inclinations, and associations were at that time fairly well developed, so that they may be assumed to have carried the home community's ideals to every community touched.

that the movement of the students of the academy in two currents, one back to the farms, the other away from the farms in migration, is a fair representation of the migratory movement in this locality.

The "larger community," so called in this study, comprises the territory from which Union Academy has received the bulk of its students. It is all within a radius of about 7½ miles, a distance which has been considered practical for students to travel back and forth, either daily or weekly. In the early days there was no institution of like character near as a competitor. In somewhat later days, when there arose competitors, the larger area still held for a time to the academy by habit and tradition. In recent years a much smaller area, referred to here as the "smaller community," has furnished the greater part of the students, with some additions

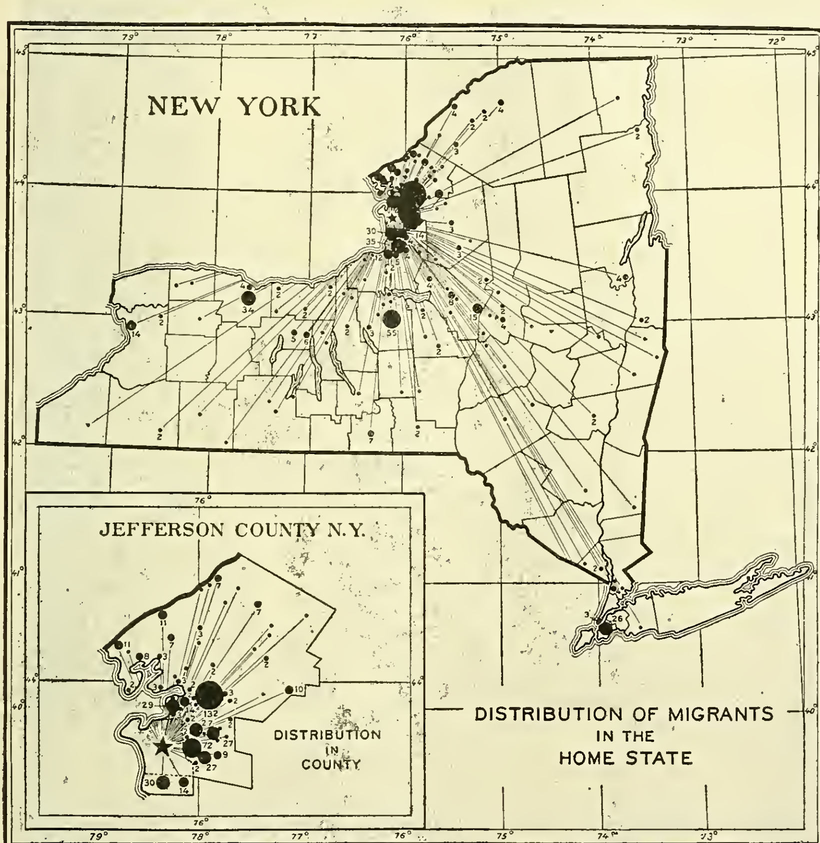


FIG. 9.—Map of migration to the county and the State. The number of migrants from the farms of the larger community of Belleville who went no farther than the State boundary is here graphically displayed, the dots of different sizes showing the distribution of migrants in residence in the county, and in the State outside of the county. The smallest sized dot represents one migrant.

from certain farms in the larger community where the tradition still holds. (See fig. 2.)

MIGRATION FROM THE FARMS OF THE COMMUNITY.

The elaborate character of the following study of migration is deemed necessary in order to make a convincing impression with a time-worn theme. Everybody has been aware of the stream to the

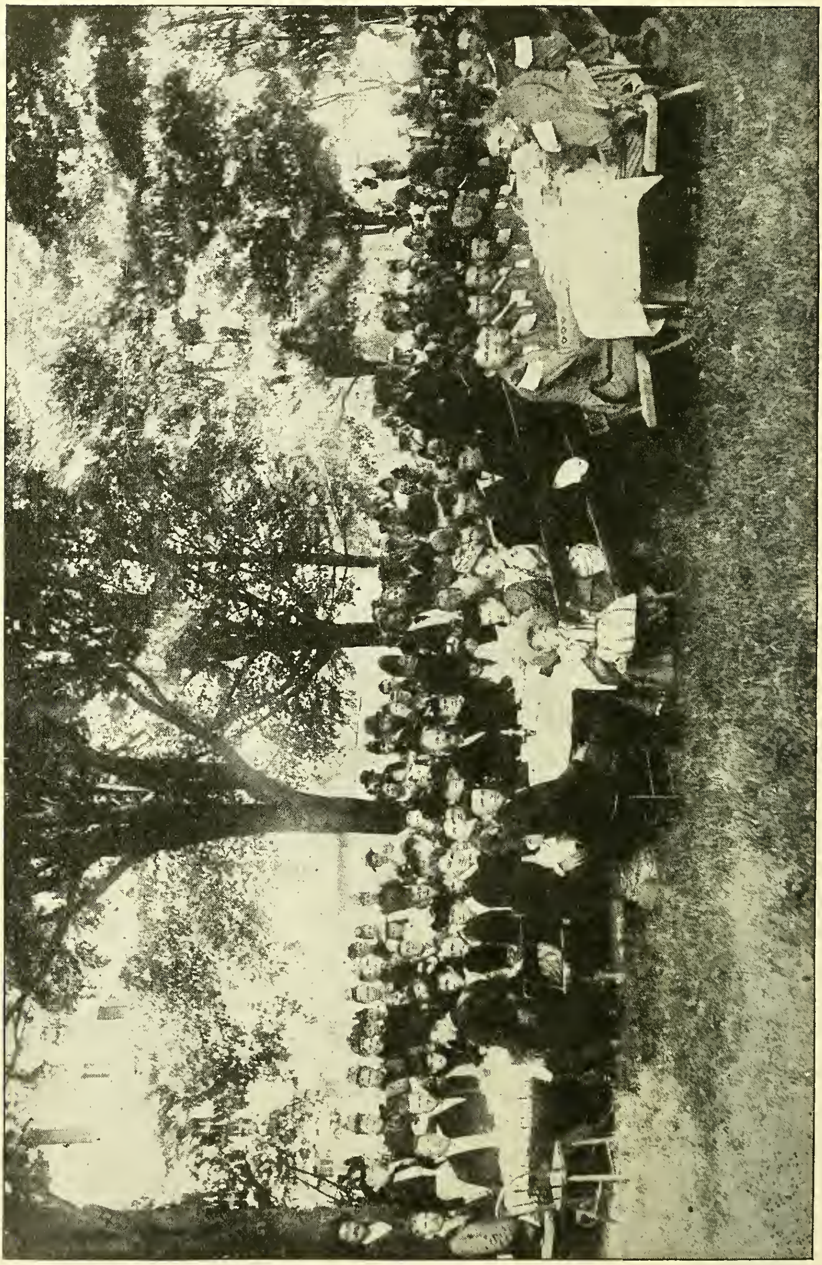


FIG. 10.—A commencement dinner on the academy lawn 30 years ago. The history of this community recounts many such gatherings.

city from the country, but the whole subject is placed on a new footing for fertile discussion when the rills are seen flowing from farm after farm to the Nation at large. (See figs. 1 and 8.)

In answer to the question, "Where do farm people go?" an attempt was made to trace to his final residence each student of Union Academy from 1824 to 1920. Out of the 3,604 students whose names appear on the academy records it was possible to trace the residences selected by 2,445. Among the other 1,159 there were 69 who died

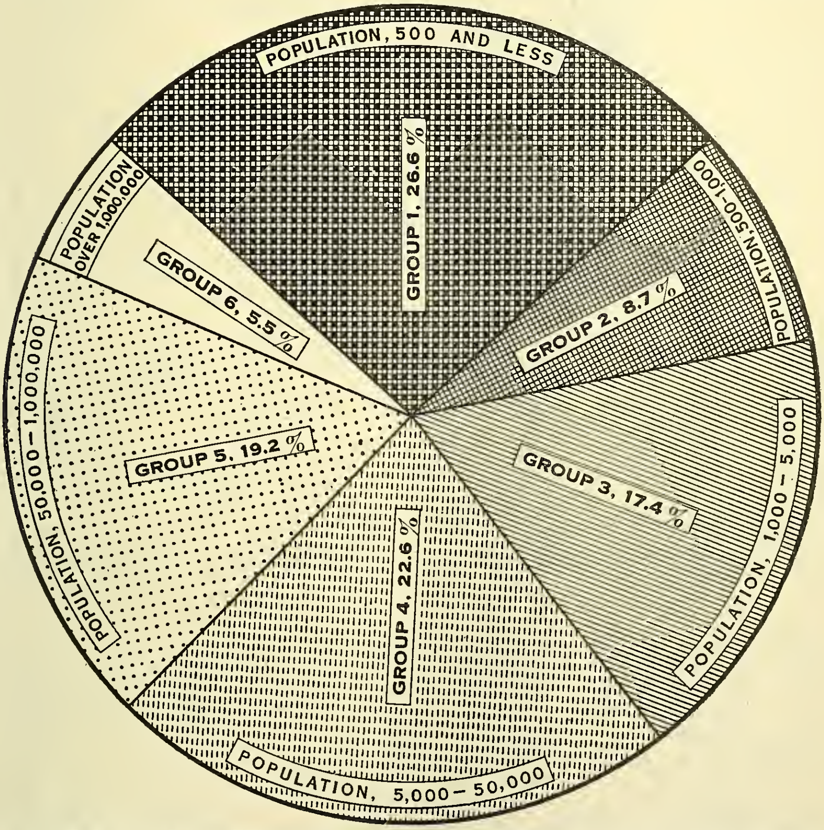


FIG. 11.—Chart showing sizes of migration centers for Belleville migrants. The proportion of migrants choosing each size of migration center is here shown. The Belleville migrant has located in all types of communities from the sparsely settled prairie or mining section to the most densely populated metropolis.

too young to select residences, 99 who are still students living at home, and 991 whose places of residence are unknown.

Of the 2,445 students who could be traced, 17 settled outside the United States, 430 settled in the United States outside of the State in which the community is located, 375 in the State but outside the county in which the community is located, 500 in the county, but outside of the larger Belleville community, and 1,123 in the larger Belleville community. (See figs. 1 and 9.)

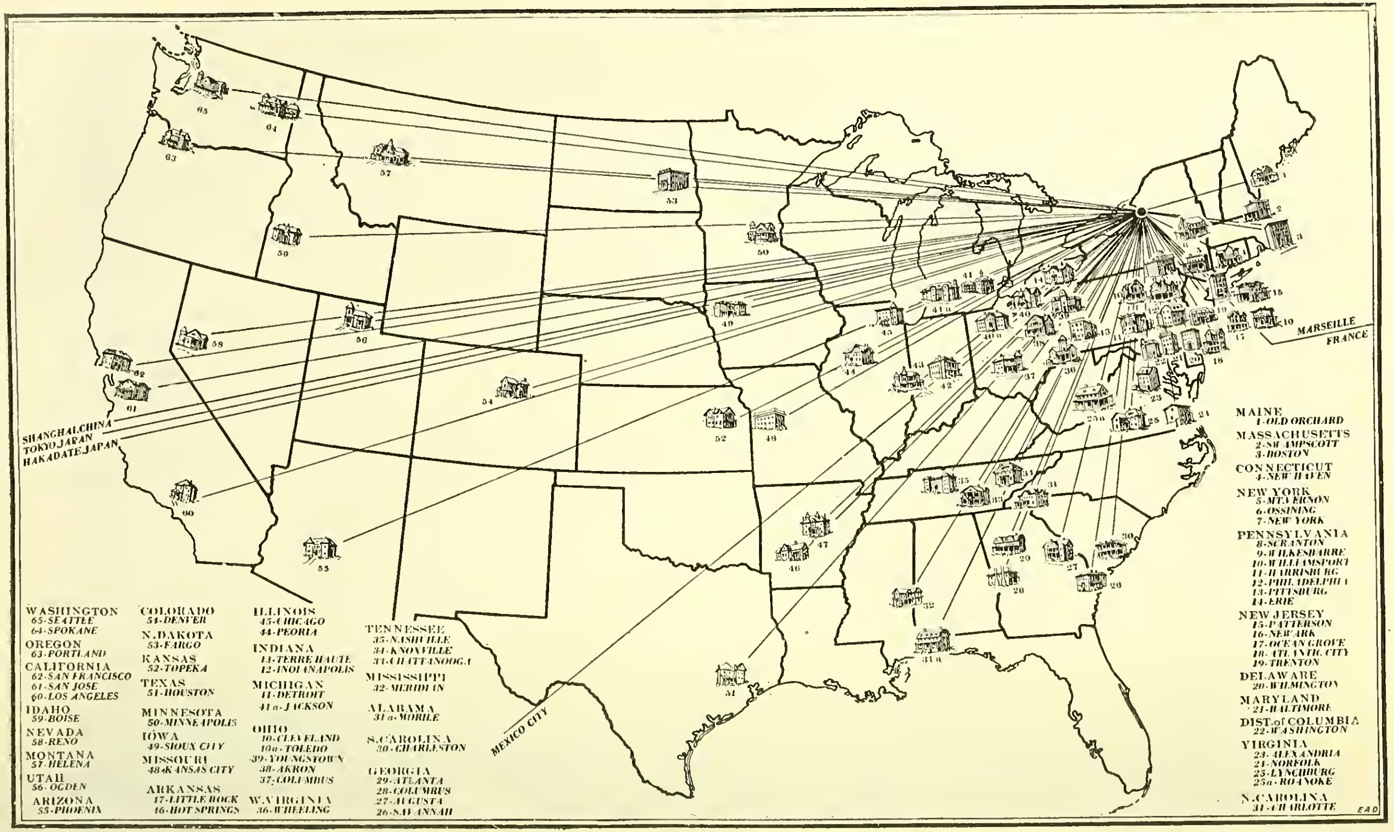


FIG. 12.—Map showing influence of Charles N. Crittenton (farm No. 701). He became a leading wholesale druggist in New York City, and in the latter part of his life gave his energies, time, and resources to establishing the rescue missions for girls, called the Florence Crittenton Missions.

The destinations of the 500 students who settled in the county outside the larger Belleville community were arranged according to townships. It was found that there were representatives from the Belleville community in each of the 22 townships of Jefferson County, as is shown in Table I. The two most popular points of migration in the county were found to be Adams, the nearest town, and Watertown, the county seat and largest city in the county.

FIG. 13.—Showing influence of Charles Finney. The Reverend Charles Finney, the evangelist and educator, lived in the larger Belleville community on farm No. 618. This map indicates the localities directly influenced by his activities.

TABLE I.—*Migration of the young people of the Belleville community into Jefferson County by townships. (1824–1920.) This table gives the migration centers of the county in which Belleville is situated, with the number of migrants going to each village or residential center.*

[None of the centers within the larger Belleville community are included in this table. The larger Belleville community in itself comprises all of Henderson Township and parts of Adams and Ellisburg Townships. (See Tables XII and XIII for distribution of those remaining in the Belleville community.)]

Adams Town:	
Adams	72
Adams Center	27
Green's Settlement	2
Honeyville	1
North Adams	2
Total	104
Alexandria Town:	
Alexandria Bay	7
Plessis	1
Redwood	1
Alexandria Town—Continued.	
St. Lawrence	1
Thousand Island park	1
Total	11
Antwerp Town: Antwerp	1
Brownville Town:	
Brownville	2
Dexter	3
Limerick	1

Brownville Town—Continued.	
Perch River	1
Pillar Point	3
Total	10
Cape Vincent Town:	
Cape Vincent	11
French Settlement	1
Total	12
Champion Town: Champion	1
Clayton Town:	
Clayton	11
Depauville	7
Total	18
Ellisburg Town:	
Ellisburg	30
Mannsville	14
Total	44
Hounsfield Town:	
Chestnut Ridge	3
East Hounsfield	2
Field Settlement	1
Hounsfield	14
Jewettville	1
Sacketts Harbor	29
Stowell's Corners	1
Total	51
Leray Town:	
Evans Mills	1
Leraysville	2
Total	3
Lorraine Town:	
Allendale	2
Lorraine	27
Total	29
Lyme Town:	
Chaumont	3
Point Peninsula	2
Three Mile Bay	8
Total	13
Orleans Town:	
Lafargeville	3
Stone Mills	1
Total	4
Pamelia Town: Pamelia	2
Philadelphia Town:	
Philadelphia	1
Sterlingville	1
Total	2
Rodman Town:	
Algona	1
East Rodman	2
Klondike	1
Rodman	27
Tremaine	1
Total	32
Rutland Town:	
Black River	3
Rutland	2
Total	5
Theresa Town: Theresa	7
Watertown Town: Watertown	132
Wilna Town: Carthage	10
Worth Town: Worth	9

When the destinations of those who settled in New York State outside of Jefferson County, in which Belleville is located, were arranged according to counties, it was found that 42 out of the 62 counties in New York State had migrants from the Belleville community located within their borders, as shown in Table II. Favorite points of location within the State were Sandy Creek, the nearest town outside the county, and Syracuse, the nearest large city outside the county. Rochester, Utica, and Buffalo have the next largest percentage of migrants from Belleville, and it is known that Belleville colonies exist in these cities.

TABLE II.—*Migration of the young people of Belleville community into New York State by counties. This table gives the migration centers of the State in which Belleville is situated, with the number of migrants going to each center. (1824–1920.)*

Albany	6
Allegany:	
Belmont	1
Edwards	1
Total	2
Broome: Kattleville	2
Cattaragus: Allegany	2
Cayuga:	
Auburn	2
Meridian	1
Sennet	1
Total	4
Chautauqua: Jamestown	1
Chenango: German Flats	1
Clinton: Dannemora	1
Cortland: Marathon	1
Delaware:	
Delhi	1
Stamford	1
Total	2
Dutchess: Pawling	1
Erie:	
Akron	2
Buffalo	14
Total	16
Essex: Keesville	2
Genesee: Stafford	1
Greene: Coxsackie	2
Herkimer:	
Coldbrook	1
Frankfort	1
Herkimer	4
Ilion	1
Middleville	2
West Winfield	1
Total	10
Kings: Brooklyn	26
Lewis:	
Copenhagen	1
Constableville	3
Denmark	1
Leyden Station	1
Lewis—Continued.	
Lowville	3
Osceola	1
Total	10
Madison:	
Canastota	2
Erie	1
Hamilton	2
Total	5
Monroe:	
Charlotte	4
Rochester	34
Total	38
Montgomery: St. Johnsville	1
Nassau: Merrick	1
New York: New York	3
Oneida:	
Camden	4
Hinckley	2
Lee Center	1
Rome	8
Stanwix	1
Utica	15
Vernon	1
Total	32
Onondaga:	
Brewerton	2
Cigarville	1
Clay	1
Skaneateles	3
Solvay	1
Syracuse	55
Total	63
Ontario:	
Geneva	6
Orleans	5
Total	11
Orleans:	
Albion	1
Medina	1
Total	2

Oswego:	
Hastings	1
Lacona	4
New Haven	1
Orwell	4
Parish	2
Pulaski	12
Redfield	1
Richland	5
Sandy Creek	35
Volney	1
Total	66
Otsego:	
Cooperstown	1
Plainfield	1
Total	2
Rensselaer:	
Berlin	1
North Nassau	1
Valley Falls	1
Total	3
Rockland:	
Nyack	2
Sloatsburg	1
Total	3
St. Lawrence:	
Canton	2
De Kalb	2
Gouverneur	3
Hammond	1
Ogdensburg	4
Potsdam	3
Total	15
Schenectady:	
Schenectady	6
Scotia	1
Total	7
Seneca:	
Fayette	1
Waterloo	1
Total	2
Steuben:	
Bath	1
Keuka	1
Wheeler	1
Total	3
Tioga: Oswego	7
Tompkins: Ithaca	1
Ulster: New Paltz	1
Warren: Glens Falls	4
Washington: Easton	2
Wayne:	
Lyons	2
Macedon	1
Ontario	2
Red Creek	2
Total	7
Westchester:	
Dobbs Ferry	1
White Plains	1
Yonkers	4
Total	6

The destinations of those who settled outside of New York, the State in which Belleville is located, were arranged according to States. It was found that people from Belleville had located in 32 of the 48 States, as will be seen in Table III. (See fig. 1.) It will be noted that Michigan and Illinois lead in the number of migrants from Belleville.

TABLE III.—*Migration of the young people of Belleville community to the United States. This table gives the migration centers of the United States by States, with the number of migrants going to each center. (1824–1920.)*

Arizona: Globe	1
California:	
Long Beach	2
Los Angeles	7
Oakland	1
Riverside	1
San Francisco	3
General	18
Total	32
Colorado:	
Boulder	1
Colorado Springs	2
Denver	3
Greeley	6
Trinidad	1
General	5
Total	18
Connecticut:	
Huntingdon	1
Meriden	1
New Haven	1
Stafford Springs	1
Total	4
Dist. Columbia: Washington	13
Florida:	
Daytona	1
Jacksonville	2
Miami	8
Orlando	2
St. Augustine	1
General	5
Total	19
Georgia: Marietta	1
Idaho: Iron Springs	1
Illinois:	
Bald Mound	1
Camp Point	1
Chicago	32
Evanston	1
Jacksonville	1
Morrison	1
Sterling	1
General	5
Total	43
Iowa:	
Belmont	1
Blairstown	1
Burlington	2
Clinton	1
Dows	1
Farmington	2
Forest City	1
Iowa City	4
Sioux City	4
General	6
Total	23
Kansas:	
Edna	2
Leavenworth	9
Wichita	1
General	3
Total	15
Massachusetts:	
Amherst	1
Arlington	1
Boston	3
Jamaica Plains	1
Lynn	2
New Bedford	2
Provincetown	2
Salem	2
General	3
Total	17
Michigan:	
Allegan	1
Bay City	1
Bellevue	2
Big Bay	2
Detroit	7
Flint	1
Grand Rapids	6
Holland	1
Ionia	1
Kalamazoo	2
Mill Brook	1
Muskegon	1
Parma	1
Scottsville	1
General	15
Total	43

Minnesota:	
Blue Earth	2
Hammond	1
Minneapolis	4
Ortonville	1
St. Charles	1
St. Paul	1
Winnebago City	1
General	2
Total	13
Missouri:	
Brookfield	6
Franklin	1
Kansas City	1
Montgomery City	1
Pierce City	1
St. Joseph	1
St. Louis	6
Union	2
General	4
Total	23
Montana:	
Geyser	5
Highwood	1
Thompson Falls	1
General	2
Total	9
Nebraska:	
Greenwood	1
Lincoln	1
Omaha	1
Prosser	1
Tamora	2
General	2
Total	8
New Jersey:	
East Orange	2
Newark	2
Westwood	1
Woodbridge	2
General	1
Total	8
North Carolina: Kinston	1
North Dakota:	
Hanks	2
General	5
Total	7
Ohio:	
Auburn	1
Chagrin Falls	1
Cincinnati	2
Cleveland	2
Dayton	2
Monroeville	1
Mount Washington	1
Seville	1
Toledo	3
General	2
Total	16
Oklahoma:	
Apache	1
General	1
Total	2
Pennsylvania:	
Easton	1
New Wilmington	1
Pennsburgh	3
Philadelphia	2
Pittsburg	2
Warren	1
General	3
Total	13
Rhode Island: Providence	5
South Carolina: Charleston	1
South Dakota:	
Doland	5
Huron	1
Laurel	1
Wessington	2
General	1
Total	10
Tennessee:	
Cumberland Gap	1
Knoxville	1
Nashville	1
Sewanee	1
Total	4
Vermont:	
Danby	1
Middlebury	1
Rutland	2
General	2
Total	6

Virginia:	
Norfolk	1
General	1
Total	2
Washington:	
Everett	1
Olympia	1
Seattle	5
Wenatchee	1
Total	8
West Virginia:	
Buckhannon	1
Morgantown	2
Total	3
Wisconsin:	
Downing	1
Eau Claire	1
Fort Howard	1
Wisconsin—Continued.	
Fulton	1
Madison	1
Marshfield	1
Oshkosh	1
Sheboygan	1
Waukesha	2
General	1
Total	11
Wyoming:	
Lander	1
Rawhide	1
Total	2
Alaska:	
Iditarod	1
General	2
Total	3
Panama, Canal Zone: Panama	7
The West	38

In order to determine whether the migration from the Belleville community has been of a steady character or whether there have been special eras in which migration has been particularly great, the migration was arranged by 10-year periods from 1830 to 1920, as is shown in Table IV. The high peak of migration seems to have been during the Civil War period, and immediately after, from 1860 to 1870, at the time when the West was being opened up.

TABLE IV.—*Migration by decades. The migration of men and women of the Belleville community to the county, State, and Nation is given by 10-year periods, from 1830 to 1920.*

Period.	Community.		County.		New York.		United States.		Foreign.		Total.
	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	
1830–1840	48	12	50	2	11	1	15	4	......	....	143
1840–1850	27	13	15	....	8	2	14	5	......	....	84
1850–1860	79	43	35	11	20	15	32	23	1	2	261
1860–1870	107	76	89	32	27	19	62	40	2	1	455
1870–1880	91	81	44	29	26	33	44	49	1	....	398
1880–1890	50	51	31	29	30	22	38	19	1	1	272
1890–1900	79	75	30	31	31	39	23	18	3	2	331
1900–1910	51	35	27	19	34	23	17	15	......	....	221
1910–1920	109	96	16	10	20	14	5	7	......	3	280
Total	641	482	337	163	207	168	250	180	8	9	2,445

MIGRATIONS OF SINGLE FAMILIES.

To determine how closely the migration of a single farm family follows the paths of community migration, a study was made of the migration of the descendants of Edward Barney, who settled on farm No. 67, in 1804. (See Table V.)

TABLE V.—*Residences selected by migratory descendants of Edward Barney.*

California: Los Angeles.
Colorado: Colorado Springs.
Florida: Miami.
Illinois: Chicago.
Iowa: Des Moines, Farmington, Sioux City.
Michigan: Detroit.
Minnesota: Duluth, Minneapolis.
Missouri: Pierce City.
New York: Hamilton, Lowville, New York City, Syracuse.
Ohio: Cincinnati, Cleveland, Dayton, Granville, Seville.
Pennsylvania: Philadelphia.
South Dakota: DeSmet, Huron.
Wisconsin: Milwaukee.

The composite character of even a single farm family is evident when it is known that the descendants of Edward Barney married into the following strong farm families of the Belleville community: Gore, Scott, Kibling, Goodenough, Wood, Schuyler, Eveleigh, Coburn, Kinney, Bishop, Cook, Freeman, Hawley, Salisbury, Clark, Reed, Littlefield, Phillips, Martin, Taylor, Hungerford, Brodie, Williams, Boomer, Stanley, Robbins, Muzzey, Warriner, and another Barney family. It is plainly not to be wondered at that the descendants of a single farm family, in their movements, illustrate the trend of the community.

The Barney descendants of whom records are here given were born and reared in the community, and, almost without exception, were educated at Union Academy. The majority of migrants of this family left Belleville in their late teens or early twenties.

All through the history of Union Academy there has been a constant temporary migration of the Belleville young people as teachers to educational centers. The following list of educational centers influenced by the teaching of one generation of the Butler family, including eight sisters and one brother, who attended the Union Academy, can serve as an illustration of this kind of migratory influence.

1. Belleville, N. Y.
2. Mather's Mills, N. Y.
3. Bunnell District, N. Y. (Two members of family taught here.)
4. Chestnut Ridge, N. Y.
5. Rural Hill, N. Y.
6. Sacketts Harbor, N. Y. (Three members of family taught here.)
7. Brownville, N. Y.
8. Oswego, N. Y.
9. Wolcott, N. Y.
10. Rome, N. Y.
11. Fort Plain, N. Y.
12. Alder Creek, N. Y. (Two members taught here.)
13. Wells Island, N. Y. (Two members taught here.)
14. Keesville, N. Y. (Two members taught here.)
15. Corinth, N. Y.
16. Huntington, Long Island, N. Y.
17. Yonkers, N. Y.
18. Mount Vernon, N. Y.
19. New York City, N. Y.
20. Niagara Falls, N. Y.
21. Yenna, Md.
22. Paterson, N. J.
23. Gorham, N. H.
24. Maine.

MIGRATION CENTERS CLASSIFIED.

It was found that 438 villages, towns, and cities were selected as residences of the 2,445 people migrating from the Belleville community. Out of these 438 communities, 10 were in foreign countries and 127 were known only by approximate location in State or section and not by name. There remained 301 migration centers in the United States which could be accurately classified as to population in order to determine the general types of communities to which the Belleville people migrated. The county, State, and United States migratory centers are, in Tables VI, VII, and VIII, grouped in six main population groups. Table IX gives a summary of county, State, and United States migration center population groups. (See fig. 11.)

TABLE VI.—*Migration of Belleville young people to population groups in Jefferson county outside the larger Belleville community. The migration centers of the county are arranged in population groups, with the number of migrants going to each center and to each group in the county. (1824–1920.)*

GROUP I. (Population, 500 and less.)	
Adams Center	27
Algona	1
Allendale	2
Brownville	2
Champion	1
Chestnut Ridge	3
Depauville	7
East Hounsfield	2
East Rodman	2
Ellisburg	30
Fields Settlement	1
French Settlement	1
Green's Settlement	2
Honeyville	1
Hounsfield	14
Jewettville	1
Klondike	1
Leraysville	2
Limerick	1
Lorraine	27
North Adams	2
Pamelia	2
Perch River	1
Pillar Point	3
Plessis	1
Point Peninsula	2
Rodman	27
Rutland	2
Sacketts Harbor	29
Sterlingville	1
Stone Mills	1
Stowell's Corners	1
St. Lawrence	1
GROUP I—Continued.	
Thousand Island Park	1
Three Mile Bay	8
Tremaines	1
Worth	9
37 communities; students	220
GROUP II. (Population 500 to 1,000.)	
Antwerp	1
Black River	3
Chaumont	3
Evans Mills	1
Lafargeville	3
Mannsville	14
Philadelphia	1
Redwood	1
Theresa	7
9 communities; students	34
GROUP III. (Population 1,000 to 5,000.)	
Adams	72
Alexandria Bay	7
Carthage	10
Cape Vincent	11
Clayton	11
Dexter	3
6 communities; students	114
GROUP IV. (Population 5,000 to 50,000.)	
Watertown	132
Total for Jefferson County:	
Communities	53
Students	500

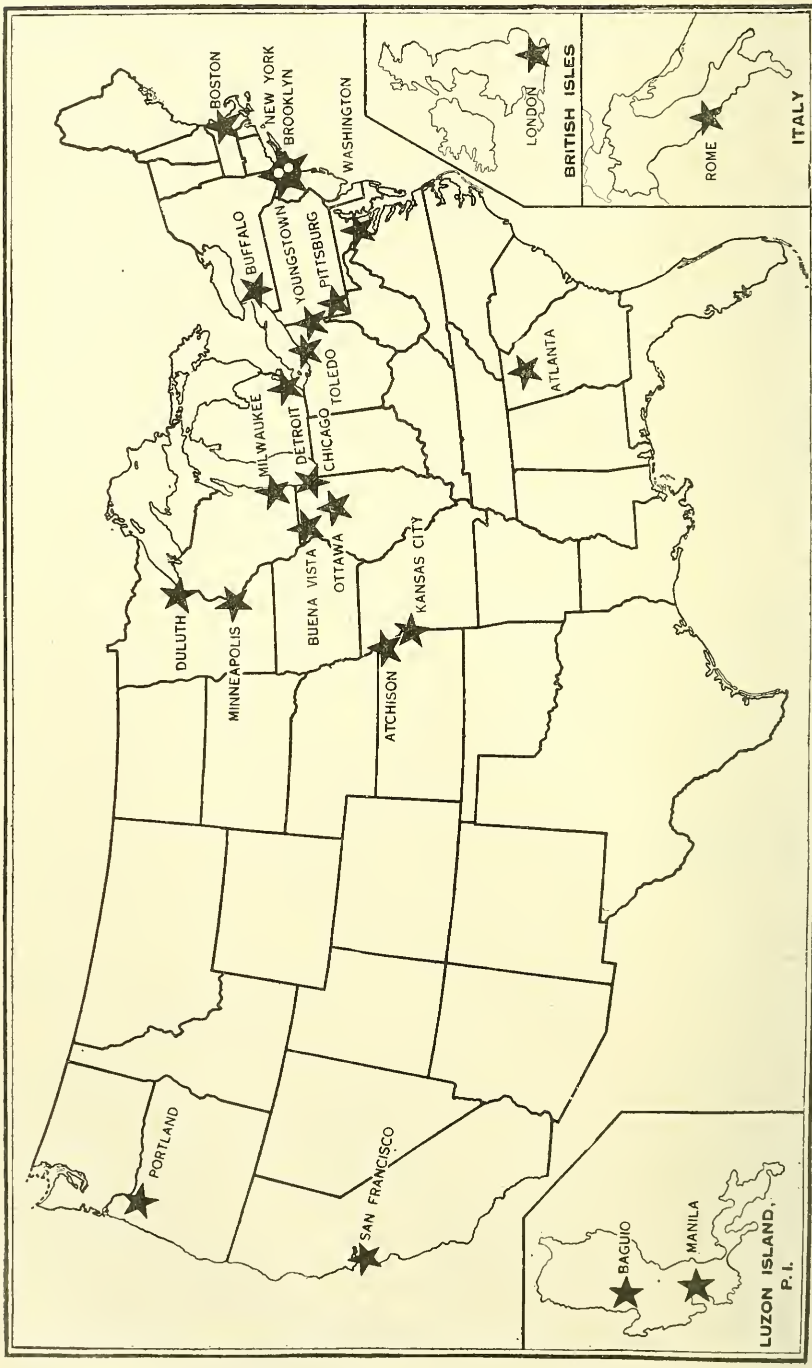


FIG. 14.—Map showing national influence of Daniel Burnham, architect. Stars indicate cities having one or more buildings designed by Daniel Burnham; several of these cities were largely replanned by him.

TABLE VII.—*Migration of Belleville young people to population groups in New York State, outside Jefferson County. The migration centers of the State are arranged in population groups, with the number of migrants going to each center and to each group in the State. (1824–1920.)*

Group I. (Population 500 and less.)	
Brewerton	2
Clay	1
Cigarville	1
Constableville	3
Cold Brook	1
De Kalb	2
Denmark	1
Easton	2
Edwards	1
Erie	1
Fayette	1
German Flats	1
Hammond	1
Hastings	1
Kattleville	2
Keuka	1
Lacona	4
Lee Center	1
Leyden Station	1
Meridian	1
Merrick	1
New Haven	1
North Nassau	1
Orleans	5
Orwell	4
Osceola	1
Parish	2
Plainfield	1
Red Creek	2
Redfield	1
Richland	5
Sennet	1
Stafford	1
Stanwix	1
Vernon	1
Volney	1
Wheeler	1
37 communities; students	59

Group II. (Population 500 to 1,000.)	
Berlin	1
Copenhagen	1
Hinckley	2
Macedon	1
Middleville	2
Ontario	2
Pawling	1
Sandy Creek	35
Sloatsburg	1
Stamford	1
Valley Falls	1
West Winfield	1
12 communities; students	49

Group III. (Population 1,000 to 5,000.)	
Akron	2
Allegany	2
Bath	1
Belmont	1
Camden	4
Canastota	2
Canton	2
Charlotte	4
Cooperstown	1
Coxsackie	2
Dannemora	1
Delhi	1
Dobbs Ferry	1
Frankfort	1
Gouverneur	3
Hamilton	2
Keesville	2
Lowville	3
Lyons	2
Marathon	1
New Paltz	1
Nyack	2
Potsdam	3
Pulaski	12
Scotia	1
Skaneateles	3
St. Johnsville	1
Waterloo	1
28 communities; students	62

Group IV. (Population 5,000 to 50,000.)	
Albion	1
Auburn	2
Geneva	6
Glens Falls	4
Herkimer	4
Ilion	1

GROUP IV—Continued.

Ithaca	1
Jamestown	1
Medina	1
Ogdensburg	4
Oswego	7
Rome	8
Solvay	1
White Plains	1
14 communities; students	42

GROUP V.

(Population 50,000 to 1,000,000.)

Albany	6
Buffalo	14
Rochester	34

GROUP V—Continued.

Schenectady	6
Syracuse	55
Utica	15
Yonkers	4
7 communities; students	134

GROUP VI.

(Population over 1,000,000.)

Brooklyn	26
New York	3
2 communities; students	29

Total for New York State:	
Communities	100
Students	375

TABLE VIII.—*Migration of Belleville young people to population groups in the United States, outside New York State. The migration centers of the United States are arranged in population groups, with the number of migrants going to each center and to each group in the United States. (1824–1920.)*

GROUP I.

(Population 500 and less.)

Auburn, Ohio	1
Bald Mound, Ill	1
Big Bay, Mich	2
Cumberland Gap, Tenn	1
Downing, Wis	1
Edna, Kan	2
Forest City, Iowa	1
Fort Howard, Wis	1
Franklin, Mo	1
Fulton, Wis	1
Geyser, Mont	5
Greenwood, Nebr	1
Hammond, Minn	1
Hanks, N. Dak	2
Highwood, Mont	1
Huntington, Conn	1
Iditarod, Alaska	1
Iron Springs, Idaho	1
Jamaica Plains, Mass	1
Laurel, S. Dak	1
Millbrook, Mich	1
Pierce City, Mo	1
Prosser, Nebr	1
Rawhide, Wyo	1
Sewanee, Tenn	1
Tamora, Nebr	2
Thompson Falls, Mont	1
27 communities; students	35

GROUP II.

(Population 500 to 1,000.)

Apache, Okla	1
Bellevue, Mich	2
Blairstown, Iowa	1
Danby, Vt	1
Doland, S. Dak	5
Dows, Iowa	1
Mount Washington, Ohio	1
New Wilmington, Pa	1
Parma, Mich	1
Scottville, Mich	1
Seville, Ohio	1
Union, Mo	2
Wessington, S. D	2
13 communities; students	20

GROUP III.

(Population 1,000 to 5,000.)

Allegan, Mich	1
Belmond, Iowa	1
Blue Earth, Minn	2
Buckhannon, W. Va	1
Camp Point, Ill	1
Chagrin Falls, Ohio	1
Daytona, Fla	1
Farmington, Iowa	2
Lander, Wyo	1
Middlebury, Vt	1
Monroeville, Ohio	1

Group III—Continued.

Montgomery City, Mo	1
Morrison, Ill	1
Orlando, Fla	2
Ortonville, Minn	1
Pennsburg, Pa	3
Provincetown, Mass	2
St. Charles, Minn	1
Stafford Springs, Conn	1
Wenatchee, Wash	1
Westwood, N. J	1
Winnebago City, Minn	1
Woodridge, N. J	2
23 communities; students	30

Group IV.

(Population 5,000 to 50,000.)

Amherst, Mass	1
Arlington, Mass	1
Bay City, Mich	1
Boulder, Colo	1
Brookfield, Mo	6
Burlington, Iowa	2
Clinton, Iowa	1
Colorado Springs, Colo	2
Easton, Pa	1
East Orange, N. J	2
Eau Claire, Wis	1
Evanston, Ill	1
Everett, Wash	1
Flint, Mich	1
Globe, Ariz	1
Greeley, Colo	6
Holland, Mich	1
Huron, S. Dak	1
Ionia, Mich	1
Iowa City, Iowa	4
Jacksonville, Ill	1
Kalamazoo, Mich	2
Kansas City, Mo	1
Kinston, N. C	1
Knoxville, Tenn	1
Leavenworth, Kan	9
Lincoln, Neb	1
Long Beach, Calif	2
Madison, Wis	1
Marietta, Ga	1
Marshfield, Wis	1
Meriden, Conn	1
Miami, Fla	8
Morgantown, W. Va	2
Muskegon, Mich	1
Norfolk, Va	1

Group IV—Continued.

Olympia, Wash	1
Oshkosh, Wis	1
Panama C. Z	7
Riverside, Calif	1
Rutland, Vt	2
Salem, Mass	2
Sheboygan, Wis	1
St. Augustine, Fla	1
Sterling, Ill	1
Trinidad, Colo	1
Warren, Pa	1
Waukesha, Wis	2
48 communities; students	91

Group V.

(Population 50,000 to 1,000,000.)

Boston, Mass	3
Charleston, S. C	1
Cincinnati, Ohio	2
Cleveland, Ohio	2
Dayton, Ohio	2
Denver, Colo	3
Detroit, Mich	7
Grand Rapids, Mich	6
Jacksonville, Fla	2
Los Angeles, Calif	7
Lynn, Mass	2
Minneapolis, Minn	4
Nashville, Tenn	1
Newark, N. J	2
New Bedford, Mass	2
New Haven, Conn	1
Oakland, Calif	1
Omaha, Nebr	1
Pittsburgh, Pa	2
Providence, R. I	5
San Francisco, Calif	3
Seattle, Wash	5
Sioux City, Iowa	4
St. Joseph, Mo	1
St. Louis, Mo	6
St. Paul, Minn	1
Toledo, Ohio	3
Washington, D. C	13
Wichita, Kans	1
29 communities; students	93

Group VI.

(Population over 1,000,000.)

Chicago, Ill	32
Philadelphia, Pa	2
2 communities; students	34

TABLE VIII.—*Migration of Belleville young people to population groups in the United States, outside New York State. The migration centers of the United States are arranged in population groups, with the number of migrants going to each center and to each group in the United States (1824–1920)*—Continued.

	Total for United States.	
	Communities.	Students.
Total for cities	142	303
"Went West" (precise destination unknown)	38	38
To States (precise destination unknown)	89	89
Total for United States	269	430

TABLE IX.—*Table of migration to population groups. Village and city migration centers of county, State, and Nation are summarized here in population groups, with the number of students going to each population group in county, State, or Nation, and percentages of students and of migration centers in each group. (1824–1920.) (See fig. 11.)*

	Group I. Villages of 500 or less.		Group II. Villages of 500 to 1,000.		Group III. Cities of 1,000 to 5,000.		Group IV. Cities of 5,000 to 50,000.	
	Communities.	Students.	Communities.	Students.	Communities.	Students.	Communities.	Students.
Jefferson County (outside community)	37	220	9	34	6	114	1	132
Per cent		*44.0*		*6.8*		*22.8*		*26.4*
New York State (outside Jefferson County)	37	59	12	49	28	62	14	42
Per cent		*15.7*		*13.1*		*16.5*		*11.2*
United States (outside New York State)	27	35	13	20	23	30	48	91
Per cent		*11.5*		*6.6*		*9.9*		*29.9*
Foreign	1	1					2	3
Per cent		*14.3*						*42.9*
Total (destination known)	102	315	34	103	57	206	65	268
Per cent	*34*	*26.6*	*11*	*8.7*	*19*	*17.4*	*21.7*	*22.6*

	Group V. Cities of 50,000 to 100,000		Group VI. Cities over 1,000,000.		Total.	
	Communities.	Students.	Communities.	Students.	Communities.	Students.
Jefferson County (outside community)					53	500
Per cent						*100*
New York State (outside Jefferson County)	7	134	2	29	100	375
Per cent		*35.7*		*7.8*		*100*
United States (outside New York State)	29	93	2	34	142	303
Per cent		*30.9*		*11.2*		*100*
Foreign	1	1	2	2	6	7
Per cent		*14.3*		*28.5*		*100*
Total (destination known)	37	228	6	65	301	1,185
Per cent	*12.3*	*19.2*	*2*	*5.5*	*100*	*100*
Belleville community in United States						1,123
Population unknown					127	127
Foreign, population unknown					10	10
Total number choosing residence					438	2,445
Unknown						1,159
Total number of students						3,604

OCCUPATIONS OF MIGRANTS AND OF STAY-AT-HOMES.

In order to answer, for this particular community, the question "What occupations do farm migrants enter?" a record was made of all the occupations entered by the Union Academy students. Of the 2,445 students whose final residence is known, it was possible to discover the occupations of 2,079.

Table X shows the distribution of students from the academy among the chief occupation groups. Those who chose farming, for the most part remained in the home community, and usually upon the home farm or upon a farm in close proximity to it. The table, then, becomes an interpretation of the occupations of migrants, by making allowance for the farming quota as "stay-at-homes."

For comparative purposes, the 3,604 students of the academy are classified as coming from farm and nonfarm homes in column A of the table. In column B, which gives the occupations of both men and women students, the married women, except in the case of self-supporting widows, are classified under the occupations in which their husbands were engaged. In column D, the married women are classified as home makers.

TABLE X.—*Occupations chosen by students of Union Academy (1824–1920).*

Occupations.	A Occupations of fathers of students.		B Occupations of male and female students.		C Occupations of male students.		D Occupations of female students.		E Occupations of married women's husbands.		F Occupations of unmarried women.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Farming	3,043	84.43	948	45.60	646	52.65	......	......	307	44.30	......	......
Public service			451	21.69	228	18.56	14	1.65	214	30.89	14	9.09
Professions	561	15.57	348	16.74	8	15.24	82	9.68	79	11.39	82	53.24
Commerce			194	9.33	122	9.94	9	1.06	68	9.81	9	5.84
Manufacturing			76	3.66	44	3.59	7	.83	25	3.61	7	4.56
Home making	......	......	62	2.98	......	......	735	86.78	......	......	42	27.27
Total	3,604	100	2,079	100	1,227	100	847	100	693	100	154	100

For a closer view of this occupational phase of the study, the occupations followed by the descendants of one farmer were tabulated. (See Table XI.) Farming is found to rank high among the members of this family, though none of the other groups of occupations are unrepresented.

TABLE XI.—*Occupations selected by descendants of Edward Barney, farmer.*

Occupations.	Generations.					
	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.
Farming	6	13	13	7	5	1
Public service	......	......	......	10	4	......
Professions	......	6	10	10	3	......
Commerce	......	......	11	11	5	......
Manufacturing	......	2	3	2	......	......

ACHIEVEMENTS OF MIGRANTS FROM THE COMMUNITY.

"Can certain farms be said to be the seed beds of achievers in national life?" With a view to answering this question in regard to the farms of the Belleville community, as complete a history as possible of each farm in the community was compiled and a list of the occupants of each of the 928 farms was made. The occupants were then classified

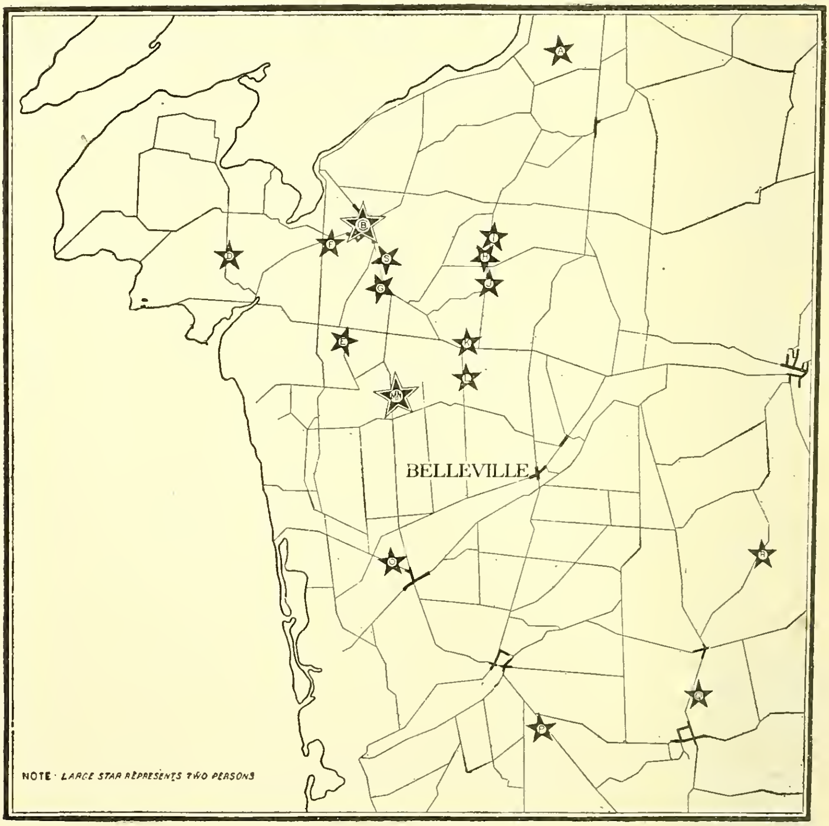


FIG. 15.—Map of community, showing farms where prominent Belleville people were reared. Almost any farm community of 50 years' duration in the United States, provided it has had as its center some institution of culture, will be able to show, upon examination, its quota of statesmen, philanthropists, artists, educators, and manufacturers, similar to those shown in this illustrative map of the Belleville community.

as "migrants" and "stay-at-homes." Several migrants were discovered to have made achievements of national significance, notable among whom are C. N. Crittenton, Daniel H. Burnham, and Charles Finney.

A GREAT PHILANTHROPIST.

C. N. Crittenton lived, until a young man, in the larger Belleville community on farm No. 701. (See Pl. V, fig. 1.) He then migrated to New York City and there became a leading wholesale druggist.

In the latter part of his life Mr. Crittenton gave his energies, time, and resources to establishing the rescue missions for girls, called, after his daughter, the Florence Crittenton Missions. (See fig. 12.)

At his death, in 1909, Mr. Crittenton left half of his fortune to the Crittenton Missions, so that it has been possible for the work to go on, until at the present time this unselfish ministry has reached

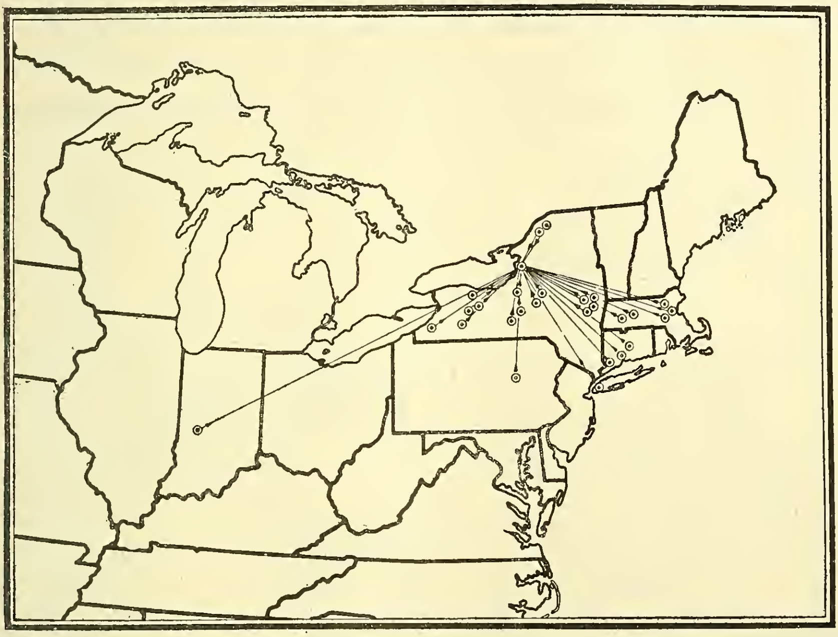


FIG. 16.—Map showing location of colleges and universities which have been represented in the community through the teaching staff of the academy. Over one of the portals of the Washington Union Station, planned by Daniel Burnham, is engraved this aphorism: "He that would bring home the wealth of the Indies must carry the wealth of the Indies with him. So it is in traveling—a man must carry knowledge with him if he would bring home knowledge." The people of Belleville community have been wise in giving their children the best that gifted men and women from the great culture centers of the East can supply.

every section of the United States as well as France, Mexico, China, and Japan.

A GREAT DIVINE.

The Rev. Charles Finney, the evangelist, lived in the larger Belleville community on farm No. 618. (See Pl. V, fig. 2.) Finney was converted as a young man in a revival held by Jedediah Burchard, who was long Belleville's local country preacher. After conversion, Finney became one of the foremost evangelists of his day. His sermons are said to have inspired the founding of the Salvation Army. He was for 40 years connected with Oberlin College, Ohio, and, as its president, did much toward building it up into a strong institution.

A GREAT ARCHITECT.

Daniel H. Burnham, the famous architect who planned the grounds and buildings of the World's Exposition at Chicago, 1892, came from Henderson Village, in the larger Belleville community. His father at one time lived on farm No. 104 and kept the store at Rural Hill. Burnham (see fig. 14) made the plans for lake front improvement and beautifying of the city of Chicago, was chairman of World's Congress of Architecture, 1893, president of American Institute of Architecture, 1894, and chairman of the National Commission of Fine Arts, established by President Roosevelt, and made plans for beautifying the city of Washington. He founded the American School of Architecture at Rome, Italy, and replanned the city of San Francisco after the earthquake and fire of 1905.

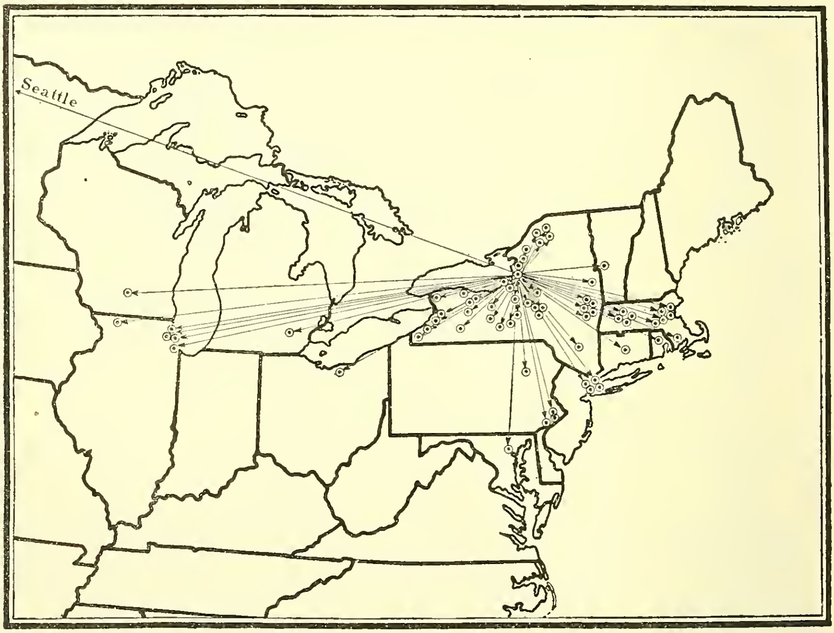


FIG. 17.—Map showing colleges and universities attended by Belleville young people. It is often said that college students learn not so much from their instructors as from one another. This map indicates that the Belleville community has done its share toward influencing American college life.

A PIONEER EDUCATOR.

Joshua Bradley, founder of Union Academy, was a type of country minister who, seeing the importance that high rural ideals have in national life, was able to crystallize and centralize the finest sentiments among the farmers of the Belleville community into an institution which should persist for a hundred years, throwing its influence for good into every township of the county, every county of the State, and finally into every State in the Nation. Norris Shepardson, farmer-poet of Belleville, wrote this tribute to his leadership:

When the wolf's howl had hardly died away,
What led our fathers in that early day,
To build a temple to a God unknown?
The power that gave to them the yearning mind,
When they were dead to leave some good behind,
Gave them a leader, with his name who led,
The chosen tribes o'er Jordan's naked bed,
That name I speak with reverence to-day,
Bradley, whose Christian name was Joshua.
As when a pebble in still water's thrown,
The widening circles evermore go on,
So has their influence spread in times before,
So will it spread till time shall be no more,
O, may we perish with the wealth we've earned
And from remembrance let our names be spurned,
If we degenerate through vile lust for gold,
God and our father's guerdon fail to hold.

Following is an outline of the life work of Joshua Bradley:

Born, Randolph, Mass., 1773.

Educated, Wrentham, Mass., Brown University, Providence, R. I.

Founded educational institutions at the following places: Wallingford, Conn., 1813; Belleville, N. Y., 1824; Granville, Ohio, 1830; Indianapolis, Ind., 1831; Brownsville, Pa., 1835; Harrison County, W. Va., 1837; Roanoke County, Va., 1843; Bucknell University, Lewisburg, Pa., 1845; Lansingburg, N. Y., 1849.

Had charge of schools as follows: Shurtleff College, Alton, Ill.; Ladies' Seminary, Edwardsville, Ill.; Middletown, Ohio; Indianapolis, Ind.; Brownsville, Pa.

Founded churches as follows: Windsor, Vt.; Albany, N. Y., and a number in the western part of the State.

OTHER NOTABLE PERSONS.

In addition to these four outstanding types, whose work has been described in some detail, there were found to be numerous other men and women in the Belleville community who have, in one way or another, contributed much to the national welfare. On the accompanying map (fig. 15) there are indicated, by letters, the sites of the homes of prominent migrants and residents, as follows:

A. Home of Dr. Samuel Guthrie, discoverer of chloroform. One mile north of farm No. 521.

B. Home of Hiram Barney, friend of Abraham Lincoln, collector of the port of New York, who assisted in writing the Emancipation Proclamation. Henderson Village.

C. Birthplace of Daniel Burnham, architect, village of Henderson. (See Pl. IV.)

D. Birthplace of Charles N. Crittenton, philanthropist. Farm No. 701. (See Pl. V, fig. 1.)

E. Birthplace and home of Willard Grant, who introduced manual training into the high schools of the United States. Farm No. 757.

F. Birthplace of Judge Orsemus Cole, for 30 years judge of supreme court, Madison, Wis. Farm No. 666.

G. Home of Charles Finney, evangelist and college president. Farm No. 618. (See Pl. V, fig. 2.)

FIG. 18.—Map showing farm and village homes sending students to normals, colleges, and universities in one year.

H. Birthplace of Gov. George Peck, editor (author "Peck's Bad Boy," etc.). Farm No. 555. (See Pl. VI, fig. 1.)

I. Birthplace of Cushman K. Davis, United States senator, and governor of Minnesota. Farm No. 556. (See Pl. VI, fig. 2.)

J. Birthplace and home of Charles Larkin, founder of manual training school, Brooklyn, N. Y. Farm No. 566.

K. Birthplace and home of Hiram Barney, noted educator, superintendent of schools, State of Ohio. Farm No. 176. (See Pl. VII.)

L. Birthplace of Maj. Barney, farmer, soldier, friend of "Stonewall" Jackson. Farm No. 87. (See Pl. VIII.)

M. Home of Norris Shepardson, farmer, poet, and community builder; originator of Academy Memorial. Farm No. 92. (See Pl. IX.)

FIG. 1.—BIRTHPLACE AND BOYHOOD HOME OF CHARLES N. CRITTENTON. FARM NO. 701.

FIG. 2.—HOME OF CHARLES FINNEY, NEAR ALEXANDER'S CORNERS. FARM NO. 618.

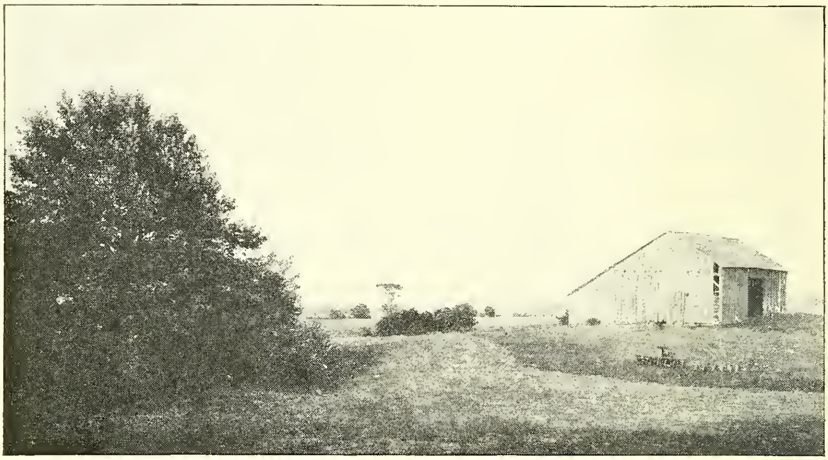
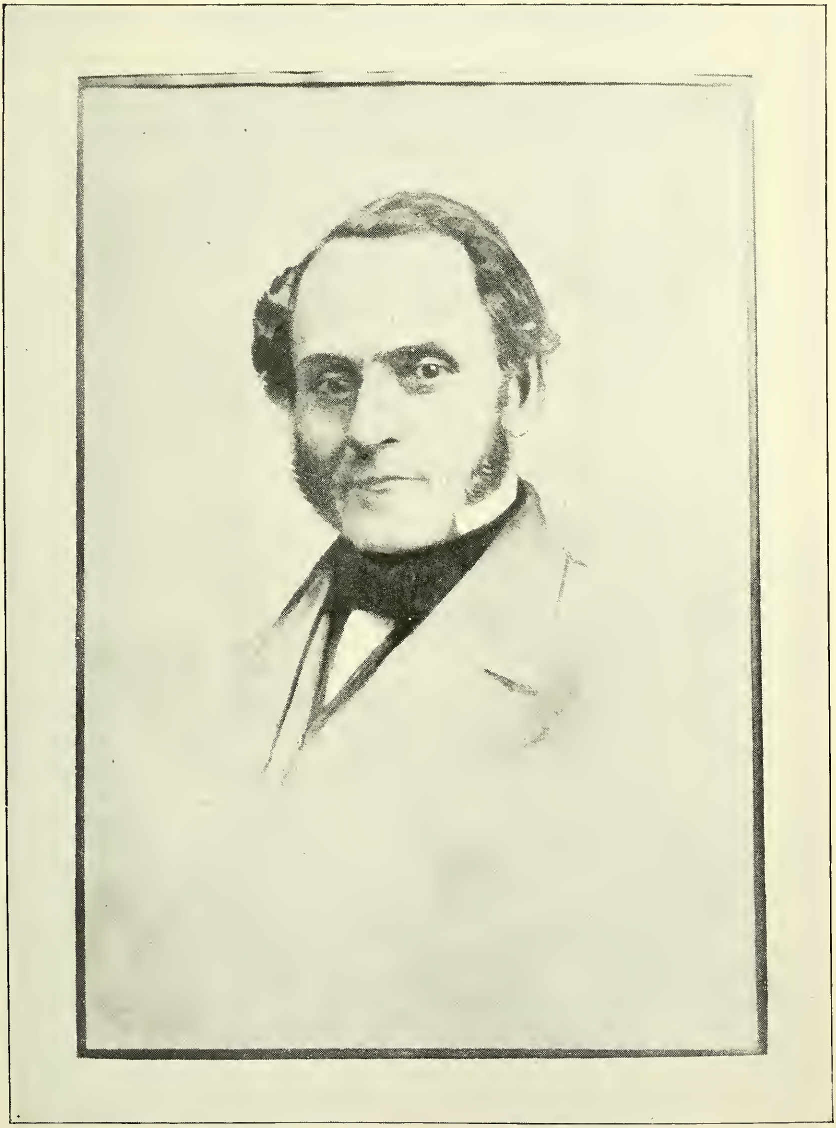


FIG. 1.—SITE OF BIRTHPLACE OF GEORGE PECK, GOVERNOR OF WISCONSIN. FARM NO. 555.

Peck's father was a farmer at Bishop Street. The house stood at the left of the picture, near the large clump of bushes.

FIG. 2.—BIRTHPLACE OF CUSHMAN K. DAVIS, GOVERNOR OF MINNESOTA. FARM NO. 556.

Davis grew up on a farm in Bishop Street, studied law, went to war, and later became Governor of Minnesota and United States Senator from that State. He was instrumental in negotiating the treaty between the United States and Spain at the close of the Spanish-American War.



PEN SKETCH OF HIRAM BARNEY, HANGING IN BELLEVILLE ACADEMY MEMORIAL HALL.

Hiram Barney was born on farm No. 176, and educated at Union Academy and Union College. He afterwards became State Superintendent of schools in Ohio and introduced the union school system into that State.

FIG. 1.—CHARCOAL DRAWING OF MAJOR ANDREW JACKSON BARNEY, THE FARMER-SOLDIER, WHO IS STILL THE WAR HERO OF THE COMMUNITY.

Major Barney, born on farm No. 87, in Belleville, was educated in Union Academy and Union College, but returned to farming in the Belleville community and became a trustee of the Academy. At the outbreak of the Civil War he led out, as Captain, scores of boys and young men from the Academy and community. In the second battle of Bull Run he was killed. His body was recognized by Stonewall Jackson, who had long been a friend of the Barney family, and sent home to Belleville, where he was buried by his own people with military honors.

FIG. 2.—HOME OF MAJOR BARNEY. FARM NO. 69.

A spot which to the people of the community is more than a farmstead, more than a house and a growing place for crops.

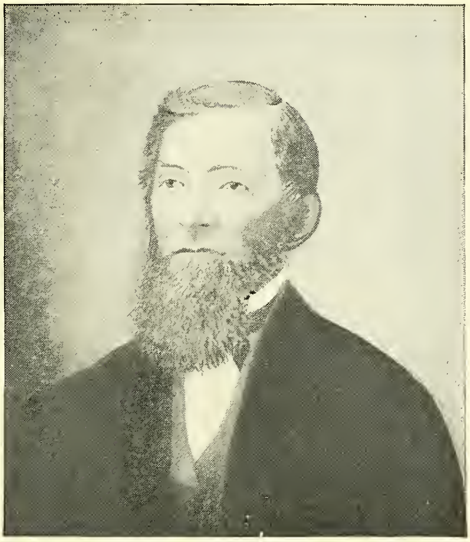


FIG. 1.—PORTRAIT OF NORRIS SHEPARDSON, PAINTED BY HIS COUSIN, IRA SHEPARDSON, WHICH HANGS IN ACADEMY MEMORIAL HALL.

Norris Shepardson was a farmer-poet. His public gifts were many and lavish. A typical case is that of a ten-acre piece of woods, willed to Woodside Cemetery, near Rural Hill, with the proviso: "No live tree in it to be cut down in a hundred years."
The Academy board of trustees was made trustee of this gift.

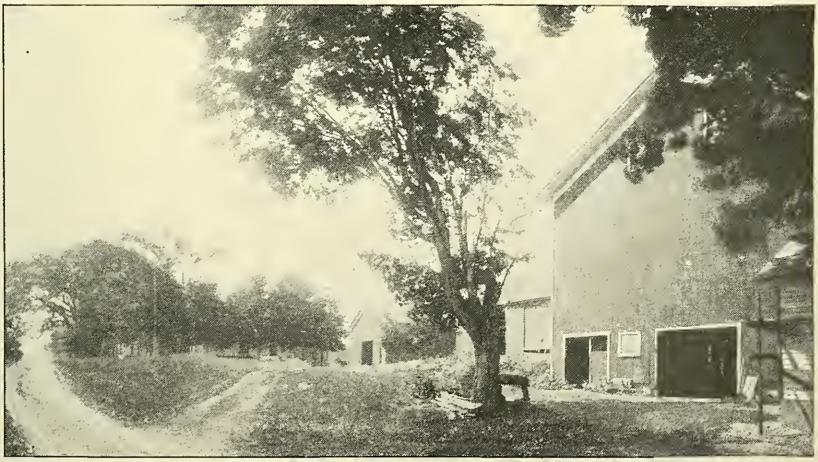


FIG. 2.—HOME OF NORRIS SHEPARDSON, POET-FARMER. FARM NO. 62.

N. Birthplace of Henry and James Bull, founders of farm schools in Minnesota. Farm No. 92.

O. Home of Reuben Wood, governor of Ohio. Farm No. 119.

P. Birthplace of Lucia Hawes Hunting, "Mother of clubs in Kansas." Farm No. 829.

Q. Home of D. C. Hurd, originator and manufacturer of Hurd shoe. Farm No. 886.

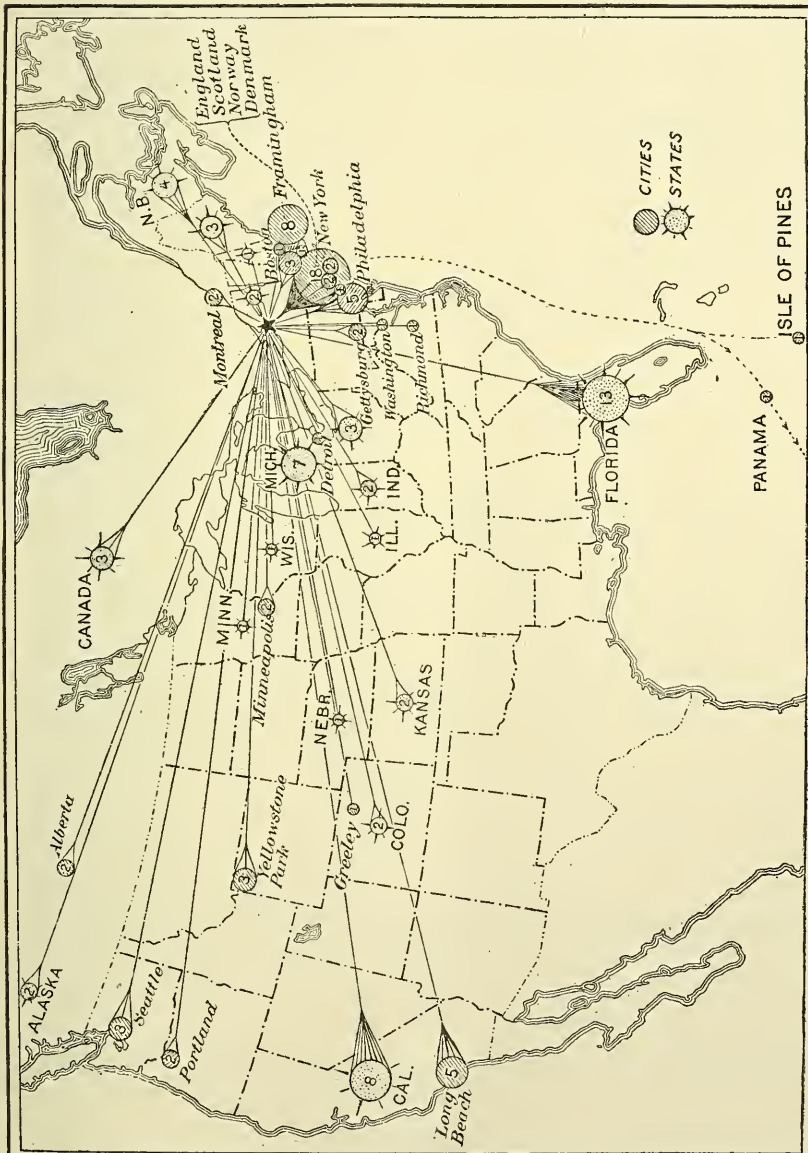


FIG. 19.—Map showing vacations and trips taken by members of Belleville farm families. This represents a few of the vacations taken by the families of Belleville farmers during a period of five years (1910-1915). Education has taught these farmers the value of recreation, change, travel, new experience, new surroundings, but has not made them discontented with their own homes and their own communities.

R. Birthplace and home of the author, Marietta Holley ("Samantha Allen"), fifth in the line of Holleys to have lived on this farm. Farm No. 418.

S. Boyhood home of Robert G. Ingersoll, celebrated orator and author. Farm 554.

CONNECTIONS OF BELLEVILLE COMMUNITY WITH NATIONAL LIFE.

The community of Belleville is found to maintain certain well-defined connections with the larger interests of the Nation. At no point do the people appear to feel in any way out of the stream of national events and movements. Since the founding of the academy they have kept in touch with the best in the educational world through the splendid teachers which they have brought to the com-

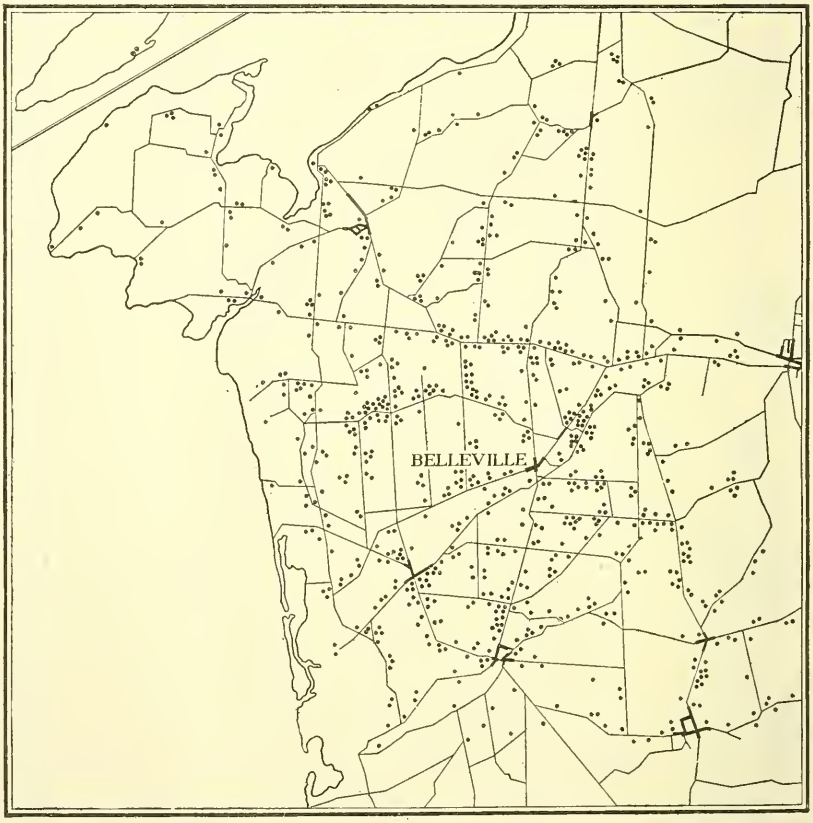


FIG. 20.—As a matter of comparative interest this map is given to show the number of students of the academy who went back to the farms and remained in the community. Each dot one student. The stay-at-homes have, all during the community's history, as a general rule, rated up well in numbers, caliber, and education when compared with the migrants.

munity and through their own young people, whom they have sent to the best normal schools, colleges, and universities of the East.

COLLEGE CONNECTIONS.

Following is a list of schools, colleges, and universities from which the Union Academy teachers have come (see fig. 16):

Albany Business College, Albany, N. Y.
Albany Normal College, Albany, N. Y.
Amherst College, Amherst, Mass.
Belleville Academy, Belleville, N. Y.

Bloomsburg Normal School, Bloomsburg, Pa.
Colgate University, Hamilton, N. Y.
Cornell University, Ithaca, N. Y.
Cortland Normal School, Cortland, N. Y.
Cooper Union School, New York City.
DePauw University, Greencastle, Ind.
Fairfield Seminary, Fairfield, Conn.
Fredonia Normal School, Fredonia, N. Y.
Genesee Wesleyan Seminary, Lima, N.Y.
Geneseo Normal School, Geneseo, N. Y.
Harvard University, Cambridge, Mass.
Hamilton College, Clinton, N. Y.
Mount Holyoke College, South Hadley, Mass.
New England Conservatory of Music, Boston, Mass.
Oberlin College, Oberlin, Ohio.
Potsdam Normal School, Potsdam, N. Y.
Rochester University, Rochester, N. Y.
St. Lawrence University, Canton, N. Y.
Syracuse University, Syracuse, N. Y.
Troy Female Seminary, Troy, N. Y.
Union College, Schenectady, N. Y.
Vassar College, Poughkeepsie, N. Y.
Wellesley College, Wellesley, Mass.
Wesleyan Methodist Seminary, Houghton, N. Y.
Wesleyan University, Middleton, Conn.
Yale University, New Haven, Conn.

Below is a list of higher institutions of learning that have had students from the Belleville community (see fig. 17):

Adams Training School, Adams, N. Y.
Albany Business College, Albany, N. Y.
Albany Normal College, Albany, N. Y.
Amherst College, Amherst, Mass.
Art Institute, Chicago, Ill.
Boston University, Boston, Mass.
Brockport Classical School, Brockport, N. Y.
Brown University, Providence, R. I.
Brown's Business College, Freeport, Ill.
Buffalo State Normal School, Buffalo, N. Y.
Buffalo University, Buffalo, N. Y.
Cazenovia Seminary, Cazenovia, N. Y.
Chaffee's Phonographic Institute, Oswego, N. Y.
Chautauquan Institution, Chatauqua, N. Y.
Chicago Normal School, Chicago, Ill.
Chicago University, Chicago, Ill.
Colgate University, Hamilton, N. Y.
Columbia University, New York City, N. Y.
Cook Academy, Montour Falls, N. Y.
Cooper Union Woman's Art School, New York City, N. Y.
Cornell University, Ithaca, N. Y.
Cortland State Normal School, Cortland, N. Y.
Crane Normal Institute of Music, Potsdam, N. Y.
Emma Willard School for Girls, Troy, N. Y.
Fort Edward Institute, Fort Edward, N. Y.
Fredonia State Normal School, Fredonia, N. Y.
Garrett Biblical Institute, Evanston, Ill.
Geneseo State Normal School, Geneseo, N. Y.
Hamilton College, Clinton, N. Y.
Hamilton Theological Seminary, Hamilton, N. Y.
Harrington Normal and Training School, New Bedford, Mass.
Harvard University, Cambridge, Mass.
Hobart College, Geneva, N. Y.
Ives Seminary, Antwerp, N. Y.
Johns Hopkins University, Baltimore, Md.
Keuka College, Keuka Park, N. Y.
Lasell Seminary for Young Women, Auburndale, Mass.
Massachusetts Agricultural College, Amhurst, Mass.
Michigan University, Ann Arbor, Mich.
Mount Holyoke College, South Hadley, Mass.
New England Conservatory of Music, Boston, Mass.
New Paltz State Normal School, New Paltz, N. Y.
New York Commercial School, New York City, N. Y.
New York State School of Agriculture, Morrisville, N. Y.
New York State School of Agriculture, St. Lawrence University, Canton, N. Y.
Niagara University, Niagara Falls, N. Y.
Oberlin College, Oberlin, Ohio.

Oswego State Normal School, Oswego, N. Y.
Paris University, Paris, France.
Pennsylvania University, Philadelphia, Pa.
Potsdam State Normal School, Potsdam, N. Y.
Pratt Institute, New York City, N. Y.
Rensselaer Polytechnic Institute, Troy, N. Y.
Rochester Business College, Rochester, N. Y.
Rochester University, Rochester, N. Y.
Simmons College, Boston, Mass.
Smith College, Northampton, Mass.
St. Lawrence University, Canton, N. Y.
Strassburg University, Strassburg, Germany.
Syracuse University, Syracuse, N. Y.
Theological Seminary of the Reformed Episcopal Church, Philadelphia, Pa.
Troy Conference Academy, Poultney, Vt.
Union College, Schenectady, N. Y.
Washington State University, Seattle, Wash.
Watertown City Hospital Training School, Watertown, N. Y.
Watertown Commercial College, Watertown, N. Y.
Wesleyan Methodist Seminary, Houghton, N. Y.
Wesleyan University, Middletown, Conn.
Wisconsin University, Madison, Wis.
Wiskis School of Music, Philadelphia, Pa.
Wyoming Seminary, Kingston, Pa.

The following is a list of farm and village homes in the Belleville community sending out students to college in one year (see fig. 18):

Farm homes:
No. 34. Cortland Normal.
No. 31. Smith College.
No. 48. Albany Normal.
No. 180. Cornell University.
No. 281. Cornell University.
No. 282. Buffalo Normal.
No. 374. Syracuse University.
No. 679. Syracuse University.
No. 81. Cortland Normal.

Village homes:
A (Belleville). Colgate University.
B (Belleville). Syracuse Law School.
C (Belleville). Syracuse University.
D (Belleville). Syracuse University.
E (Belleville). Syracuse University.
F (Belleville). Oswego Normal.
G (Ellisburg). Syracuse University.
H (Belleville). Colgate University.

THE LECTURE ASSOCIATION.

Through their lecture association, which has been maintained over a period of 50 years, the people of Belleville have been able to bring to their own home platform many of the leading orators, statesmen, humorists, philanthropists, clergymen, and concert singers. While their young people have had instruction and encouragement in school along the line of music, oratory, and art, there have been from time to time community classes of adults meeting for special study and training in literature, singing, painting, and orchestral music.

VACATIONS.

Supplementing this secondhand intercourse with the world at large are the vacations taken by the farm people of the Belleville community. The fact that a man is a farmer does not, in this community, bar him from taking pleasure in fishing and hunting expeditions, camp outings, or touring trips, nor does it keep him from joining the business men's club in the nearest city or from going into the city occasionally to attend a good concert or play. Vacations among the farmers of this community seem always to have been the rule rather than the exception. (See fig. 19.)

ADVANCED METHODS OF FARMING.

Along every line of their chief occupation, agriculture, the people of the Belleville community have been alert, taking up each worthy

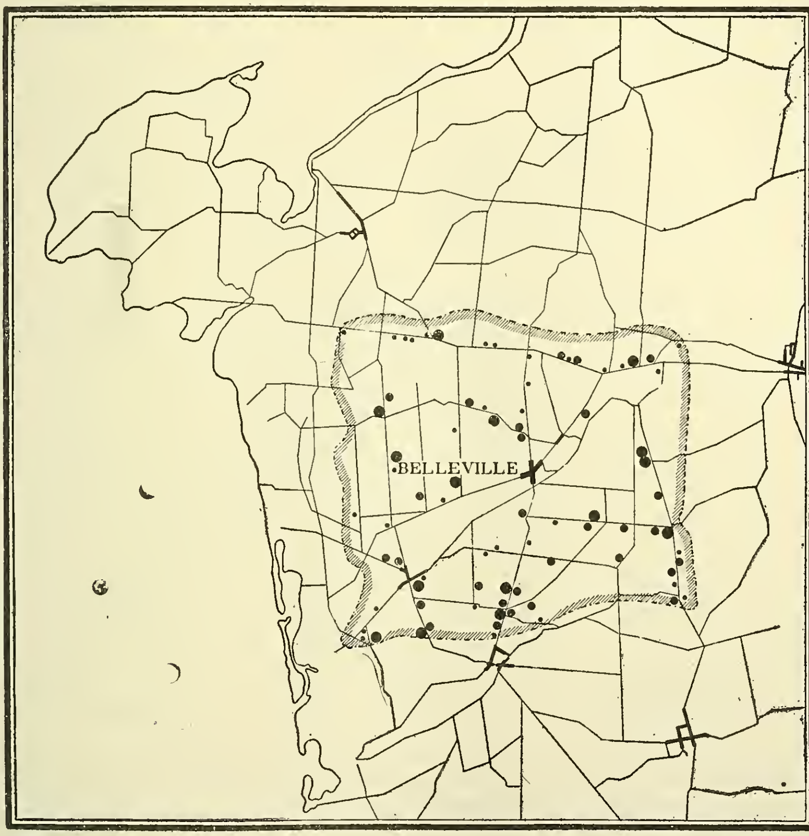


Fig. 21.—Map of the smaller community, showing farms on which two, three, or four generations of the same family have lived. Small dot indicates two generations, medium dot three generations, and large dot four generations.

new discovery and movement with enthusiasm. At an early date the Belleville community had a local agricultural fair and took an important part in the county fair. Individual farmers in the community were among the strongest supporters for a State fair and a State policy for farmers' institutes. Belleville itself had a farmers' institute for many years, and was the first community in the county to hold a farm woman's institute, just as it was the first to introduce into its high-school curriculum a complete course of agriculture.

In live-stock affairs the community has contributed by furnishing national presidents for various breeders' associations, and many famous breeders of hogs, cows, and horses. For example, the Benton Wilkes horses and the Cheshire hogs originated in this community. Belleville farmers were among the first, too, to make use of the Babcock test, and to see the value of cooperative marketing. For many

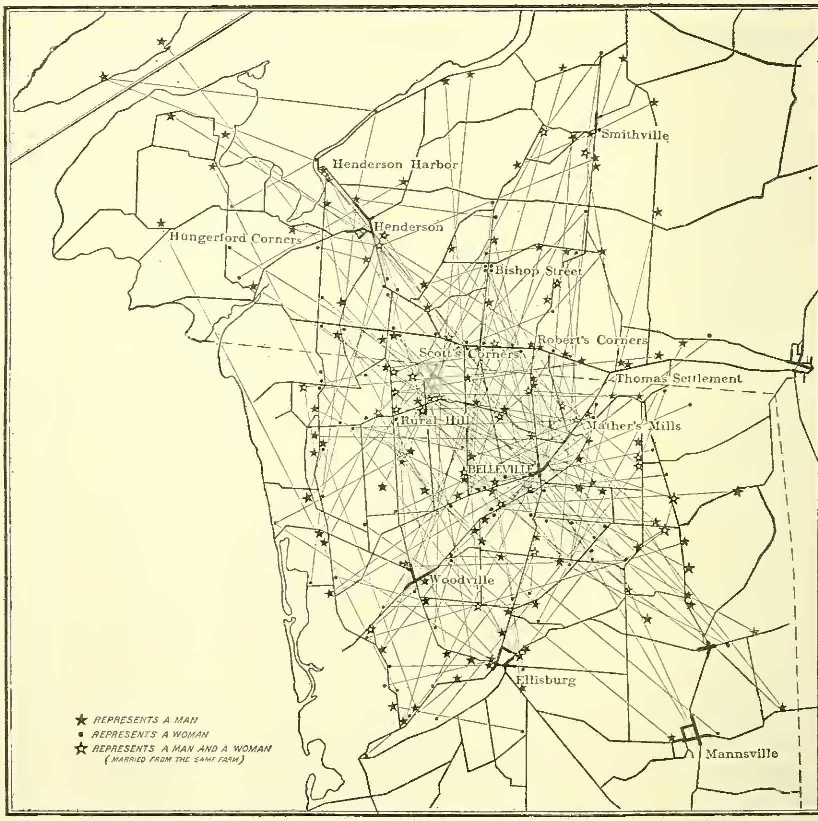


FIG. 22.—Map showing farm homes of the community connected with one another by marriage of students of the academy, and farm homes connected with village homes by such marriages. The academy has proved to be an instrument for weaving family lines into a close community texture, and for providing social contentment by bringing about acquaintanceship between congenial young people.

years their cooperative cheese factory, located in the village of Belleville, was one of the largest in the world.

What is called the original "cow census" in the United States was made in the town of Ellisburg by a resident of Belleville, in 1888, under the direction of Gov. Hoard, of Wisconsin. At this time Ellisburg was said to have more cows per capita than any other township in the United States.

RURAL ORGANIZATIONS.

The grange of Belleville was the fifth to be established in the State and is still active, with a large membership. The Farm Bureau and Home Bureau and the Dairymen's League have also taken a firm hold in the community.

FIG. 23.—Map showing farms in the Belleville community on which descendants of Edward Barney, who settled on farm No. 67, have lived. On several of these farms fifth, sixth, or seventh generation members of this family are still living.

PERSISTENT FAMILIES REMAINING ON THE FARMS OF THE COMMUNITY.

It is to be expected that every farm community shall send out, as migrants, a considerable proportion of its educated young people. But the migration need not be weakening to the community if at the same time a large number of the well-trained and cultured young people remain. Tables XII and XIII show that the Belleville community has held as permanent residents a great number of its academy-trained young people. (See fig. 20.)

TABLE XII.—*Distribution of the stay-at-homes among the academy students, 1824–1920, in the smaller Belleville community.*

Parts of three townships are included in the smaller Belleville community. Under these township headings are listed the names of the small villages, hamlets, and settlements, together with the number of students settling in or near each.

Adams Town:		
Roberts Corners	8	
Thomas Settlement	18	
Total		26
Ellisburg Town:		
Belleville	381	
Ellisburg	75	
Hemmingway's Corners	1	
Lake View	1	
Log London	6	
Mathers Mills	10	
Pierpont Manor	26	
Rural Hill	16	
Taylor Settlement	5	
Wardwell Settlement	12	
Woodville	85	
Total		618
Henderson Town:		
Roberts Corners	9	
Scotts Corners	36	
Total		45
Total		689

TABLE XIII.—*Distribution of the stay-at-homes among the academy students, 1824–1920, in that part of the larger Belleville community outside the smaller community.*

Parts of three townships are included in the larger Belleville community. Under these township headings are listed the names of the small villages, hamlets, and settlements, together with the number of students settling in or near each.

Adams Town:		
Adams	44	
Giddingsville	1	
Smithville	30	
Total		75
Ellisburg Town:		
Ellisburg	70	
Mannsville	30	
Pierpont Manor	20	
Total		120
Henderson Town:		
Bishop Street	27	
Butterville	15	
Galloup Island	3	
Henderson	141	
Henderson Harbor	15	
Smithville	37	
Stony Point	1	
Total		239
Total		434
Total, smaller and larger communities combined		1,123

In looking over the early history of the Belleville community, one finds outstanding names among the early settlers which occur again and again in the historical records and are still to be found in connection with certain neighborhoods and farms. If it has been a uniform custom for each farm to part with some of its best young people, it has also been customary for it to retain some of its strongest personalities.

Indeed, it is not the names of the migrants who have become famous which are most on the tongues and in the hearts of the people of the community, but rather the names of the stay-at-homes, the farmers, doctors, preachers, and teachers, who, born and reared in their midst, have devoted their lives to the interests of the community.

FOUR BROTHERS, GEORGE, SIMEON, WILLIAM AND MILO MATHER, BORN ON FARM NO. 204.

Raised and educated in the community, these men settled on farms near the homestead and lived there all their lives. In memory of George and William, their widows and children in 1901 gave the sum of $10,000 to the Academy for the establishment of an agricultural course.

FIG. 1.—HOME OF DEACON EDWARD BARNEY, EARLY SETTLER IN BELLEVILLE. FARM NO. 67.

Two of his sons became founders of Union Academy. His descendants still live in the community.

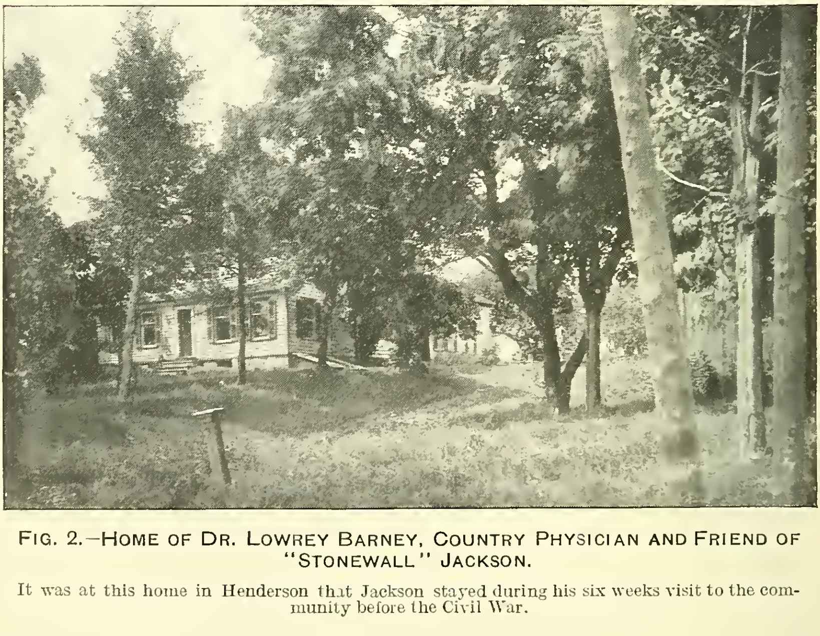
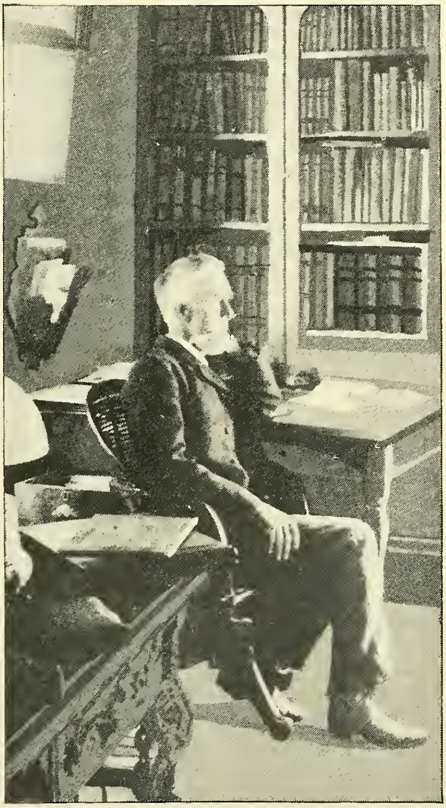


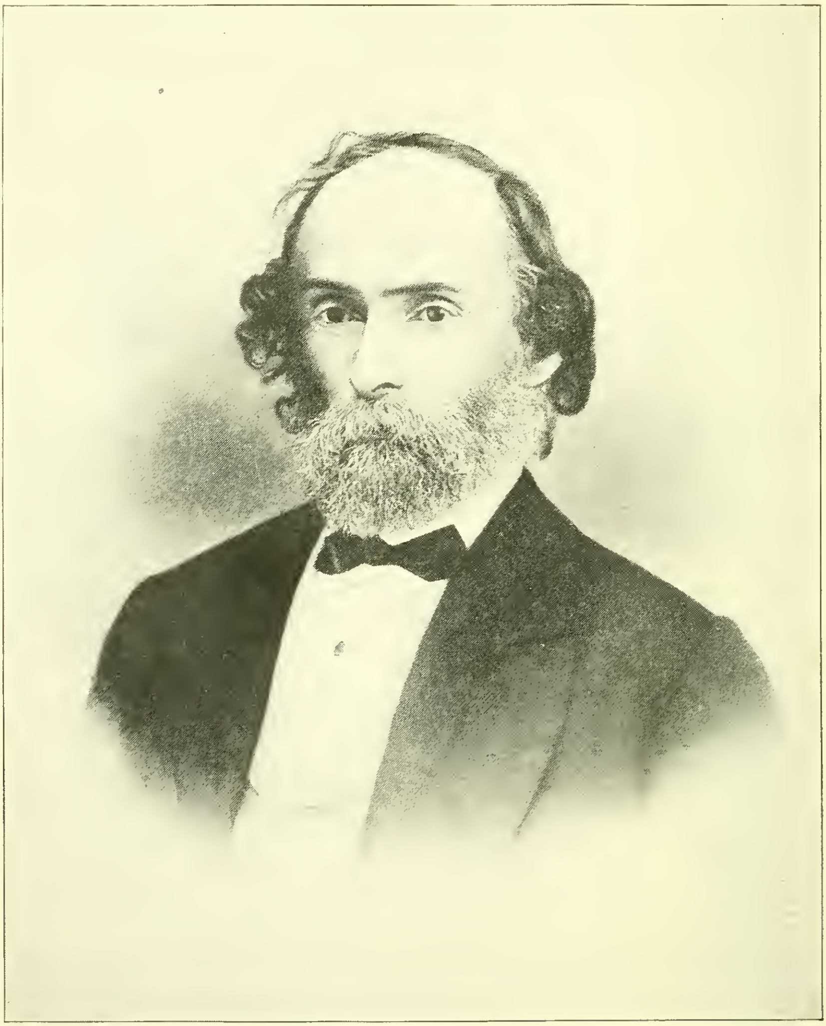
FIG. 2.—HOME OF DR. LOWREY BARNEY, COUNTRY PHYSICIAN AND FRIEND OF "STONEWALL" JACKSON.

It was at this home in Henderson that Jackson stayed during his six weeks visit to the community before the Civil War.



FREDERICK WILLIAMS, DESCENDANT OF ROGER WILLIAMS, OF RHODE ISLAND FAME, IN HIS FARM HOME.

Williams was a man who adorned the occupation of farming by his wide interest in the human concerns which lie above the bare economics of agriculture.



PORTRAIT OF J. DUNBAR HOUGHTON, HANGING IN UNION ACADEMY MEMORIAL HALL.

J. Dunbar Houghton, born on farm No. 127, was for thirteen years the beloved principal of Belleville Academy and he holds a place with Norris Shepardson and Major Barney in the hearts of the people. At his death the following resolution was passed by the trustees of the Academy:

"Resolved, that, reared among us, he ceased not to have our welfare educationally and religiously near his heart, giving to us his main energies and work of his life; and as 'it is the strength of a town or community to have its best men in everlasting remembrance,' so it shall be our care that the memory of his life and teachings shall not die."

It should be said, moreover, that there is nothing in any way artificial nor sentimental in this persistence on the farm of these families. There is no feeling of apology among those who have elected to stay at home on the farm, no feeling of regret at not having gone out into the world. These farm people have stayed in this community from choice, because it is home to them, because their interests are there, because they feel there is a good opportunity for investing a lifetime there.

In Table XIV it may be seen that there are large numbers of farm families staying generation after generation in the community and even on the same farm. Ten persistent families remaining for four generations on their farms are enough to save a community from disintegration. (See fig. 21.)

TABLE XIV.—*Number of generations during which the present families in the smaller community have been living in the community and farming on the same farm.*

Farm No.	Number of generations—		Farm No.	Number of generations—		Farm No.	Number of generations—	
	On same farm.	In community.		On same farm.	In community.		On same farm.	In community.
1	1	1	45	1	2	89	1	4
2	1	2	46	1	1	90	1	4
3	1	3	47	1	2	91	1	5
4	1	1	48	1	1	92	3	3
5	1	1	49	1	4	93	1	3
6	1	1	50	1	3	94	4	4
7	1	1	51	2	3	95	1	4
8	(a)	(a)	52	1	1	96	1	3
9	1	1	53	1	4	97	1	3
10	1	3	54	1	5	98	1	5
11	1	2	55	3	3	99	1	5
12	1	3	56	1	4	100	1	3
13	2	4	57	1	3	101	1	3
14	1	1	58	1	2	102	1	4
15	2	3	59	1	4	103	1	4
16	1	3	60	1	5	104	1	3
17	1	1	61	1	3	105	1	2
18	1	2	62	2	2	106	4	4
19	1	3	63	(a)	(a)	107	2	4
20	2	3	64	1	3	108	1	3
21	3	3	65	(a)	(a)	109	1	3
22	1	1	66	4	5	110	1	3
23	2	4	67	3	5	111	(a)	(a)
24	3	3	68	2	4	112	2	3
25	4	4	69	1	3	113	1	1
26	(a)	(a)	70	4	4	114	(a)	(a)
27	1	4	71	3	4	115	1	1
28	3	4	72	3	3	116	1	1
29	1	3	73	1	1	117	3	3
30	1	3	74	2	2	118	1	4
31	1	1	75	2	4	119	3	4
32	(a)	(a)	76	1	2	120	(a)	(a)
33	1	2	77	1	3	121	1	3
34	1	5	78	1	3	122	(a)	(a)
35	1	1	79	3	3	123	1	3
36	1	1	80	1	1	124	1	1
37	1	4	81	1	2	125	1	3
38	1	4	82	1	2	126	2	4
39	1	4	83	1	3	127	(a)	(a)
40	1	2	84	1	1	128	1	3
41	(a)	(a)	85	1	1	129	1	4
42	1	4	86	1	2	130	1	1
43	1	3	87	1	1	131	1	3
44	1	1	88	1	1	132	3	1

[a] Vacant.

TABLE XIV.—*Number of generations during which the present families in the smaller community have been living in the community and farming on the same farm*—Con.

Farm No.	Number of generations—		Farm No.	Number of generations—		Farm No.	Number of generations—	
	On same farm.	In community.		On same farm.	In community.		On same farm.	In community.
133	2	4	192	1	2	251	1	1
134	1	3	193	1	2	252	1	1
135	3	3	194	1	4	253	(a)	(a)
136	4	4	195	1	1	254	2	3
137	3	3	196	1	1	255	3	4
138	1	3	197	1	1	256	(a)	(a)
139	3	3	198	1	1	257	1	1
140	1	3	199	3	4	258	3	3
141	1	3	200	1	2	259	2	2
142	1	4	201	2	4	260	2	5
143	1	1	202	1	3	261	1	4
144	1	1	203	1	2	262	3	4
145	(a)	(a)	204	3	3	263	1	1
146	3	4	205	2	4	264	1	1
147	3	2	206	(a)	(a)	265	1	1
148	4	4	207	1	1	266	1	1
149	3	3	208	1	1	267	3	1
150	2	4	209	2	4	268	1	2
151	1	1	210	1	2	269	(a)	(a)
152	(a)	(a)	211	4	4	270	(a)	(a)
153	(a)	(a)	212	1	4	271	(a)	(a)
154	(a)	(a)	213	3	3	272	1	1
155	(a)	(a)	214	2	4	273	1	1
156	1	2	215	1	1	274	1	3
157	1	1	216	1	2	275	1	4
158	1	3	217	1	1	276	2	3
159	1	3	218	1	3	277	2	4
160	1	4	219	1	3	278	1	2
161	2	3	220	(a)	(a)	279	1	3
162	1	1	221	1	3	280	1	3
163	1	1	222	(a)	(a)	281	4	4
164	1	3	223	1	3	282	1	3
165	2	4	224	1	1	283	1	2
166	2	2	225	4	4	284	1	5
167	1	2	226	4	4	285	1	4
168	2	3	227	(a)	(a)	286	(a)	(a)
169	2	2	228	(a)	(a)	287	(a)	(a)
170	1	3	229	1	1	288	2	2
171	4	1	230	1	2	289	4	4
172	1	3	231	1	2	290	2	3
173	1	3	232	1	1	291	1	1
174	(a)	(a)	233	1	1	292	2	2
175	1	4	234	(a)	(a)	293	1	4
176	(a)	(a)	235	1	1	294	2	4
177	1	3	236	3	3	295	(a)	(a)
178	1	2	237	(a)	(a)	296	(a)	(a)
179	1	3	238	1	4	297	1	1
180	1	2	239	4	4	298	1	3
181	2	3	240	1	3	299	3	4
182	3	3	241	3	3	300	1	4
183	(a)	(a)	242	1	1	301	1	4
184	2	3	243	(a)	(a)	302	1	4
185	1	2	244	1	4	303	1	1
186	1	2	245	1	1	304	(a)	(a)
187	1	2	246	(a)	(a)	305	(a)	(a)
188	1	3	247	1	1	306	1	3
189	1	2	248	1	3	307	4	1
190	2	2	249	1	1			
191	1	3	250	1	3			

a Vacant.

A study showing the persistency of a single farm family (that of Edward Barney) through seven generations on the farms of the Belleville community is presented in figure 22.

In the study of the Belleville community, special attention was paid to the forces which tended to weave together the community texture. It was found on investigation that not only were there strong, persistent farm families rallying around the academy as the central institution, but that these strong families were knit together by the marriage of their young people who became acquainted while attending the academy. Table XV shows the farm and village homes in the community tied together by marriage. (See also fig. 23.)

It is interesting to note that the percentage of village or town girls who married farm boys is much larger than the percentage of village or town boys who married country girls.

TABLE XV.—*Marriages between Union Academy students connecting farm and village homes of the Belleville community. (1824–1920.)*

Home of woman.	Home of man.	Home of woman.	Home of man.	Home of woman.	Home of man.	Home of woman.	Home of man.
1	179	133	597	307	254	624	274
1	41	136	818	335	94	650	637
1	B.	139	514	335	209	650	753
2	261	140	757	336	299	655	624
3	247	140	927	341	537	668	629
3	443	142	P. M.	354	E.	678	B.
5	6	142	851	354	106	698	603
7	W.	143	67	358	611	703	72
7	153	144	B.	360	371	711	655
18	148	151	181	370	808	761	803
21	59	152	33	382	81	767	151
23	B.	152	70	382	B.	774	18
23	481	153	96	391	213	778	740
24	255	156	394	391	797	779	793
31	32	161	150	394	372	782	798
35	64	163	160	401	720	806	B.
46	66	165	47	404	146	823	776
46	327	165	556	408	90	854	45
48	B.	169	573	455	B.	877	140
48	388	172	108	462	B.	897	55
52	92	174	139	477	474	910	75
57	614	177	657	477	90	E.	281
59	106	181	20	484	476	H.	661
59	108	181	784	499	93	M.	69
59	790	182	60	507	519	W.	293
60	310	184	B.	507	547	P. M.	164
63	92	186	724	515	505	M. M	67
65	424	188	158	515	534	M. M	376
69	70	196	152	519	506	B.	38
69	658	196	37	519	208	B.	133
70	176	201	733	542	773	B.	568
70	293	216	B.	547	344	B.	522
75	87	218	31	550	64	B.	556
76	577	221	2	552	637	B.	50
78	140	225	B.	555	59	B.	40
81	92	229	2	555	488	B.	87
81	485	235	57	559	575	B.	683
90	B.	241	235	560	64	B.	152
92	204	241	264	561	M.	B.	335
92	34	241	172	561	260	B.	76
92	117	264	241	567	58	B.	79
93	68	267	117	567	B.	B.	6
96	55	283	521	611	172	B.	90
96	346	290	146	614	43	B.	542
97	9	290	277	614	520	B.	199
104	360	293	277	614	707	B.	189
104	788	294	276	617	376	B.	65
109	35	301	W.	618	658	B.	12
119	117	301	784	620	614	B.	877
119	522	301	894	620	94	B.	3
125	133	303	14	621	260	B.	910

B.=Belleville; E.=Ellisburg; H.=Henderson; M.=Mannsville; W.=Woodville; M. M.=Mather's Mills; P. M.=Pierpont Manor.

CONCLUSIONS.

SAFEGUARDING THE FARM HOME FROM OVERMIGRATION.

Migration from the farms of the Belleville community has been steady for the past hundred years. Yet during this time the strong families have persisted on the farms and in the community. Community life itself has been positive, virile, and progressive. No signs of community disintegration or folk depletion have appeared. The question at once arises: "What is the secret of the healthy community and family life in this particular community?" The further question comes up whether the reason for a healthy state of migration in the Belleville community will apply to other communities also.

WHEN THE FINER GOODS OF LIFE COME FROM THE WORLD RIGHT UP TO THE GATEWAY OF THE FARM COMMUNITY.

One can not fail to note in the analysis of the Belleville community life that the gateway of the community has always stood open and let the goods of life in from the Nation and the world.

Without question, moreover, the farmers' academy has been and still is the gateway to the community from the world of thought. When the father and mother on the farm come to the point of deciding the matter of education, higher than the common school, for their children, the academy in their own community is and always has been present to satisfy this desire. Parents did not need to stimulate the migratory process by sending their sons and daughters away from home and vicinity for a period of years during adolescence in order to give them the cultural ideals of American life.

The academy also became, as it continues to be, an intellectual, esthetic, and social center for the adults on the farms, satisfying the desire for contact with the higher things of the mind. The teaching faculty of the academy, furthermore, brought into the community, for the stimulation of the adults as well as of the youth, the intellectual ideals of the time from the college and university centers of America. The American platform lecturers of the day went to the Belleville farm community just as they were accustomed to go to the cities and towns. The courses of music and fine arts in the academy, maintained from the very beginning of the school, satisfied one of the strong desires of farm mothers and fathers on behalf of their daughters.

The reason which the best farmers have always given for leaving the farm after obtaining a fair competence is that they wish the family to have the benefits of education and refinement. The people of the Belleville community have never been obliged to leave their community for these things. The world has brought its goods to their door. It appears to be a fair principle to apply to all farm communities, that when the best things of the mind come on call to the door of the farms, the danger of losing the population in order to satisfy intellectual and social cravings is minimized.

WHEN THE COMMUNITY POSSESSES INSTITUTIONS TO BE PROUD OF.

The farmers in the Belleville community founded their academy themselves; sacrificed for it, lavished their lives upon it. It became their pride. Before towns and cities in the county had similar institutions, this farm community was pioneering in higher education while pioneering in farming. The farmers determined to have an academy without waiting until they could amply afford it. It would be an extraordinary inducement that would lure from his farm a Belleville farmer whose father had nobly built his life into the local institution. People leave communities when community ties have no holding power. The community institution is an investment of life and energy and is a bond hard to break.

If one were to put this principle into the form of a recipe for a community suffering from overmigration, he would say: "If you wish to hold your people to the farms, get them to establish institutions to be proud of and let them lavish themselves upon these institutions. And don't wait until you think you can afford it."

TAKING THE FIRST STEP IN A COMMUNITY TO REMEDY A CONDITION OF OVERMIGRATION.

A farm community which possesses the economic basis of good land but which finds itself losing its best people—its best farmers, its best young men and women—if it determines to safeguard itself from depletion, will at once set about the task of building up community institutions which will provide doors to the community for the goods of life from the world at large. The common school will be supplemented by a local farmer-supported high school. This will become a great center of intellectual life, of community spirit, of agricultural enthusiam. Other institutions will naturally follow this first step in stemming the current of folk depletion.

WHAT PUBLIC OPINION WILL DO ABOUT OVERMIGRATION.

The universal cry of "keep the boy on the farm" can be expanded into a great public sentiment for establishing at the very door of the farms the institutions which all people crave. Neither exhortation nor force will keep people on farms, away from the best of the life of the world; but when the tide of the world flows up into the country and deposits its riches of thought on the institutional thresholds of farm life, the great social motive of youth and middle age for leaving the farms will be undermined.

The States and the Nation can well afford to encourage and assist farm communities to build up a satisfying institutional life. In fact, no other course is reasonable. Lethargy on the part of statesmen at this point is indefensible. The weak, helpless cry of "keep the boy on the farm" can be transformed into a rallying cry: "Build great community institutions for farm boys and girls."

WHEN THE EYES OF THE NATION TURN TO FARM LIFE.

Human life on the farm will get national attention comparable to that given crop estimates and crop reports, food shortage, and farm-labor shortage, when the eyes of the Nation at large once come to rest upon the human side of farm life. It is hoped that the Belleville community story will serve in some measure to direct the eyes of Americans in general to our farm community life, and thus help start a train of thought about the people of the farms, their daily life, their capacity to utilize modern community institutions and about their contributions to national growth.

No more powerful stimulus can come to rural social development than the rise in the national mind of optimism about human life in farm communities. If once side-tracked, so that the right of way is given to optimism for a decade, pessimism about the farmer and his family will drop out of national thought. Such a change in the realm of public attention alone would do much to turn the restless farmers' thought back to the benefits of farm life. It is not a marvel, when the whole agricultural brain power of the Nation has been focussed for a generation upon the economics of farm life, that in some instances the farmer and his boy should come to think that money benefits are the prime goals of life. This is the point at which education of farm youth may well dwell upon the specifically human ideals of life.

RECOGNITION OF DISTINGUISHED SERVICE.

When the Nation sees the farm population in a true light, it will accord a more generous recognition to the people who stand by the farm community and keep the human seed plot of national life green. Every State will come to honor the family which has maintained itself on the old homestead or in the same farm community generation after generation. A "Who's Who" of such families might conceivably come to be looked upon as a roll of honor in every State, matching the "Who's Who" of the farm-bred who have achieved fame in industry, in science, in professional life after migration from the farm community.

A FIELD OF SERVICE FOR THOSE WHO WOULD SEEK TO INVEST THEIR LIVES.

The American college has always quietly held aloft before its men and women "Service to humanity" as a motive of work. "Investment of life" where the dividends of influence were largest, has made its appeal to college men and women. But there has always been an easy assumption that the largest dividends of social influence were to be found in centers of the densest population. The results of this study of the national influence of a single farm community distinctly challenge that old assumption. To the highly trained professional man or woman who hitherto has shunned country service these results suggest alluring possibilities. To the teacher, to the physician, to the minister, to the librarian, to the lyceum teacher, to the university extension man and woman the spirit of the Belleville community calls:

> You have feared that your influence would be lost if loosed among farmers. Look at the rivulets, streams, and rivers of youth flowing from the farms into the sea of national life. How could you more surely send your influence into every part of the Nation than to lodge your life in the farm community? Come back into the hills or out into the plains whence comes the strength of the Nation and sell your life on the best terms to humanity at large. Let your life seep into national life through the human carriers from the farms.

If an argument for the richness of opportunity in a country leader's life were wanted, nothing could serve the purpose better than the example of the torch handed down from the hand of Joshua Bradley, founder of Union Academy, to Jedediah Burchard, on to Charles Finney, who in his turn sent out from Oberlin College hundreds of inspired young leaders.

RURAL COMMUNITY PROBLEMS ESSENTIALLY NATIONAL.

The country-life movement and the habilitation of farm community institutions do not, it is evident, belong, as problems, exclusively to farm people. The ordinary farm community is shown by the foregoing analysis of one representative farm community to be connected up with the life of the whole Nation. So far-reaching is the influence of a typical, obscure farm community, that the statesmen and thinking citizenry of the Nation appear to be highly interested parties to all rural community problems.

There are approximately 20,000 farm communities in the United States surrounding our villages and small cities. If a close historical study were to be made of each one of these communities, doubtless a surprising set of powerful influences would be discovered flowing outward to the Nation. Multiply the national influence of our single farm community a thousandfold, and then multiply the result by ten, then double that result, and one would get some idea of what the farm population of America means to American national life.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 985

Contribution from the Bureau of Markets and Crop Estimates
H. C. TAYLOR, Chief

Washington, D. C. November 9, 1921

A SYSTEM OF ACCOUNTING FOR COTTON GINNERIES.[1]

By

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and

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CONTENTS.

WHO CAN USE THE SYSTEM.

The system of accounting described in this bulletin will meet the needs of cotton ginneries generally as they are operated in the cotton belt of the United States. However, especial attention has been given to the needs of custom ginneries, and no effort has been made to consider the problems of ginneries on private plantations. Since the latter do comparatively little work for the general public, they were not included in the investigation, although there is little question that they would find this system of accounting helpful.

With no previous knowledge of bookkeeping whatever, practically anyone can keep the records and accounts described in this bulletin.

[1] The authors desire to make acknowledgment to Dr. Lewis H. Haney for helpful suggestions and for reading and criticism of the manuscript of this bulletin.

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To do this, one must carefully read the bulletin before starting any actual work. That portion beginning on page 14, under the heading "How the system works," and the sample entries on the forms at the back, will be especially helpful. In the day-to-day work of keeping the records, the Appendix and the sample entries will answer practically every question which will ever occur to the user, and the Bureau of Markets is at all times ready and willing to answer questions.

There is no short cut to adequate information relating to the operation of any business. The only way is to install a good set of records, open the proper ledger accounts, and keep them correctly. Then the results must be studied. The information in this bulletin will enable a business man of average intelligence to do these things.

RESULTS OF USING THE SYSTEM.

A large number of business men look upon their bookkeeping as a sort of necessary evil, from which they can get no return. The information which a properly kept set of records and accounts can furnish, however, is the guidepost along the highway to business success. If one would succeed in his business probably no other tool will help more than a system of bookkeeping which will give the results herein described.

The final test of the adequacy of any system of accounting lies in the question whether or not it will furnish the information necessary for the intelligent conduct of the business. This information should consist of a statement of the financial standing (Balance sheet, see page 4), a statement showing the loss or gain as a whole (Income and expense statement, see page 6), prepared in such detail that the relation of the various items of income and expense may be readily seen, and any other information that may be of assistance to the management. It should also make it possible to prepare income tax reports with comparatively little work.

An illustration of each of the reports essential to a ginnery follows, with a few comments concerning each report.

To obtain the very best benefits possible from an adequate accounting system, nothing can take the place of an independent audit by a reputable firm of public accountants. Some of the advantages to be derived from such an audit may be summarized as follows:

(1) An impartial and disinterested opinion of the general policy and administration of the business is obtained.

(2) The financial records are carefully examined, and reports presented in the best possible form.

(3) Opinion is rendered as to whether the methods in use could be improved and whether or not adequate reserves are being accumulated to care for depreciation, bad accounts, etc.

The cost of such an audit may seem prohibitive to some of the smaller organizations. However, this expense may be somewhat reduced by the formation of a cooperative auditing association, such as is now in existence in some sections of the country. It is strongly recommended that an audit of the kind referred to above should be made at the close of the fiscal year.

Part I.—REPORTS THE MANAGER NEEDS.

BALANCE SHEET.

The investigations made by the Bureau of Markets have disclosed the fact that many cotton ginneries have never made either an income and expense statement or a balance sheet. A model of each of these forms is therefore shown. The arrangement of balance sheet shown herein conforms to that suggested by the Federal Reserve Board and is recommended as a simple yet comprehensive exhibit of the financial position of the company. The management should very carefully study the statement of one year as compared with another, noting particularly the increases and decreases in such important items as Notes and accounts receivable, Inventories, Depreciation reserves, Notes and accounts payable, Surplus, and Total net worth; also, the relation of Total current assets to Total current liabilities, which should be approximately 2 to 1, if the organization is in sound financial condition.

THE BLANK GINNING COMPANY.

COMPARATIVE BALANCE SHEET AS AT ...., 19.....

Account number.	ASSETS.	Current year.			Last year.		
	Current assets:						
	Cash—						
A1	On hand	. ..			. ..		
A2	In bank	. ..	. ..		. ..	. ..	
A3	Notes receivable		. ..			. ..	
A4	Accounts receivable	. ..			. ..		
H5	Less reserve for doubtful accounts	. ..			. ..	. ..	
A5	Inventories:						
	Seed cotton	. ..			. ..		
	Ginned cotton	. ..			. ..		
	Cottonseed	. ..			. ..		
	Bagging and ties	. ..			. ..		
	Operating supplies on hand.						
	TOTAL CURRENT ASSETS			. ..			. ..
	Fixed assets:						
B1	Land		. ..			. ..	
B2	Buildings	. ..			. ..		
H1	Less reserve for depreciation	. ..	. ..		. ..		
B3	Machinery and equipment	. ..			. ..		
H2	Less reserve for depreciation	. ..	. ..		. ..	. ..	
B4	Office furniture and equipment	. ..			. ..		
H3	Less reserve for depreciation	. ..	. ..		. ..	. ..	
	TOTAL FIXED ASSETS			. ..			. ..
	Other assets:						
C1	Prepaid insurance			. ..			
	TOTAL ASSETS			. ..			. ..

Account number.	LIABILITIES AND NET WORTH.	Current year.			Last year.		
	Current liabilities:						
F1	Notes payable		. ..			. ..	
F2	Accounts payable		. ..			. ..	
F3	Dividends payable		. ..			. ..	
	Accrued liabilities:						
G1	Pay-roll account	. ..			. ..		
G2 and 3	Accrued rent and taxes	. ..	. ..		. ..	. ..	
	TOTAL CURRENT LIABILITIES			. ..			. ..
	Net worth:						
I-1	Capital stock (issued)		. ..			. ..	
I-2	Surplus	. ..			. ..		
I-3	Loss and gain (net profit current period)	. ..			. ..		
	Less dividends declared	. ..	. ..		. ..	. ..	
	TOTAL NET WORTH			. ..			. ..
	TOTAL LIABILITIES AND NET WORTH			. ..			. ..

NOTE.—Short dashes (. ..) are used to indicate the places where the figures are to be inserted.

INCOME AND EXPENSE STATEMENT.

The income and expense statement is an itemized statement of the entries made in the loss and gain account, arranged in such a way as to set forth clearly the financial results of the operations of the periods involved. The items should be obtained from this account, and the final balances must agree.

The following form of income and expense statement will be found convenient for exhibiting the operations of the ginnery for either a monthly or a yearly period. Wherever possible a monthly statement of income and expense is advised.

In the past no standard form of income and expense statement has been used; therefore this form should fill a very definite need. By its use, not only the stockholders and directors may follow the details of the business, but a ready comparison may be made between the costs of operation of various periods.

In preparing this statement the amounts shown as sales and purchases should be net figures. That is, merchandise returned by the buyer should be deducted from the total sales, and merchandise returned by the company to the concern from whom it is purchased should be deducted from the total purchases.

In preparing the trading section of the income and expense statement it will be found that a space is provided for showing the inventory at the beginning of the period separately from the purchases. If the entries have been made in the purchase accounts in the order provided, the amount of the inventory (where one existed at the close of the previous period) should be the first item in the various purchase accounts. By deducting this amount from the balance on the purchase account, the purchases for the period may be found.

Special attention is called to the item "Less cost of ginning purchased seed cotton." The method of ascertaining this amount is explained on page 35.

Special care should be used to see that this item is correctly ascertained, for in no other way can correct results be obtained. The items also appear on the "Comparative cost and income analysis," page 7.

The result of this statement, "Net profit for year," must agree with the balance of the loss and gain account.

BLANK GINNING COMPANY.

INCOME AND EXPENSE STATEMENT FOR ...., 19......

Account number.		Current year.	Last year.
	OPERATING.		
	Ginning income:		
K1	Custom ginning income		
	Ginning expense:		
	Operating—		
N1	Salaries and labor expense		
N2	Power expense		
N3	Repairs		
N4	Depreciation		
N5	Operating supplies expense		
N6	Insurance		
	Administrative—		
O1	Office supplies		
O2	Telegraph, telephone, and postage		
O3	Rent		
O4	Taxes		
O5	Losses from bad accounts		
O6	Miscellaneous expense		
	Total ginning expenses		
P1a	Less—cost of ginning purchased seed cotton		
	Cost of custom ginning		
	Custom ginning net profit		
	TRADING.		
L3	Bagging and ties sales (net)		
A5	Inventory beginning of year		
P4	Purchases (net)		
A5	Less—inventory—end of year		
	Cost of sales (bagging and ties)		
	Gross profit on bagging and ties		
L1	Cottonseed sales (net)		
L2	Cotton sales (net)		
	Total		
A5	Inventories—beginning of year—		
	Seed-cotton		
	Cottonseed		
	Cotton		
	Purchases (net)—		
P1	Seed-cotton		
P2	Cottonseed		
P3	Cotton		
A5	Less—inventories—end of year		
	Seed-cotton		
	Cottonseed		
	Cotton		
	Material cost		
P1a	Cost of ginning purchased seed cotton		
	Cost of sales (cotton and cottonseed)		
	Gross profit on cotton trading		
	Miscellaneous income:		
M1	Cash discounts on purchases		
	Sundry income		
	Net profit for year		

NOTE.—Short dashes are used to indicate the places where figures are to be inserted.

SUMMARY OF OPERATIONS.

A form for presenting a summary of the ginning operations is shown below. It is arranged to present in form convenient for use the information relative to the quantity of cotton and cotton seed handled. The information is obtained from the ginning register.

SUMMARY OF OPERATIONS.

Bale record:		
Number of bales ginned........................		....
Total weight of lint..............................		....
Seed cotton handled:		
Net weight bought..................................	lbs.	....
Net weight sold......................................	lbs.	....
Disposition of seed:		
Taken by owner.....................................	lbs.	....
Bought..	lbs.	....
Value...		$..........

THE COST AND INCOME ANALYSIS.

The form for the cost and income analysis is arranged to show in summary the cost and income per bale of the ginning operations. Columns are provided for exhibiting the cost information of two years in such a way that they can easily be compared. This affords an excellent check on the efficiency of the business.

The information for this report is obtained from the income and expense statement, and the per bale figure is obtained by dividing by the number of bales ginned, except in the case of the item "Less cost of ginning purchased seed cotton," where the number of bales of such cotton is used.

Comparative cost and income analysis.

Total number of bales ginned........ —— Bales purchased seed cotton ginned........ —— Custom bales ginned........ ——	Current year 192—			Last year 192—		
	Amount.		Per bale.	Amount.		Per bale.
Total ginning income..........................		– —	– —		– —	– —
Ginning Expense–operating..........................	– —		– —	– —		– —
Ginning Expense–administrative..........................	– —		– —	– —		– —
Ginning Expense–total..........................	– —		– —	– —		—
Less cost of ginning purchased seed cotton..........................	– —		– —	– —		– —
Cost of custom ginning..........................		– —	– —		– —	– —
CUSTOM GINNING NET PROFIT..........................		– —	– —		– —	– —
Bagging and ties sold..........................	– —		– —	– —		– —
Bagging and ties cost of sales..........................	– —		– —	– —		– —
BAGGING AND TIES GROSS PROFIT..........................		– —	– —		– —	– —
Cotton trading (gross profit)..........................		– —			– —	
Miscellaneous income..........................		– —			– —	
TOTAL NET PROFIT AS PER INCOME AND EXPENSE STATEMENT..........................		– —			– —	

NOTE.—Short dashes (– —) are used to indicate the places where the figures are to be inserted.

Part II.—THE RECORDS.

WHAT FORMS TO USE.

Many business men and bookkeepers have not had the broad and varied experience which will enable them to devise a complete and related set of forms for the particular business with which they are connected.

For this reason such a set is shown and described herein. This set is the result of wide observation and discussion with experienced ginnery accountants and managers. While it is true that no set of forms can be made which will exactly fit all the details of every organization, it is believed that these forms will be found satisfactory for use in the vast majority of cotton ginneries in the cotton belt of the United States.

Some of the forms shown are not absolutely essential to successful accounting, but are provided that a complete system may be available for use. Also, in some cases, alternate forms are shown. These variations are discussed in the paragraph describing the particular form.

For the convenience of those interested in the system described in this bulletin, and for those who desire to install the system, the Bureau of Markets has provided printer's copy of the several forms for free distribution. A list of firms by whom the forms are published and carried in stock will be supplied on request. All ginneries installing this system of accounts may refer to this Bureau any question regarding its installation or operation.

DESCRIPTION AND USE OF THE FORMS.[1]

The following forms comprise the system of accounting for cotton ginneries:[2]

Form 2. The ginning ticket and register.
Form 3. The ginning ledger
Form 5. The cash journal.

In addition to the above, the following forms are described and illustrated, as they will be of material assistance in keeping accurate records of all items of importance:

Form 1. The bale tag.
Form 4. The cash receipt.

THE BALE TAG—FORM 1.[3]

The bale tag is fully described in United States Department of Agriculture Bulletin No. 520, "A System of Accounts for Cotton Warehouses," as follows:

Various methods are in use in cotton warehouses for the identification of the bales, but by far the most successful, and the one most generally used, is that of the numbered tag, supplemented by a record of the owner's private mark. Form 1 shows a

[1] Further discussion of the operation of the forms will be found on p. 14.
[2] Sample copies of these forms will be furnished to ginners on request.
[3] See page 42.

form of tag that is recommended. In every instance the tag should be made of reasonably heavy waterproof paper or of linen. Double eyelets with an extra reinforcement strip are desirable, and a double flexible wire, preferably of copper, for attaching the tag will give the best results. The tags should be numbered consecutively and used in numerical sequence throughout the season.

The selection of the tag to be used should be made with great care, as it is to become the principal means of identification of the cotton when the bale is in the warehouse. A tag of poor quality, improperly fastened to the bale with a single small steel wire, is often twisted off by the action of the wind and much trouble is caused by such a loss.

To guard against just such confusion as the loss of a bale tag will cause, it is often the practice to stencil or print on the bale itself some marks of identification. It is felt that in most cases this would prove fully as satisfactory as the use of a bale tag. It is recommended, however, that the number which is placed on the bale be the same as the number of the ginning ticket issued for it. This will make it easy to trace ownership through the records, and make it necessary to use only one set of identifying marks.

THE GINNING TICKET AND REGISTER—FORM 2.[1]

The ginning ticket, Form 2, is the foundation of all the subsequent records of operations. On it is recorded the bale number, the mark of the bale, owner, driver, to whom delivered, the weight, charges, and other facts relating to the ginning operations. Each ticket is the record of one bale of cotton, and since the tickets are numbered consecutively, the last number used indicates the number of bales ginned. Care must be taken to make the number of the bale tag (Form 1) (or the stencil number if stenciling is practiced) correspond with the number of the ginning ticket. On the right side of the ginning ticket are found columns for the classification of the facts found on the left-hand side. Ample space is also provided for calculations. It is an excellent practice to preserve the computations on the ticket for future reference.

This form is put up, five tickets to the page, in duplicate or triplicate, depending on whether or not the State law requires a copy for the landlord, in which case one copy is given to the grower, one to the landlord, and one is retained in the office.

In some ginneries it will be found desirable to use a tablet of ginning tickets (Form 2*a*[2]), and a separate register (Form 2*b*[3]). It should be understood, however, that Form 2 should not be used when Forms 2*a* and 2*b* are used, as these two forms are used in place of Form 2. The same information is found on the two forms as described under Form 2, the only advantage being that the ticket is a little longer and the register contains a larger number of entries on the page. The tickets should be put up in duplicate or triplicate, one ticket to the page, depending on whether or not the State law requires a copy for the landlord.

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[1] See page 40. [2] See page 41. [3] See page 10.

Bureau of Markets and Crop Estimates
Ginnery System
Form 2b

GINNING REGISTER

Date 1920	Ginning Ticket No	Owner of Cotton	Owner of Farm	L F	Bale Record: No.	Weight	Mark	Del.	Seed Cotton Weight: Gross	Tare	Net	Ginning Charges: B. & T.	Ginning	Total	Cash Received	Disposition of Seed: Tak'n	Bo't	Price	Amt	Balance Due: Ginner	Owner
			Brought forward																		
Aug 15	39771	A B Castley	Same		39771	530	ABC	Sept 1	3150	1550	1600	2 00	3 71	5 71			1071	75	8 02		2 31
			Totals forwarded																		

NOTE.—One page is given to the account of each individual. Postings are made from the ginning tickets to all but the last two columns: postings to these come from the cash journal. Instead of this form, a simple ledger form of the usual style may be used.

Where the ginning is done on a cash basis, or where the grower's copy of the ginning ticket (Form 2 or 2*a*) is returned to the gin at the time payment of the account is made, an excellent receipt is provided by marking the tickets paid and returning them to the customer. In case there are a number of bales, however, less time will be consumed if Form 4 is filled out.

THE GINNING (ACCOUNTS RECEIVABLE) LEDGER—FORM 3.[1]

Form 3 is the customer's ledger, one sheet being used for each grower. Since it rarely happens that the ginning is paid in cash for each bale at the time of ginning, it is necessary that an account be kept with every customer. The ginning ledger provides this record, one page being assigned to each customer, whose name is placed on the top of the page in the space provided.

The same columns are found in the ginning ledger as in the ginning register (except the name and the cash received columns), namely, the date, the ginning ticket number, and the bale record under which is found the number, the weight, the mark, and the date of delivery. Under Seed cotton are found the gross, tare, and net weight; under Ginning charges, bagging and ties, ginning charge, and the ginning total. Under Disposition of seed is found the amount taken, amount bought, price, value, and check number. In the last column is the date and the amount of payment.

All postings of ginning charges to customers' accounts are made from the ginning register (Form 2), and when the posting is completed the total of all the ginning accounts should be equal to the total in the register. The amount of the payments should be equal to the corresponding total of the payments in the cash journal.

If desired, the ginning ledger sheet can be so made as to give a carbon copy, in which case the original should be perforated so that it may be torn off and handed to the customer at the end of the season or whenever the settlement of the account is completed. Care must be taken, of course, that the account is kept intact until it is fully paid.

In case charge sales of cotton, cotton seed, or other materials are made to persons for whom no ginning has been done, these accounts should be opened in the ginning ledger, using, instead of the regular ginning-ledger sheet, an ordinary stock form of ledger sheet. These sales should be entered in the cash journal and posted from there to the proper account in the ginning ledger.

THE CASH RECEIPT—FORM 4 (OPTIONAL).[2]

Since no entry is made on the ginning ticket except for cotton, each ticket representing a bale, it is not convenient to use this form as a cash receipt, and therefore it is suggested that a separate blank be used, similar to Form 4, on which every item of cash receipts is

[1] See page 12. [2] See page 42.

U. S. Bureau of Markets and Crop Estimates
Ginnery System
Form 3—Ginning Ledger

M A. B. Castley FARM OF

DATE 1920	Ginning Ticket No.	BALE RECORD				SEED COTTON WEIGHT			GINNING CHARGE			DISPOSITION OF SEED					RECEIVED FOR GINNING	
		No.	Wgt.	Mark	Del.	Gross	Tare	Net	B. & T.	Ginning	Total	Tak'n	Bo't.	Price	Amt.	Check No.	Date	Amt.
Aug 15	39771	39771	530	ABC	Sept 1	3150	1550	1600	2 00	3 71	5 71		1070	75	8 02	1025		
" 25	39892	39892	530	ABC	"	3150	1550	1600	2 00	3 71	5 71	1070						

NOTE.—The entry of two ginning tickets made out on Form 2a No. 39771, where seed was bought and the owner paid by check for the balance due; No. 39782, where the owner retained part of the seed and the balance is to be paid later.

recorded. The form is put up in duplicate, one going to the payer and the other being retained in the bound book; the receipts are numbered consecutively, and every number must be properly recorded. They should be entered in the cash journal. This form is not absolutely essential, but it will be found that its use very often saves confusion and additional work.

THE CASH JOURNAL—FORM 5.[1]

The cash journal (Form 5) is a combination of the cash book and the journal. The incorporation of these two books into one form and the columnal development of the form tend to facilitate the classification of entries and to reduce the posting to the ledger. No special forms are provided in the system for the recording of purchases and sales, but the cash journal is used for the recording of these items.

Effort has been made to reduce the size of this form by limiting the number of special columns to those having sufficient items each month to warrant economy in their use. A book of moderate proportions will be found much more convenient to handle and to operate than one containing a large number of columns, if the needs of the business are not such as to necessitate the additional columns.

The captions of the columns of the cash journal are as follows:

Debit side: Ledger folio (L F); general ledger; ginning ledger (accounts receivable); receipt number; cash received; bank deposits; notes payable; bagging and ties purchased; cottonseed purchases; seed-cotton purchases; blank; pay-roll account; repairs; power expense; blank; insurance; rent and taxes; office supplies; blank.

Credit side (reading from left to right): Date; name; ledger folio; general ledger; ginning ledger (accounts receivable), cash payments; check number; bank withdrawals, notes payable; bagging and ties sales; cottonseed sales; cotton sales; custom ginning income; ginning purchased seed-cotton; three blank columns.

JOURNALIZING.

As often as is convenient, the results recorded in the ginning register (Form 2) are entered into the cash journal after the manner illustrated below. This is one of the most important features of the work, and should be very carefully performed.

Ginning ledger.	Cotton seed bought.	Cash receipts.	Oct. 31, 1919.	Ginning.	B. and T.
	225.00		Cottonseed bought.		
75.00			Accounts receivable.		
			Custom ginning income	250.00	
			Bagging and ties sales		50.00
			Totals from the ginning register.		

[1] See folded sheet facing page 16.

THE GENERAL LEDGER.

The form of general ledger sheet is usually kept in stock by stationers. The posting is done from the cash journal into the general ledger once a month or as often as is desired. No individual items are posted into the general ledger, except those found in the general ledger columns of the cash journal. The totals of the special columns are posted direct from the cash journal to the proper account in the ledger. The debit totals are posted to the debit side and the credit totals to the credit side of the account. Since the debits are equal to the credits in the cash journal, and since no posting is done from any other book, the two sides of the ledger must be equal and the trial balance should be easy to obtain at any time. The accounts found in the ledger are charted and described on pages 21 to 35.

HOW THE SYSTEM WORKS.

Sample entry of actual transactions showing the operation of the system will be found on the forms illustrated at the end of this bulletin. In studying the system or in actually using it, these sample entries should be referred to until it is thoroughly understood just how the entry should be made.

THE GINNING RECORDS.

The ginning records are the bale tag (Form 1), the ginning ticket and register (Form 2), and the ginning ledger (Form 3). The sole function of the bale tag is to identify the bale as it passes from the producer to the consumer. The ginning ticket and register is the original detailed and serial record of the bale and all the information relating to the ginning operations, while the ginning ledger is the book of personal accounts of patrons. The debit side of the ginning ledger and the total ginning charges in the register should be equal when the posting is completed. The net total of the balances in the ginning ledger should agree with the balance of the accounts receivable account in the general ledger.

RECEIVING THE COTTON.

As the grower drives on the scale, the weigher takes the next numbered bale tag (Form 1) and on a ginning ticket (Form 2), *of the same number as the tag*, he records the gross weight; then the cotton is drawn into the gin, after which the tare or the weight of the wagon and driver is deducted; the difference is the net weight of the seed cotton. The weight of the bale multiplied by the rate gives the charge for ginning. Adding the value of the bagging and ties gives the total charges if the charge for bagging and ties is not included in the ginning charge. By subtracting the weight of the bale from the net weight of the seed cotton the weight of the cotton seed from the bale is found. Except when the seed cotton is of a very low grade, is unusually dirty, or contains hulls and bolls in large quantities, no deduction for such foreign matter need be made, as the weight of the bagging and ties placed on the bale usually will offset this loss. Care should be taken to perform the calculations in the proper space on the ginning ticket. This will be of great assistance in auditing and will also be a valuable record in case disputes arise later. It is also of great importance that every tag and ticket be recorded and that memoranda be made of lost or destroyed tickets and tags. Care should be taken to fill out every space and that every signature required be properly signed. If the form is put up in triplicate, two copies are perforated and are torn out, while the third remains in the book for permanent record.

Two courses are open to the grower—either to pay the ginning charges in cash or to sell the seed to the ginner. When the cotton seed is bought, the net pounds of seed are recorded, the price per hundredweight, and the total value. From this the charges are deducted and the balance is due the grower, which should be paid by check.

The practice is for the ginner to carry an account with the grower until the end of the season or until the cotton is sold, when settlement of the account is made. Occasionally a small lot of seed is carried home by the grower, and this should be recorded.

As stated in the introduction, trading should be entirely disassociated from the ginning operations, as otherwise it would be impossible to establish a satisfactory basis for ginning costs. Where a ginner buys seed cotton on his own account, he should charge this cotton with the ginning, as explained on page 35, and the usual record should be made of the ginning and baling.

The distribution columns at the right of the ginning ticket should be totaled at the end of each page and the totals forwarded. These totals furnish the facts for the summary of operations at the end of the season.

THE GINNING LEDGER.

Once a week, or as often as occasion requires, the data recorded in the ginning register are footed and posted into the ginning ledger (Form 3). No specific instructions for posting are necessary, since the arrangement of the columns in the register and ledger are identical. The sheets in the ledger are arranged alphabetically, so that the initial of the account should be noted as a posting mark in the L. F. column of the register. Care must be taken to see that the total charge in the register and the postings to the ledger are equal.

THE FINANCIAL RECORDS.

The cash receipt (Form 4), the cash journal (Form 5), and the general ledger (Form 6) comprise the financial records.

Cash Receipts.

Every item of cash received is entered on a cash receipt (Form 4). This includes borrowed money payments on account and miscellaneous receipts of every description. Care should be taken to use a good pencil carbon sheet so as to insure a perfect copy. Patrons should be trained to expect a receipt for every payment. Every day the receipts are recorded in numerical order in the cash journal, and the amounts are distributed to their respective columns.

PAYMENTS.

It is suggested that, whenever practicable, all receipts be deposited in the bank and that all payments be made by check. When this is done, the difference between the receipts and payments will always be equal to the balance in the bank if all the checks have been paid. It is a good practice to enter the check number in the margin opposite the payee on the credit side of the cash journal and to preserve the check as a receipt. A notation on the check of the items paid is a valuable record. A special voucher check will be found very convenient in a large business. The canceled check should be attached to the original invoice or voucher and filed away for reference. Cash discount should be taken at every opportunity, not only because of the saving, but because the credit and reputation for good business methods are greatly enhanced by a habit of promptness in meeting obligations.

The Cash Journal.

The cash journal (Form 5) provides a chronological record of the financial transactions of the business and combines the features of the cash book, journal, sales book, and purchase book. All transactions must be journalized in detail or in totals in the cash journal; consequently no items can be posted to the general ledger except those appearing in the journal. On the left-hand page appear the debit columns and on the right-hand the credit columns; at every stage of the record the totals of the two sides must be equal

DEBIT COLUMNS.

Cash.—All receipts of cash of whatever nature are entered in the cash column, the corresponding credits being made to the proper accounts affected.

Bank deposits.—The amounts of the deposits made in the bank are entered in the bank deposits column. The bank balance, as shown by the cash journal at the end of the previous month, is carried forward to the head of the bank deposits column for the current month, making it possible to ascertain at all times the available amount of money in the bank by deducting the footing of the with-

CR.

	GENERAL LEDGER	L F	TON ES	CUSTOM GINNING INCOME		HAULING		
42								
				7 42				
42				7 42				

55231°—21. (To face page 16.)

U. S. Bureau of Markets and Crop Estimates
Ginnery System
Form 5

CASH JOURNAL

CASH JOURNAL

DR. / CR.

Misc Ex	Operating Expense: Office Supplies	Operating Expense: Rent and Taxes	Operating Expense: Insurance	Operating Expense: Power Expense	Operating Expense: Repairs	Operating Expense: Pay-roll Account	Seed-cotton Purchases	Cottonseed Purchases	Bagging and Ties Purchases	Notes Payable	Bank Deposits	Cash Received	Rect. No.	Ginning Ledger	General Ledger	L. F.	Date	Name	L. F.	General Ledger	Ginning Ledger	Cash Payments	Check No.	Bank Withdrawals	Notes Payable	Bagging & Ties Sales	Cottonseed Sales	Cotton Sales	Custom Ginning Income	Hauling
																		Brought forward												
												75.00					1	Cash on hand-undeposited		75.00										
												8.75					3	John White on account			8.75									
												4.75						Cash sale-cotton seed									4.75			
											738.75						7	Discounted note at bank												
																		90 days at 6%							750.00					
11.25																		Miscellaneous Expenses												
																		(Discount on above note)												
				137.50													8	Alabama Coal Co. - Ck. in					1018	137.50						
																		payment of car of coal												
																		Car No. 1C 110375												
				117.85														M&O Ry. - Ft on coal					1019	117.85						
				70.00													9	Texas Oil Co. - 35 gals. oil					1020	70.00						
					22.50												11	Southern Machine Co.					1021	22.50						
																		Repairs on engine & boiler												
						169.25											15	Labor - 1st to 15th												
																		Joe Jackson					1022	48.75						
																		Ira Jones					1023	68.00						
																		Mott White					1024	52.50						
	4.80																19	Office Supplies - Paper												
																		Envelopes				4.80								
																		Ink												
												28.75					20	Ira Jones - on account			28.75									
														11.42			25	Accounts Receivable Control												
																		Bagging & Ties								4.00				
																		Custom Ginning Income											7.42	
								8.02										Cotton Seed Purchases												
							3.00											Seed Cotton Purchases												
																		T.B. Costley on a/c (#3977)			5.71									
																		Ck. for Cotton					1025	5.31						
																		These two entries record												
																		transactions as shown on												
																		Ginning tickets (or register)												
											110.00						26	Deposited in bank				110.00								
11.25	4.80			325.35	22.50	169.25	3.00	8.02			848.75	117.25		11.42						75.00	43.21	114.80		522.41	750.00	4.00	4.75		7.42	

drawals column from the footing of the bank deposits column. The balance thus forwarded must be deducted from the total of the column before posting is made to the general ledger at the end of the month.

General ledger.—This column is used for all items to be posted to the debit of the accounts in the general ledger, and for which no special columns have been provided. Posting should be made in detail from the column to the proper accounts in the general ledger.

Ginning ledger (accounts receivable).—In the ginning ledger column are entered all charges for ginning as they are recorded in the ginning register and all charges for sales of material on account. All detail postings are made from the register to the ginning ledger and only the total charges are posted once a month or at the end of the season into the accounts receivable control account on the general ledger.

Notes payable.—In this column are entered payments on written obligations, such as notes, mortgages, drafts, etc.

Bagging and ties purchases.—In this column are entered amounts paid for all purchases of bagging and ties which are to be used in the ginning operations.

Cotton seed purchased.—In this column are entered all amounts paid for cotton seed purchased.

Operating expense columns.—In these columns are entered payments for the various charges indicated by the column caption.

Other columns are operated in a similar manner to those which have been mentioned.

CREDIT COLUMNS.

Cash.—The cash column carries all items of cash of whatever nature which are disbursed by the organization, either for petty expenditures or to be deposited in the bank. It should be a strict rule that all cash receipts are to be deposited in the bank when it is possible to do so. It is sometimes found inexpedient to adhere to this rule, and for that reason a cash column on the credit side of the journal has been provided. Where a petty cash fund is in use, the credit cash column need not be used.

General and ginning ledgers.—These columns serve the same purposes on the credit side as were explained on the debit side, the postings in this instance being made to the credit side of the ledger accounts.

Notes payable.—In this column are entered loans and renewals for which written obligations have been given.

Cottonseed sales, custom ginning income.—The entries into these and other columns not specifically mentioned are items which fall under the respective captions, and are similar in operations to those described.

Blank columns are provided for accounts having frequent entries.

The General Ledger.

The general ledger is the book of accounts and is the most important book for the use of the manager when seeking information. In it should be found all accounts which relate to the financial side of the business. From these accounts it should be possible to obtain all financial information desired, without reference to the records in which the entries are first made.

No form is shown for this book, inasmuch as a stock form which will be entirely satisfactory and less expensive can be found at most stationery stores. A loose-leaf ledger will be found much more satisfactory, and, in the end, cheaper than the old-fashioned bound book.

OFFICE EQUIPMENT.

It is of great importance to have proper office equipment. Nothing discredits a business establishment more quickly in the eyes of the public than slovenly appearance of the premises, and particularly an office littered with all kinds of rubbish and devoid of every convenience and comfort.

It should be emphasized that no great amount of money is required to keep the litter off the desk and counters and the cobwebs off the shelves. Many valuable conveniences can be improvised by the progressive bookkeeper and manager, and a duster costs practically nothing.

The first step in organizing any office, simple or complex, is to get things off the desks and counters completely, at least once a day. This means filing; it means keeping only things that are useful—papers, documents, books; it means continually applying the old adage, "A place for everything and everything in its place."

Failure to file and index papers and material which are frequently referred to causes an enormous waste of time. Such failure, generally, is due not to ignorance of proper method, but to a lack of the application of common sense. Anyone can use a dictionary or a telephone directory. There are no better models of good indexing. If drawers become numerous, number them and index the contents, thus saving the time and annoyance of frequent hunting for misplaced things.

FILING.

This investigation showed that there is great laxity in handling the papers in the average ginnery. It is, therefore, suggested that wherever practicable a suitable vertical file be provided. Where the volume of papers is considerable, the numerical file will be found convenient and a suitable card index should be used to locate the individual files. In filing vouchers, or any evidence of cash payment, it is suggested that the vouchers be numbered the same as the checks, and that all papers pertaining to each payment be filed with the canceled check.

APPENDIX.

[How to keep the necessary accounts, close the books at the end of the year, prepare the annual reports, etc..

LEDGER ACCOUNTS TO USE.

No matter what forms are used in recording the transactions, unless the financial facts are recorded in a uniform manner, under uniform account-captions, a uniform system of accounting can not be said to exist. The use of a uniform system of accounting and reporting by the ginning industry as a whole makes possible the exchange of data regarding business operations which is of great value as a guide to efficient operation. Furthermore, the attitudes of banks toward the extension of credit is influenced by the clarity of the reports submitted in support of an application for a loan, and by the ease with which the financial condition and progress of the organization can be ascertained from such reports. It is with the aim of assisting in this highly important work of unification that a classification of general ledger accounts is presented herein.

On pages 21 to 35, following, is described the detail operation of the general ledger accounts which it is believed will be found desirable for use in the average cotton ginnery. Some organizations will not need all of these accounts, while others will wish to have additional ones to show certain special features of their operations.

The accounts hereinafter described are so arranged that a monthly income and expense statement can be prepared with a minimum of work and without closing the books. The combination of letter and number shown at the right of the account title should be used as the number (page) of the account in the ledger. This plan of numbering permits the insertion of additional accounts without disturbing the relative position of those already in use. The plan is a decided aid to the preparation of monthly and annual statements. In the discussion of ledger accounts the term "fiscal period" means the financial or other operating period as distinguished from the calendar periods; the term "at the opening of the books" means the time of installation of a new system of accounts.

OPENING THE BOOKS.

In order to open the accounts, it is necessary to take a physical inventory of all assets and to take into consideration all liabilities of the concern. These should be arranged in the form known as a balance sheet, with assets on the left and liabilities on the right. (See illustration on page 4.) The difference between the total assets and total liabilities will represent the net worth, either as capital stock, surplus, or deficit. These accounts are described at length under their respective captions. The assets should be arranged in the order of their probable cash realization and the liabilities in the order of their probable priority as to liquidation.

The items appearing in the balance sheet should then be entered in the cash journal, the amount of each item being posted from the cash journal to the proper ledger account. As succeeding transactions are classified, entered in the journal, and posted to the proper ledger accounts, the ledger will contain a summary of the financial facts of the business, arranged under their proper designation, each summary being known in bookkeeping as an account.

CHART OF LEDGER ACCOUNTS FOR COTTON GINNERIES.

Balance Sheet Accounts (Nos. A to I, inclusive).

ASSETS.

LIABILITIES, RESERVES, AND NET WORTH.

Income and expense accounts (Nos. A to P, inclusive).

Operation of Ledger Accounts.

A. CURRENT ASSETS.

Cash on Hand (A1).

Debit:	Credit:
1. With the total of undeposited checks and cash on hand in the office as shown by the balance sheet at the time of opening the books. 2. With the total cash received during the current period.	1. With the total cash receipts deposited in bank (at this time, debit cash in bank account). 2. With the total cash disbursed direct from the office during the current period.

The original amounts which are finally entered in this account are found in the cash receipts book (Form 4), the totals of which are recorded daily in the cash journal (Form 5) where the amounts are distributed to the proper columns.

Cash in Bank (A2).

Debit:	Credit:
1. With the balance in the bank as shown by the balance sheet at the time of opening the books. 2. With the total of all deposits during the period. 3. With interest credited by the bank.	1. With the amount of overdraft as shown by the balance sheet at the time of opening the books. 2. With the total of all amounts disbursed by check during the period. 3. With interest charged by the bank on overdraft.

This account will appear in the ledger under the name of the bank and should be debited with the amount of cash on deposit at the beginning of the period. This balance is determined by taking the balance rendered by the bank and deducting therefrom the total of all outstanding on uncanceled checks. Normally the balance shown by the bank will be in excess of that shown by the records of the organization.

Debits and credits to this account for interest receipts and payments and exchange charges will arise from debit and credit memoranda submitted by the bank at the time of rendering its statement.

Notes Receivable (A3).

Debit:	Credit:
1. With the face value of notes of others on hand as shown by the balance sheet at the time of opening the books. 2. With the face value of the notes received during the period.	1. With amounts paid on notes by their makers, settlements made in any other manner or amounts charged to reserve for doubtful accounts as uncollectible.

It is sometimes the practice to allow customers to make settlement of their accounts with a note. In such instances the face value of the note should be charged to this account and credited to the customer's account in the ginning (accounts receivable) ledger. If these notes are discounted at the bank before maturity this account would be credited with the face value of the note, charge being made to the bank for the proceeds, and to miscellaneous expense for the discount.

ACCOUNTS RECEIVABLE CONTROL (A4).

Debit:	Credit:
1. With the total charged to individual accounts as shown by the balance sheet at the time of opening the books. 2. With the monthly totals of the charge sales as shown by the debit ginning ledger column in the cash journal.	1. With the monthly totals of collections on account, as shown by the credit ginning ledger column in the cash journal. 2. With any other credits to customer's accounts, including the writing off of uncollectible accounts. (See Reserve for bad debts.)

The debit balance of this account must equal the net total of the balances of customer's accounts as shown by a summary of the ginning ledger.

The postings to this account are the monthly totals of the ginning ledger columns in the cash journal.

INVENTORY (A5).

Debit:	Credit:
1. With cost value of all salable merchandise and operating supplies on hand as shown by the balance sheet at the time of opening the books. 2. At the close of each fiscal period with the cost value of all salable merchandise and operating supplies on hand as per inventory. (Credit the various purchase accounts.)	1. At the beginning of each fiscal period with the cost value of all salable merchandise and operating supplies on hand. (Debit the various purchase accounts.)

The balance of this account will represent the value of salable merchandise and operating supplies on hand at the end of the previous fiscal period. (See discussion of inventory on page 37.)

B. FIXED ASSETS.

LAND (B1).

Debit:	Credit:
1. With the cost of the land owned as shown by the balance sheet at the time of opening the books. 2. With any subsequent purchases of land. 3. With the cost of any permanent improvement, such as sewers, water, mains, etc.	1. With the cost of any land sold.

If any land is sold at a price in excess of its cost, such excess should be credited to surplus.

BUILDINGS (B2).

Debit:	Credit:
1. With the cost of the buildings as shown by the balance sheet at the time of opening the books. 2. With the cost of all new constructions. 3. With the cost of all additions or alterations when such cost increases the utility. 4. With the cost of replacements in excess of the cost of the part replaced.	1. With the total cost of any buildings sold. 2. With the cost of parts of buildings destroyed or replaced. (Debit Reserve for depreciation on buildings.)

See Reserve for depreciation on buildings.

As the land and buildings are frequently purchased at the same time, the purchase price will include both assets. Care must be exercised that a proper division of these assets is made, as depreciation is to be figured only upon the buildings.

MACHINERY AND EQUIPMENT (B3).

Debit:	Credit:
1. With the original cost of the machinery and equipment as shown by the balance sheet at the time of opening the books. 2. With the cost of subsequent purchases of machinery and equipment including freight or express on same, installation, etc. 3. With the cost of alterations and improvements increasing the efficiency or the capacity of the plant.	1. With the cost value of machinery or equipment sold, discarded, or destroyed, at which time debit Cash account for the amount realized, if any, and debit Reserve for depreciation on machinery and equipment for the difference between the cost value and the amount realized.

The balance of this account represents the cost of machinery and equipment in use.

This account should be charged with the costs of all items of machinery and equipment which, under ordinary circumstances, will last three years or more, such as engines, boilers, motors, etc. When any article which has been charged to this account is to be replaced the asset account should be credited with the cost value placed on this item at the time of opening the books or at the time of purchase. Example: A piece of machinery costing $100 was replaced by a new one costing $150, cash being paid for the new article, the following journal entry would be made:

Debit.		*Credit.*
$100	Reserve for depreciation on machinery and equipment.	
	Machinery and equipment............................	$100
	(For discarded machine costing $100.)	
150	Machinery and equipment.	
	Bank account..	150
	(For purchase of new machine.)	

To the invoice value of any machinery purchased should be added any expense incurred, such as freight or installation charged. In case the amount set aside as reserve for depreciation is not sufficient to cover the original cost of the item replaced, the loss sustained should be charged to an account specifically captioned.

Example: A boiler costing $150 was completely destroyed by an explosion. At the time the account "Reserve for depreciation on machinery and equipment" shows a credit balance of $100. It was necessary to pay $200 for a similar boiler. The following journal entries should be made:

Debit.		*Credit.*
$50	Reserve for depreciation on machinery and equipment.	
100	Loss, boiler explosion.	
	Machinery and equipment	$150
	(For loss on machinery and equipment due to explosion.)	
200	Machinery and equipment.	
	Bank account	200
	(For purchase of new boiler.)	

In the above entries it should be carefully noted that the full amount set aside as a "Reserve for depreciation on machinery and equipment" has not been entirely exhausted by this loss, inasmuch as this fund is set aside to cover depreciation on all the machinery and equipment, and only the relative proportion applying to the boiler can be charged to the reserve account.

The account "Loss, boiler explosion" should be periodically reduced by the following entry:

Debit.		*Credit.*
$10	Expense, boiler explosion.	
	Loss, boiler explosion	$10
	(For periodical charge to amortize loss due to explosion.)	

The acccunt "Expense, boiler explosion" should be carried to Profit and loss account at the close of the fiscal year.

Office Furniture and Equipment (B4).

Debit:	Credit:
1. With the original cost of office furniture and equipment as shown by the balance sheet at the time of opening the books. 2. With the cost of additional equipment purchased, including transportation, installation, etc.	1. With the cost of any item sold, discarded, or destroyed. (See credit under Machinery and equipment.)

This account should include such articles as desks, filing cases, adding machines, typewriters, ledger, journal binders, etc. In other words, those articles which should last for an indefinite period of time.

D. ACCOUNTS PAID IN ADVANCE.

Prepaid Insurance (D1).

Debit:	Credit:
1. With the amount of unexpired insurance premiums as shown by the balance sheet at the time of opening the books. 2. With insurance premiums paid. (Credit Bank account.)	1. At the close of a fiscal period with the insurance premiums expired during the period. (Debit Insurance expense.) 2. With refunds on canceled policies.

The debit balance of this account is an asset and should be shown on the balance sheet.

Usually policies run for a year or more and are paid for in advance. This payment is charged to the "Prepaid insurance" account and represents an asset value. This amount is reduced periodically by a charge to "Insurance expense," the credit being carried to the "Prepaid insurance" account.

F. CURRENT LIABILITIES.

Notes Payable (F1).

Debit:	Credit:
1. With amounts paid on outstanding notes. 2. With the unpaid portion of old notes canceled by renewal.	1. With the balance of outstanding notes as shown by the balance sheet at the time of opening the books. 2. With all new notes issued, including renewals of old notes.

Should a note be renewed, thus in effect giving a new note for the old note, debit this account for the face value of the old note, and credit the account with the amount of the new note.

A careful record should be maintained of all notes given, showing date issued, to whom, due date, and rate of interest.

Accounts Payable (F2).

Debit:	Credit:
1. With payments on account. 2. With purchased goods returned for credit. 3. With allowances and refunds on purchases.	1. With amounts due creditors on open accounts at the time of opening the books as shown by the balance sheet. 2. With the invoice value of merchandise purchased on credit.

When the invoice has been credited to accounts payable the check given in payment of same must be charged to accounts payable. As the canceled check is a sufficient receipt, it is suggested that invoices be stamped "Paid ...., 19..," and filed alphabetically for future reference.

A method much to be preferred to that just described, especially for the larger organizations, is the use of a voucher payable register, description of which may be found in most books on accounting.

Care must be exercised when entering checks to ascertain whether they should be charged to accounts payable when goods are purchased on credit, or to an inventory or expense account when goods are purchased for cash.

Separate accounts should be opened for firms with which a credit business is conducted currently.

It is not the intention to carry individual ledger accounts with all the various creditors because in many cases only a single purchase will be made from one concern and practically all invoices will be paid during the period.

Dividends Payable (F3).

Debit:	Credit:
1. At the time of payment with the total of checks paid to the stockholders as dividends.	1. At the close of the period with the annual dividend payable to the stockholders. (Debit Surplus account).

G. ACCRUED LIABILITIES.

Pay-roll Account (G1).

Debit:	Credit:
1. With all amounts paid to employees for services, including advances made in cash.	1. With the amount of unpaid labor as shown by the balance sheet at the time of opening the books. 2. With the amount of the pay roll, as shown by the time sheet at the close of the period. (Debit Salaries and labor).

It is necessary to include all employees on the pay roll, regardless of the department in which employed. The following journal entry will serve to illustrate the operation of this account and would be made at the end of each period. Example: The entire pay roll is $400 and $20 had been advanced during the period:

JOURNAL ENTRIES.

Debit.		*Credit.*
$135.00	Factory labor.	
265.00	Office labor.	
	Pay roll	$400.00
	(For periodical pay roll.)	
380.00	Pay roll.	
	Bank account	380.00
	(For payment of periodical pay roll.)	

Inasmuch as the $20 has been charged to the Pay-roll account at the time the advance was made, it is evident that the credit of $380 to the bank account will close the Pay-roll account.

Occasionally an employee may desire an advance on his labor account in which case Pay-roll account should be debited for the amount advanced. It is not considered advisable to carry ledger accounts with employees because of cash advances, but very careful note should be made of such advances to prevent duplicating the payment.

Should an employee purchase merchandise, such sales should be charged to his personal account. At the end of the period, or whenever the pay roll is made up, a check should be drawn in favor of the employee for the full amount of his wages. The employee should then settle his account in the regular way. By following this procedure the records will reflect clearly the transactions involved.

The following journal entry will illustrate this procedure:

Debit.		*Credit.*
$8.50	John Jones.	
	Merchandise sales	$8.50
	(For sale of merchandise to John Jones, employee.)	

John Jones would then receive his entire wages and would settle for his account by the following transactions:

Debit.		*Credit.*
$8.50	Cash.	
	John Jones	$8.50
	(For payment of John Jones account.)	

Accrued Taxes and Rent (G2).

Debit:	Credit:
1. At the beginning of the fiscal period with the credit balance. (Credit Taxes, account O4, and rent, account O3.)	1. With the amount of accrued rent and taxes as shown by the balance sheet at the time of opening the books. 2. With the amount of accrued rent and taxes at the end of the fiscal period. (Debit corresponding expense account.)

This account should be entered only State and local taxes and rents. Income taxes must not be charged here, but should be charged to surplus.

H. RESERVES.

Reserve for Depreciation, Buildings (H1).

Debit:	Credit:
1. With the cost or book value of entire buildings or parts of buildings discarded or destroyed. (Credit Buildings.)	1. With the amount reserved as accumulated depreciation on buildings as shown by the balance sheet at the time of opening the books. 2. At the end of the fiscal period with the estimated amount of depreciation. (Debit Depreciation of plant.)

Where an entire roof, floor, or other part of a building is renewed, the original cost of the renewed part should be charged to this account, and the cost of the renewal to the Buildings account. Fireproof buildings of modern construction should be depreciated from 1 to 2 per cent annually and frame structure from 3 to 5 per cent.

Reserve for Depreciation, Machinery and Equipment (H2).

Debit:	Credit:
1. With the cost or book value of machinery or equipment *destroyed* or *discarded.* (Credit Machinery and equipment.) 2. With the difference between the cost value and amount realized from items *sold.* (Credit Machinery and equipment.)	1. With the amount reserved as accumulated depreciation on machinery and equipment as shown by the balance sheet at the time of opening the books. 2. With the estimated amount of depreciation at the end of the fiscal period. (Debit Depreciation on plant.) 3. With any amounts realized on sales of machinery and equipment which have previously been charged to this account.

Owing to the conditions existing in some types of plants, because of the peculiar nature of the work involved, the wear and tear of machinery and equipment is excessive. Special consideration should be given to these plant conditions in order that adequate reserves for depreciation may be provided. Further discussion will be found under "Machinery and equipment."

Reserve for Depreciation, Office Furniture, and Equipment (H3).

Debit:	Credit:
1. With the cost or book value of items *destroyed* or *discarded.* (Credit Office furniture and equipment.) 2. With the difference between cost and amount realized from items *sold.* (Credit Office furniture and equipment.)	1. With the amount reserved as accumulated depreciation on Furniture and equipment as shown by the balance sheet at the time of opening the books. 2. With the estimated amount of depreciation at the close of the fiscal period. (Debit Depreciation on plant.) 3. With any amounts realized on sales of items which have previously been charged to this account.

RESERVE FOR DOUBTFUL ACCOUNTS (H4).

Debit:	Credit:
1. With the amount of outstanding accounts found to be uncollectible. (Credit accounts receivable.)	1. With the amount reserved as accumulated losses not charged off as shown by the balance sheet at the time of opening the books. 2. With an amount estimated to cover the probable losses due to uncollectible accounts during the fiscal period. (Debit loss from bad accounts.)

Any collections made on accounts which have previously been charged off as worthless should be credited to this account.

I. NET WORTH.

CAPITAL STOCK (I1).

Debit:	Credit:
1. With the par value of shares retired or canceled.	1. With the par value of all shares issued as shown by the balance sheet at the time of opening the books. 2. With the par value of all shares sold subsequently.

The capital stock of a corporation is divided into shares, each share usually having a designated par value. These shares may be transferred from one individual to another without affecting the capital of the corporation. The ownership of a share of capital stock is evidenced by a stock certificate.

In organizing a corporation, a subscription list should first be prepared, the signers of which by law bind themselves to purchase the number of shares subscribed. No certificate of stock should be delivered to a stockholder until his subscription has been fully paid. Until such payment is made a temporary certificate may be given to the subscriber to be exchanged for the regular stock certificate on completion of payment.

When a subscription list has been prepared and the corporation formed on this basis, it is often provided that the subscription may be paid in installments. It is not desirable to credit these partial payments direct to the capital stock account. In view of this, when the subscription list has been completed an entry should be made debiting "Subscription account" and crediting "Capital stock" account for the amount subscribed. When payments of the subscription are made, either by cash or note, in full or in part, these payments should be credited to "Subscription account" and not to "Capital stock" account. The following entries will illustrate:

Debit.		*Credit.*
$10,000.00	Subscription account.	
	Capital stock	$10,000.00

For subscriptions shown on subscription list No. 1.

Debit.		*Credit.*
$4,000.00	Cash.	
1,000.00	Notes receivable.	
	Subscription account	$5,000.00

50 per cent payment of the following subscriptions:
(List those making payment.)

In case the entire capital stock is paid at one time, the following method might be used.

Entries to illustrate issue of capital stock and payment thereof:

Debit.		*Credit.*
$8,000.00	Cash.	
2,000.00	Notes receivable.	
	Capital stock	$10,000.00
	Representing payment of capital stock issued to the following:	

It sometimes happens that shares of stock are acquired or sold for more or less than the par value. and in such cases the premium or discount should be charged or credited as the case may be to "Premium and discount on capital stock" account.

For example, if a going concern desires to sell additional shares, the shares being above par in value, an entry should be made as follows:

Debit.		*Credit.*
$105.00	Cash.	
	Capital stock	$100.00
	Premium and discount on capital stock	5.00
	(For sale of one share of stock at $5 premium.)	

Likewise, if shares were sold at a discount, there would be a debit to premium and discount on capital stock.

The balance in this account is sometimes written off by periodical charges to the surplus account. If preferred, the entry may be made direct to surplus instead of opening the account premium and discount on capital stock.

It occasionally happens that capital stock is offered for sale and is purchased by the organization, to be held for resale at some future date. While this may seem to be in the nature of a retirement of the capital stocks so purchased, and as such should be charged to the capital stock account, accountants generally have preferred to treat this transaction differently, and charge a purchase made in this manner to an account called "Treasury stock." In case the purchase was made at par, the entry should be:

Debit.		*Credit.*
$100.00	Treasury stock.	
	Cash	$100.00
	(For purchase of one share of stock from Chas. Brown.)	

When treasury stock is sold, the total amount received from such sale should be credited to the treasury stock account.

It should be remembered, however, that it is not incorrect to charge par value of the stock thus purchased to capital stock, but it is not recommended.

In case the organization is not a corporation, but a partnership, sole ownership, or association, the capital stock account would be replaced by accounts indicating the ownership, or membership.

SURPLUS (12).

Debit:	Credit:
1. With the amount of dividends declared by the board of directors. (Credit Dividend account.)	1. With the amount of surplus as shown by the balance sheet at the time of opening the books.
2. With any net loss at the end of a fiscal period as shown by a debit balance of the Loss and gain account. (Credit Loss and gain.)	2. With the amount of net gain at the end of each fiscal period, as shown by a credit balance of the Loss gain account. (Debit Loss and gain.)
3. With adjustments decreasing the profits of a previous fiscal period.[1]	3. With adjustments increasing the profits of a previous period.[1]
4. With the amount of income and excess-profits taxes paid.	
5. With any appropriation of surplus made by the directors.	

In case the liabilities and outstanding capital stock exceed the total assets at the time of opening the books, the entry to this account will be a debit and will indicate a deficit. The same will be true if, at any future time, this account has a debit balance.

[1] Errors and omissions are often found which apply to a previous fiscal period. Adjustment of such items will be made through the Surplus account as indicated.

When the opening balance sheet shows the liabilities, capital stock, and accumulated reserves to be in excess of the total assets, including good will, the surplus account will show a debit balance. When this is the case, it is evident that there has been a loss due to operation which in reality amounts to an impairment of capital. The amount of such debit balance should be debited to an account captioned "Deficit." At the close of each following fiscal year the Loss and gain account should be closed into this account until the deficit is written off.

The Deficit account is in reality the debit side of the Surplus account, but should be carried under a distinctive caption. For example, if there is no surplus and a loss is sustained during the year, the loss shown by the debit balance of the Loss and gain account is an impairment of the capital and should be carried to the deficit account by the following journal entry:

Debit.		*Credit.*
$1,500.00	Deficit.	
	Loss and gain	$1,500.00
	(To close Loss and gain into Deficit account.)	

If the company makes a net profit of $2,000 during the succeeding year, the journal entry will be as follows:

Debit.		*Credit.*
$2,000.00	Loss and gain.	
	Deficit	$1,500.00
	Surplus	500.00
	(To close the Deficit and Loss and gain account.)	

LOSS AND GAIN (I3).

Debit:	Credit:
1. At the end of the fiscal year with any debit balances of income accounts (showing losses) and with the debit balances of the Expense accounts.[2] (At this time credit such accounts.)	1. With the credit balances of all income accounts at the close of the fiscal period.[1] (Debit Income accounts.) 2. With the amount charged to ginning seed-cotton purchases as cost of ginning such cotton. (See account P1*a*.)

At the end of the fiscal period, if the credits to this account exceed the debits, a net gain is shown; but if the debits exceed the credits a net loss has resulted from the year's operations. This account will be closed by a debit or credit, as the case may be, to Surplus account.

K. GINNING INCOME.

CUSTOM GINNING INCOME (K1).

Debit:	Credit:
1. With the credit balance at the end of the current period. (Credit Loss and gain.)	1. With the total of the "Ginning charges" during the period.

This account shows the earning from the ginning of cotton for patrons, usually called custom ginning.

[1] See accounts under Income accounts in the classification.
[2] See accounts under Expense accounts in the classification.

L. TRADING INCOME.

Cottonseed Sales (L1).

Debit:	Credit:
1. With the sale value of any cottonseed which has been recorded as sold, but which has been subsequently returned. 2. With the credit balance at the end of the fiscal period. (Credit Loss and gain.)	1. With the sale value of all cottonseed sold. (Debit Accounts receivable or Cash accounts.)

The sale of all cottonseed must be credited to this account.

Cotton Sales (L2).

Debit:	Credit:
1. With the sale value of any cotton which has been recorded as sold but which has been subsequently returned. 2. With the credit balance at the end of the fiscal period. (Credit Loss and gain.)	1. With the sale value of all cotton sold. (Debit Accounts receivable or Cash account.)

The sale of all ginned cotton must be credited to this account in order that the true relation existing between the trading and ginning operation may be determined.

Bagging and Ties Sales (L3).

Debit:	Credit:
1. With the sale value of any goods which have been recorded as sold, but which have been subsequently returned. 2. With the credit balance at the end of the fiscal period. (Credit Loss and gain.)	1. With the value of bagging and ties used in ginning operations and charged to customers as a part of the charge made for ginning. 2. With the sale value of bagging and ties used in ginning purchased seed cotton. 3. With the sale value of any bagging and ties sold direct and not consumed in the ginning process.

All bagging and ties used in any of the ginning operations, or sold to outsiders must be accounted for by a credit to this account. In no other way can a proper relation between the ginning and trading operations be maintained. It is absolutely necessary to establish such a relation, if the unit cost of ginning is to be ascertained, and the adequacy of the charge made for ginning to be determined.

M. MISCELLANEOUS INCOME.

Cash Discount (M1).

Debit:	Credit:
With the credit balance at the close of the fiscal year. (Credit Loss and and gain.)	With any income arising from cash discounts deducted from invoices paid.

N. GINNING EXPENSE, OPERATING.

Salaries and Labor Expense (N1).

Debit:	Credit:
With the amount actually earned for the period by all factory employees as shown by the time sheet. (Credit Pay roll account.)	With the debit balance at the close of the fiscal year. (Debit Loss and gain.)

It will be noticed that this account is not charged with *advances* to employees not with the amount *paid* to employees, but with the amount actually *earned* during the period. All payments, of whatever nature, are charged to Pay roll account. (See p. 26.)

Power Expense (N2).

Debit:	Credit:
1. With the cost of all material of every nature used as fuel in producing power. 2. With the cost of electricity used for light or power. 3. With the cost of water used in making steam power.	1. With the debit balance at the end of the fiscal period. (Debit Loss and gain.)

All expenditures except for labor and for repairs to boilers, which are made directly with the aim of producing power, must be charged to this account.

Repairs (N3).

Debit:	Credit:
1. With the cost of repairs and renewals which are necessary to maintain the efficiency of the plant but which do not add to its original value.	1. With the debit balance at the close of the fiscal period. (Debit Loss and gain.)

This account takes care of such items as a broken window pane or a new plank in the approach. Where an entire piece of equipment is replaced, the old piece should be charged to Reserve for depreciation and the new one charged to Machinery and equipment, Buildings, or Office furniture and equipment, as explained under those accounts.

Depreciation (N4).

Debit:	Credit:
1. With the amounts reserved out of the profits of each fiscal period to cover loss from wear, tear, and obsolescence of office furniture and equipment, machinery and equipment, and buildings. (Credit the corresponding reserve accounts.)	1. With the debit balance at the close of the fiscal period. (Debit Loss and gain.)

OPERATING SUPPLIES (N5).

Debit:	Credit:
1. With the cost of all supplies used in the current operation of the gin.	1. With the debit balance at the close of the fiscal period. (Debit Loss and gain.)

Operating supplies include such items as lubricating oils and greases, waste, etc., but do not include any item of repairs, or office supplies.

INSURANCE (N6).

Debit:	Credit:
1. At the close of the fiscal period with the insurance premiums expired during the period. (Credit Prepaid insurance.)	1. With the debit balance at the close of the fiscal period. (Debit Loss and gain.)

O. ADMINISTRATIVE EXPENSE.

OFFICE SUPPLIES (O1).

Debit:	Credit:
1. With all purchases of stationery, printing and supplies used in the office.	1. With the debit balance at the end of the fiscal period. (Debit Loss and gain.)

Should there be any considerable quantity of these supplies on hand at the end of the fiscal year, the value should be conservatively estimated and an entry made, charging an asset account captioned "Office supplies, inventory," and crediting this account. The asset should be shown on the balance sheet under accounts paid in advance.

TELEGRAPH, TELEPHONE, AND POSTAGE (O2).

Debit:	Credit:
1. With all payments for these items.	1. With the debit balance at the end of the fiscal period. (Debit Loss and gain.)

RENT (O3).

Debit:	Credit:
1. With the actual payments made on account of rent. 2. With accrued rent at the close of the fiscal period. (Credit Accrued rent and taxes.)	1. At the beginning of the fiscal period with the accrued rent at the close of the previous fiscal period. (Debit Accrued rent and taxes.) 2. With the debit balance at the end of the fiscal period. (Debit Loss and gain.)

No economic or theoretical rent should in any case be entered into this account.

TAXES (O4).

Debit:	Credit:
1. With the payments of all taxes (except income taxes). 2. With accrued taxes at the close of the fiscal period. (Credit Accrued rent and taxes.)	1. At the beginning of the fiscal period with the accrued taxes at the close of the previous fiscal period. (Debit Accrued rent and taxes.) 2. With the debit balance at the end of the fiscal period. (Debit Loss and gain.)

It should be noted that income taxes must not be charged to this account, but to Surplus.

LOSS FROM BAD ACCOUNTS (O5).

Debit:	Credit:
1. With the amounts reserved out of the profits to cover the probable loss from bad debts. (Credit Reserve for bad debts.)	1. With the debit balance at the close of the fiscal period. (Debit Loss and gain.)

MISCELLANEOUS EXPENSE (O6).

Debit:	Credit:
1. With the cost of any items of expense not chargeable to any other account.	1. With the debit balance at the close of the fiscal year. (Debit Loss and gain.)

To this account should be charged such expenses as donations to charitable organizations or any other expense that can not properly be charged to any of the other accounts.

P. TRADING ACCOUNTS.

SEED-COTTON PURCHASES (P1).

Debit:	Credit:
1. With the value of purchased seed cotton on hand at the beginning of the fiscal period. (Credit Inventory, account No. A5.) 2. With the cost of any seed cotton purchased.	1. With the value of the inventory of purchased seed cotton on hand at the end of the fiscal period. (Debit Inventory, account No. A5). 2. With the debit balance at the close of the fiscal period. (Debit Loss and gain.)

To the cost of purchasing seed cotton must be added the cost of ginning and baling it, in order to learn its total cost.

GINNING PURCHASED SEED COTTON (P1A).

Debit:	Credit:
1. With the cost of ginning purchased seed cotton. (Credit Loss and gain, account No. 13.) 2. With the cost of bagging and ties used in baling purchased seed cotton. (Credit Bagging and ties sales.)	1. With the debit balance at the end of the fiscal period. (Debit Loss and gain.)

Great care should be used that all charges incurred in ginning purchased seed cotton have been made in this account before it is closed into Loss and gain account. The cost of ginning seed cotton purchased must be charged to this account in order that the Income and expense statement may show the true results of the operations, including the handling of cotton.

This is sometimes done by crediting an income account with the amount which would have been received had all cotton been ginned for customers. This practice is entirely incorrect and has little if any justification. It is, therefore, to be avoided in every case, and a more nearly correct method, as described below, should be used.

To ascertain the cost of ginning seed-cotton purchases, the total of the items appearing on the Income and expense statement (see page 6) should be ascertained by filling in these items from the ledger accounts (accounts N1 to O6, inclusive). This amount is then divided by the total number of bales handled (including the number ginned from seed-cotton purchases), thus arriving at the unit cost per bale. The unit cost thus obtained is now multiplied by the total number of bales of seed-cotton purchases ginned, which will give the cost of ginning purchased seed cotton. Illustration:

Total number bales ginned	1,000
Total number bales ginned (seed cotton purchased)	150
Total ginning expense	\$2,950.00
Total ginning cost per bale (\$2,950÷1,000)	\$2.95
Cost ginning seed cotton purchased (\$2.95×150)	\$442.50

Using the figure thus obtained, an entry is made as shown on page 38.

The amount of this entry is then entered on the Income and expense statement and on the Cost and income analysis in the space provided.

COTTONSEED PURCHASES (P2).

Debit:	Credit:
1. With the value of cottonseed on hand at the beginning of the fiscal period. (Credit Inventory, account No. A5.) 2. With the cost of all cottonseed purchased.	1. With the value of the cottonseed on hand at the end of the fiscal period. (Debit Inventory, account No. A5.) 2. With the debit balance at the end of the fiscal period. (Debit Loss and gain.)

COTTON PURCHASES (P3).

Debit:	Credit:
1. With the value of cotton on hand at the beginning of the fiscal period. (Credit Inventory, account No. A5.) 2. With the cost of any cotton purchased.	1. With the value of the cotton on hand at the end of the fiscal period. (Debit Inventory, account No. A5.) 2. With the debit balance at the end of the fiscal period. (Debit Loss and gain.)

BAGGING AND TIES PURCHASES (P4).

Debit:	Credit:
1. With the value of bagging and ties on hand at the beginning of the fiscal period. (Credit Inventory, account No. A5.) 2. With all purchases of bagging and ties, including freight and drayage on same.	1. With the value of the bagging and ties on hand at the end of the fiscal period. (Debit Inventory, account No. A5.) 2. With the debit balance at the end of the fiscal period. (Debit Loss and gain.)

THE TRIAL BALANCE.

From the discussion of the journal and the ledger in the preceding entries and also on pages 16 and 18, it will be noted that all entries made in the ledger originated in the journal. Two points, therefore, must be kept constantly in mind, namely: (1) No entries are to be made direct to the ledger, but must be posted from original entries in the journal; (2) the equality of the debits and credits of each page of the various journal forms must be proved before any figures are either carried forward or posted to the ledger. It follows, then, that if the journal pages are proved to be in balance and the entries are correctly posted the ledger also must balance. In order to prove whether or not the equality of the debits and credits has thus been maintained, a trial balance must be taken of the ledger at the end of each month. A trial balance consists of a schedule of the open accounts in the general ledger showing in one column the debit balances and in another column the credit balances of the accounts. The footings of the two columns must be equal. A stock form of trial balance book should be obtained for the permanent preservation of the monthly trial balances.

After the trial balance has been completed it is necessary to "close the books" and to prepare a balance sheet and an income and expense statement in order to ascertain the results of the period's operations and the financial position of the company.

CLOSING THE BOOKS.

By the expression "closing the books" is meant the process of balancing all income and expense accounts by transferring their balances to the loss and gain account. After this has been done, the only open accounts to be found in the ledger are the balance-sheet accounts which represent the assets and liabilities of the company.

Preparatory to closing the books, it will be necessary to make the following schedules:[1]

Seed cotton on hand—unginned	List showing quantity, kind, grade, and price.
Cotton seed on hand	List showing quantity, kind, condition, and price.
Cotton on hand—ginned	List showing quantity, class, grade, and price.
Bagging on hand	List showing quantity and cost.
Ties on hand	List showing quantity and price.
Accrued interest on notes receivable [2]	List by name of drawer, date, time to run, interest rate, and amount of note. (See discussion, p. 21).
Insurance premiums unexpired at the end of the period.	List by policy number, date, property covered, time, and amount of premium unexpired.
Unused stationery and printing	List by quantity, kind, and value. (See account No. O1).
Accrued salaries and wages	List by name, time, and wage rate.
Accrued rent and taxes	List by name, time, and rate.
Accrued interest on notes payable [2]	List by name of payee, date, time to run, interest rate, amount of note.

[1] These schedules are called "inventories."

[2] In some cases there may be some notes receivable on hand, or notes payable outstanding. It is then necessary to compute the accrued interest on each class, and open two new accounts, captioned, respectively, "Accrued interest on notes receivable" and "Interest accrued on notes payable." The following journal entries would then be made:

000 Interest accrued on notes receivable.
Sundry income 000
To set up as income and asset the earning of interest not yet received in cash.

000 Miscellaneous expense.
Accrued interest on notes payable 000
To place on the books the expense for interest, not yet paid.

Great care must be exercised in inventorying these items as the value of the income and expense statement and the balance sheet depends upon the accuracy of the inventories. This work should always be conducted, or at least directly supervised, by a competent committee of the board of directors if the business is incorporated.

When the above schedules have been completed, extensions made and verified, the following journal entries should be made. The figures in the schedules will be those used for the entries.

(1)

Debit.		*Credit.*
000	Inventory.	
	Seed-cotton purchases	000
	Cottonseed purchases	000
	Cotton purchases	000
	Bagging and ties purchases	000

To place the inventories on the books as an asset.

(2)

Debit.		*Credit.*
000	Insurance.	
	Prepaid insurance	000

To enter in the expense account the amount of insurance premiums expired during the year, and reduce the asset of prepaid insurance to the amount of premiums yet to be exhausted.

(3)

000	Rent.	
000	Taxes.	
	Accrued rent and taxes	000

To set up as expense the portion of these items which apply to the period, and are still unpaid.

(4)

000	Depreciation.	
	Reserve for depreciation, Buildings	000
	Machinery and equipment	000
	Office furniture and equipment	000

To set up the expense for depreciation, and created reserve.

(5)

000	Loss from bad accounts.	
	Reserve for doubtful accounts	000

To set up as expense the estimated loss from bad accounts for the current period, and to create a reserve.

(6)

000	Custom ginning income.	
000	Cottonseed sales.	
000	Cotton sales.	
000	Bagging and ties sales.	
000	Cash discount on purchases.	
	Loss and gain	000

To close the income accounts and transfer gross gains to Loss and gain account.

(7)

000	Loss and gain.	
	Salaries and labor expense	000
	Power expense	000
	Repairs	000
	Depreciation	000
	Operating supplies expense	000
	Insurance	000
	Office supplies	000
	Telegraph, telephone, and postage	000
	Rent paid	000
	Taxes	000
	Loss from bad accounts	000
	Miscellaneous expense	000
	Seed-cotton purchases	000
	Cottonseed purchases	000
	Cotton purchases	000
	Bagging and ties purchases	000

To close the expense accounts and transfer the expenses to the Loss and gain account.

(8)

000	Ginning purchased seed cotton.	
	Loss and gain	000

To charge the former account with the cost of ginning.

PREPARING THE REPORTS.

The above journal entries when posted to the ledger will balance all Income and expense accounts and leave only the Asset and liability accounts open. At this point all the balanced accounts should be ruled with a double red line beneath the footings.

A credit balance on the Loss and gain account represents the net profit for the year, a debit balance represents a loss.

A trial balance ("after closing") should now be taken to prove that the equality of the debits and credits of the ledger accounts has been maintained, after which the preparation of the balance sheet and Income and expense statement may proceed.

In compiling the balance sheet it is necessary only to refer to the ledger accounts and draw off the balances shown in the Asset and liability accounts, entering them as indicated on the form of balance sheet provided herein. The preparation of the Income and expense statement is described on page 5.

It will be noted that while the reserves for depreciation and bad accounts are shown on the ledger as a liability they appear on the balance sheet as a deduction from the assets.

REOPENING THE BOOKS.

After having prepared the balance sheet and Income and expense statement, it is necessary to make certain journal entries in order that the accounts for the succeeding fiscal period may show the true results of the operations. These are as follows:

(1)

Debit.		*Credit.*
000	Seed-cotton purchases.	
000	Cottonseed purchases.	
000	Cotton purchases.	
000	Bagging and ties purchases.	
	Inventory	000

To transfer the inventories on hand to the purchase accounts and close the inventory account.

(2)

000	Accrued rent and taxes.	
	Rent	000
	Taxes	000

To close the accrued account and adjust the debits to the expense accounts.

It will now be possible to proceed with the entries for the new period, and the books will then reflect the correct results of the new period operations.

Bureau of Markets and Crop Estimates—Ginnery System—Form 2. (Duplicate.)

PLACE, *Austin, Tex., Aug. 15, 1920* TICKET NO. *39771*
BLANK GINNING COMPANY. By *J. M. W.*
GINNED FOR *A. B. Castley* DRIVER, *Joe Smith*
OWNER OF FARM..........

Gross........... *3150* lbs.
Tare............. *1550* lbs.
Net.............. *1600* lbs.
Wt. of bale...... *530* lbs.
Wt. of seed..... *1070* lbs.

BALE NO.	BALE MARK	DATE BALE DELIVERED
39771	*A B C*	*Sept. 1, 20.*

Disposition of Seed.					Ginning Charges.				Balance Due.	
Taken.	Bought.	Price.	Amount.	Check No.	B. & T.	Ginning.	Total.	Cash.	Ginner.	Owner.
	1070	*75c*	*8.02*	*1025*	*2.00*	*3.71*	*5.71*	*5.71*		*2.31*

CALCULATIONS.

1,070	*5.30*
75	*70*
5350	*3.7100*
7490	
8.0250	

Bureau of Markets and Crop Estimates—Ginnery System—Form 2. (Duplicate.)

PLACE, *Austin, Texas, 8/25/1920* TICKET NO. *39892*
BLANK GINNING COMPANY. By *J. M. W.*
GINNED FOR *A. B. Castley.* DRIVER, *Joe Smith*
OWNER OF FARM..........

Gross........... *3150* lbs.
Tare............. *1550* lbs.
Net.............. *1600* lbs.
Wt. of bale...... *530* lbs.
Wt. of seed..... *1070* lbs.

BALE NO.	BALE MARK	DATE BALE DELIVERED
39892	*A B C*	*Sept. 1*

	Disposition of Seed.					Ginning Charges.				Balance Due.	
	Taken.	Bought.	Price.	Amount.	Check No.	B. & T.	Ginning.	Total.	Cash.	Ginner.	Owner.
	1070					*2.00*	*3.71*	*5.71*		*5.71*	
Totals forwarded,				*8.02*		*4.00*	*7.42*	*11.42*	*5.71*		

CALCULATIONS.

530
7.0
3.7100

These sample entries show how the ginning tickets should be made up, one for each bale ginned. It should be noted that No. 39771, made out on Form 2*a* (below), contains the same information as the same numbered ticket made out on Form 2. In the case of Form 2*a*, however, the information is transferred into the ginning register, Form 2*b*, and from there posted to the ginning ledger form 3, whereas the information on Form 2 is posted direct to the ledger from the duplicate.

GINNING TICKET NO. *39771.*

BLANK GINNING COMPANY

(Town.) *Austin.* (State.) *Texas.*

Bale No. *39771.* Mark *A. B. C.* Delivered to *Smith.*

Ginned for *A. B. Castley.*

Driver, *Joe Smith.*

Farm of *A. B. Castley.*

SEED COTTON.		(Calculations.)	
Gross	*3,150* lbs.	*1070*	*5.30*
		.75	*.70*
Tare	*1,550* lbs.	*5350*	*3.7100*
Net	*1,600* lbs.	*7490*	
		8.0200	
Weight bale	*530* lbs.	Taken by *Smith.*	
Seed	*1,070* lbs.	Bought $.*75* cwt.	$*8.02*

Ginning at $.*70* per cwt. .... $*3.71*

Bagging and ties *2.00*

Total charges *5.71*

Balance paid to *A. B. Castley.* Ck. No. *1025* *2.31*

(Calculations.)	SEED COTTON BOUGHT.	
1.00	*100* lbs. @ $.*03* per lb	$*3.00*
.03	Plus balance above	*2.31*
3.00		

Paid by Ck. No. *1025* to *A. B. Castley* *5.31*

Not responsible for cotton left on yard.

BLANK GINNING COMPANY,

By *J. M. W.*

Bureau of Markets and Crop Estimates—Ginnery System—Form 2A.

This is to be put up in duplicate or triplicate, depending on whether the State law requires a copy to be furnished to the landlord.

BLANK GINNING COMPANY.

No. *1725.*

ACCOUNT.

Ginning............	8	71
Bagging and Ties...	4	00
Accts. Rec..........	....	....
Notes Rec...........	....	....
Cotton Sold.........	1	75
Cotton Seed........	14	25
Total.........	28	75

Place, *Austin, Tex.* Date, *Aug. 20, 1920*

Received from *Ira Jones*

Twenty-eight Dollars *75* Cents

For *Account in full.*

By J. M. WHITE,

Manager.

Bureauo Markets and Crop Estimate—sGinnery System—Form 4.

39771

NAME *A. B. Castley*

ADDRESS *Austin, Tex., R #1*

39771

○ 39771 ○

NAME *A. B. Castley*

NAME *A. B. Castley*

ADDRESS *Austin Tex. R #1*

U. S. B. M. and C. E. Ginnery System Form No. 1

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1921

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 986

Contribution from the Bureau of Entomology
L. O. HOWARD, Chief

Washington, D. C. December 3, 1921

STUDIES ON THE BIOLOGY AND CONTROL OF CHIGGERS.

By H. E. Ewing, *Specialist in Mites.*

CONTENTS.

INTRODUCTION.

Notwithstanding the obvious economic importance of chiggers, and an almost universal acquaintance with their injury, little has been done in the past to ascertain their habits in nature or to find efficient methods for their control. Because of these facts the writer decided early in the season of 1919, with the approval of Dr. L. O. Howard, Chief of the Bureau of Entomology, to begin a series of experiments and observations on their biology and control. The work was started in June of that year and continued until the fall of 1920. For various reasons it was thought advisable to discontinue the work then for some time, hence the results thus far obtained have been prepared for publication. It is the expectation of the writer, in the near future, not only to complete the life history for at least one of our species, but to give a synopsis of the taxonomy and distribution of the species occurring in the United States.

SPECIES CONCERNED.

Years ago C. V. Riley (*10*)[1] described from this country ("southwestern States") two chigger species under the familiar names of

[1] Reference is made by number (italic) in parentheses to "literature cited," page 19.

55672°—21——1

Leptus americanus and *Leptus irritans.* Although these names have been used frequently in American literature dealing with economic entomology, and the figures of Riley's two species often copied, the present writer is bound to confess that after studying carefully Riley's descriptions and figures and some of his microscope slides (types?) he has been unable to correlate either *americanus* or *irritans* with the two species with which he is familiar. Further than this, it can now be fairly definitely stated that *americanus* is not a species of Trombidiidae at all, but is rather a species of the family Erythraeidae, a group to which the genus Leptus really belongs, as Riley's figure clearly shows. *Leptus irritans* is the larva of a species of Trombidiidae, but the characters given by Riley are not even of generic value; hence it appears that it will never be known certainly what species his *irritans* is.

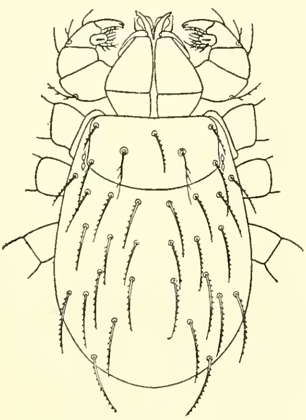

FIG. 1.—Dorsal view of an American chigger (legs omitted), X 150. This drawing was made from specimens in the University of Minnesota collection, which were taken at Lake Minnetonka, Minn.

In New Jersey, Maryland, the District of Columbia, Virginia, and southeastern Iowa there is apparently a single chigger species. The writer has examined many specimens from these sections and finds that they are all the same.

In the northern and western part of the United States there is another very closely related species which has the body shaped exactly like the first mentioned but has more dorsal spines on the abdomen, and fewer branches or barbs on the palpal setæ. This is the species studied by C. W. Howard (*6*). Specimens have been examined from Minnesota and Kansas.

NOTES ON SEASONAL HISTORY.

Chiggers are especially pests of the summer months, as has long been known, but the period of their activity has not been known, even relatively. During the year 1919, at Washington, D. C., the date of the first record of larvæ attaching themselves to man was July 2, and by July 17 larvæ were present in great abundance. On the latter date the writer was severely attacked. During the remainder of July and the whole of August the chigger larvæ continued in great abundance, and almost daily records of their attacks were obtained. In September the attacks were much less severe, yet continued. On September 22 several larvæ attached themselves to man at Chesapeake Beach, Md. No records for the northern part of the United States of chigger attacks in October have been brought to the writer's attention, but some of the larvæ are probably active during this month.

During the season of 1920 the chiggers were first noted in southeastern Iowa on June 24, when several attached themselves at Keosauqua, where they were present in the State park.

How chiggers pass the late fall and winter is not known, and will not be known until more work is done on the life history of the species and something is known of the nymphal and adult instars.

LOCAL DISTRIBUTION.

Investigations of the last year and a half have thrown much light upon the local distribution of our chiggers, which in turn may furnish the clue for locating their natural hosts and thereby give us an opportunity to rear the larvæ to maturity.

Around Washington, D. C., the chiggers usually have been encountered where there was a heavy growth of wild brush or blackberries. They are not found in cultivated fields or where the ground is bare or in well-kept parks and lawns. Usually they are absent from meadows and from weed patches unless some kind of growth of canes or shrubbery is present. They are always encountered to some extent in woodlands, but are present in great numbers only where there is a considerable growth of underbrush.

In the State of Iowa the chiggers have an even more interesting distribution. Here whole counties in the northern part of the State are apparently free from them notwithstanding that conditions for them seem ideal. The writer has collected mites for years about Ames, Iowa, and on many occasions has made special trips in search of chiggers, but has never found a single specimen in this locality. Yet the town of Ames is almost surrounded by woods and hemmed in by two creeks, and there are situations almost exactly like those along the lower Des Moines River, where chiggers are abundant.

Judging from the records up to date, chiggers are only present along the main river courses in the south-central, southeastern, and eastern parts of Iowa. From the city of Des Moines north along the Des Moines River the writer has not been able to collect specimens, although the attempt was made in several localities.

The environment found necessary in Iowa is the same as that in Virginia or Maryland, since nearly all the land is given over to cultivation; however, chiggers are found only in a relatively small area, while in the East they are found over very extensive ones.

HABITS OF UNATTACHED LARVÆ.

The belief has been almost universal that chiggers in this country are found in the grass. Observations have failed to confirm this theory. It was found that our northeastern species occurs almost exclusively at or near the surface of the soil. In this respect the larvæ differ from tick larvæ, which climb up on vegetation of various kinds and remain in wait for a host. People frequently get chiggers when they go into the grass, but our eastern species approaches from the ground. The mites can be found in surface scrapings, but repeated attempts to recover them from growing vegetation have failed.[2]

If chiggers attack man almost solely from the ground the question may be asked, How are we to account for attachments around the waist, under the armpits, and about the eyes? Again, observations show that chigger attacks are seldom made above the waistline, unless the clothes are quite loose around the waist, or the individual has been sitting or reclining on the ground. When one simply walks through a chigger-infested region, the larvæ are first found about the feet and ankles. Here they can be seen with a hand lens. They run with great rapidity, so fast in fact that it is very hard to catch them. From the ankles they spread upward, few as a rule attaching here, unless the clothing is tight; if so, many may attach. As they pass upward many of the larvæ either stop themselves or are stopped at the garters, if these are worn below the knees. If they pass the garters large numbers will attach in the space under the knees. Those that pass the knees usually go as far as the waistline before they attach.

Two factors are of importance in regard to the localization of chigger attachment—the tightness of the clothing at certain parts of the body and the thickness of the skin. The garters around the legs and the belt around the waist act as semieffective barriers. For a great many minutes, sometimes for a few hours, the larvæ run over the skin hunting a favorable place of attachment. These rapidly moving larvæ are halted by the garter or belt pressure, and after struggling some time either to pass through the mesh of the clothing at these points or to extricate themselves may attach without further search. The writer has watched these active larvæ on the skin of man before and after attachment and finds that tight clothing does not aid them in "digging in" by furnishing a fulcrum, as has been supposed. In fact, it was found experimentally that chiggers do not "dig in," as has been so frequently stated, but remain attached externally like a tick does.

The thickness of the skin is of great importance in localizing chigger attachments. Where the skin is unusually thick the larvæ attach with great difficulty or not at all; and of those that do attach

[2] Dr. F. H. Chittenden has reported to the writer chigger attacks coming from overhead vegetation. The writer has never experienced such attacks, and up to the time of the preparation of this paper none had been reported to him. It may be that a second species, which is relatively rare, occurs in this vicinity, as Dr. Chittenden suggests.

many can not remain attached during the body movements of the host or are not able to reach the lymph supply of the true skin and engorge. Of the thousands of chigger attachments observed by the writer, not a single one was found on the calloused parts of the hands or feet.

HOSTS.

It was the belief of earlier entomologists that chiggers lived upon the juices of plants. That C. V. Riley shared this common belief is evident from the following statement (*10*) which he made in regard to one of his species:

> The normal food * * * must, apparently, consist of the juices of plants and the love of blood proves ruinous to those individuals who get a chance to indulge it.

When it was learned by actual rearing experiments that several of the species of Trombidiidae were normally parasitic on terrestrial tracheates, this older theory was dropped, and it was commonly assumed, and frequently stated, that the chigger larvæ were normally parasitic on insects and closely related invertebrates. This belief was equally shared by the mite specialist and the general entomologist; but that the chigger larvæ could be normally parasitic on vertebrates was never suspected; in fact, the references to their "death feast" on man or domestic animals continued as numerous as before.

When the writer began, in the summer of 1919, his search for the natural host of the species occurring in Virginia and Maryland, he collected all insects found parasitized with trombidiid larvæ. These larvæ were examined to see if any of them belonged to the species attacking man, or were in fact true chiggers. Although many insects and other tracheates were found parasitized, in no instance did these parasitic larvæ prove to be the species attacking man.

Not satisfied with this method of investigation, another was instituted. On some vacant lots that had grown up to a considerable extent in blackberries and which were very heavily infested with chiggers (over a hundred attached in less than two hours), insects of all kinds were collected. There were hundreds of them and scores of species.

These insects were taken to the laboratory and examined both alive and after killing in cyanide bottles, and in no case was a single specimen of our eastern chigger found. The sweepings and other collections were so thorough that this observation convinced the writer that the chigger found in the vicinity of Washington is not a normal parasite on terrestrial tracheates that live above the ground.

Although never believing in the old vegetarian theory of the earlier entomologists. the writer decided to give this theory a test. First a minute examination was made of the blackberry plants, including all parts both in and above the ground. Not a single chigger was found on them. Then the examination was extended to the other plants growing on the vacant lots—goldenrod, several grasses, and a number of common weeds. Each plant species was taken by itself, specimens were pulled up, shaken over white paper, taken to the laboratory, and even examined in parts with the microscope. After several days of fruitless attempts to locate the larvæ feeding on plants the work was stopped, for evidently they could not have been feeding normally on these, or at least a few of their enormous numbers would have been encountered.

About this time there appeared in this country the extensive paper by Drs. T. Kitashima and M. Miyajima (*7*) entitled, "Studien ueber die Tsutsugamushi-krankheit," in which is given, among other things, a summary of the work on the life history and habits of the Japanese chigger, *Trombicula coarctata* Berlese (*1*). These writers claimed to have reared this chigger mite from field mice and to have established the fact that it was normally parasitic on the same. A few days later Dr. Miyajima, who happened to be visiting in this country, called at the Bureau of Entomology while in Washington. During his stay he reiterated his statement that the Japanese chigger was normally parasitic on field mice and also said he believed that it normally parasitized various other mammals.

Following the conference with Dr. Miyajima, it was decided at once to investigate the small rodents which were known to exist in the vicinity and on the ground of the infested lots. A dozen traps were procured and trapping began with these on September 13 and continued until September 24. In all, traps were set in 21 different situations, including 13 in the infested area and 8 on adjoining uninfested ground. Small mammals, chiefly rodents, were caught and examined microscopically in the laboratory as follows:

September 13	4	September 18	2	September 23	1
September 15	3	September 19	1	September 24	1
September 16	1	September 20	1		
September 17	2	September 22	1		

In all, 17 small mammals were caught, all within 11 days. Among those obtained the following were determined by Dr. Ned Dearborn, of the Bureau of Biological Survey: House mouse (*Mus musculus*); common meadow mouse (*Microtus pennsylvanicus*); short-tailed shrew (*Blarina brevicauda*).

Not only were the skins of these mammals examined carefully, but the ears and some of the other parts were removed and washed violently in alcohol and the washings examined. As a result of these examinations not a single chigger was found.

This examination of the small mammals of the infested area, it should be noted, was made late in the season. It is possible that if the trapping had been done earlier, different results would have been obtained. During the summer of 1921 such trappings are planned for the months of June and July. It will be interesting to observe the results.

Among other hosts held under suspicion were reptiles. Tortoises were found in the vicinity of the infested area. These were caught and examined, but no chigger larvæ were found. Early in July, 1920, Mr. William Palmer, of the National Museum, captured a large king snake, *Lampropeltis getulus getulus*, at Chesapeake Beach, Md., that had hundreds of mite larvæ attached to its skin, between the scales. He brought the snake to the Museum, and when it was shown to the writer a few days later it had molted. In the cast skin were found hundreds of trombidiid larvæ in various stages of engorgement. An examination of these showed them to be no other than the chigger that attacks man along the Atlantic slope. Parts of the cast skin with chiggers attached were placed in breeding cells, and chiggers that appeared fully engorged were likewise placed in breeding cells, but in neither case did any of the larvæ transform into nymphs. Those attached to the skin of the snake remained attached and soon died unless forcibly removed. The actions of the chiggers in remaining attached to the skin after the latter was cast and their dying in this attached position would seem to show that the king snake is not a natural host. Further, it is known that chiggers exist in enormous numbers where very few snakes of any kind are found.

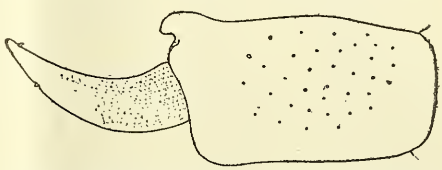

Fig. 2.—Right chelicera of a chigger-mite larva from the inside, X 1,200. Drawing made from specimen taken at Lake Minnetonka, Minn., and belonging to the University of Minnesota collection.

The determination of the natural hosts of our American chiggers has not been made. Further investigation along this line is needed.

INJURY.

CHIGGER INJURY CONFUSED WITH MANY OTHER KINDS OF INJURY.

Of the many complaints about chiggers that have come to the writer, a very large number, fully one-half in certain sections, were found upon investigation to be due to hives, caused by the disagreement of some food eaten and probably accentuated by hot weather. A very large number of complaints supposed to be concerning chigger attacks were found to be due to nettling from some thorned plant. Serious attacks in a front lawn in Virginia, reported to be due to chiggers, were found to be due to *Hyletastes missouriensis* Ewing, a gamasid mite, the habits of which are not well known.

Injury from fleas is very similar to the first-stage injury of chiggers, and since fleas soon leave their hosts and chiggers are so small that they frequently are overlooked, flea injury is mistaken for chigger injury. A careful examination with a hand lens will enable one to see the attached chiggers and prevent confusion of flea injury with an attack by chiggers.

DO CHIGGERS PENETRATE THE SKIN?

Both among entomologists and the public generally there is a belief that chiggers burrow into the skin. C. V. Riley (*10*) states in regard to his *irritans* that "This mite is able to bury itself completely in the flesh." In speaking of the same chigger, Osborn (*8, p. 252*) sys: "It is brushed from the leaves of various plants onto the hands or clothing of people and to the bodies of other animals, and the mite then proceeds to burrow into the skin."

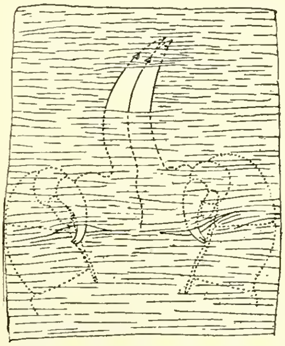

FIG. 3.—View showing the method of attachment of a chigger (northeastern species). Drawing of a part of a "slice" of skin, made from the underside while the larva was attached.

To find out whether chiggers penetrate the skin or not, and also to observe their injury, resort was made to experimentation. On July 15, 1919, the writer exposed the left calf and ankle to chigger attack, and after the mites had settled numbered 10 individuals by writing on the flesh near the mite with ink. Daily observations were made on these chiggers, using low and high power lenses, for the next eight days. It was observed on the first day that the mites attached only by their mouthparts and in no way burrowed into the skin. Observations on the second day showed no change; in fact, after once attaching to the skin by their mouthparts the larvæ became quiescent and did not change their position until they dropped off.

By means of a razor blade several individuals were removed by slicing off a small area of the epidermis around them. When this "slice" of epidermis was examined under a high-power microscope objective it showed the attachment as represented in figure 3. The hooked and ventrally barbed cheliceræ were thrust into the epidermis only, and the palpal claws were found forced downward and backward into the epidermis. After both the cheliceræ and the palpi have been inserted in this fashion they hold the larva locked, as it were, to the skin. This was made evident by watching the actions of larvæ with high-power objectives after they had been removed with a "slice" of epidermis. They wriggled first one way, then another, pulled with all their strength backward and forward, gave side twists, and in fact strained in almost every possible way until released. One individual was timed during this process, and it took it seven minutes to free itself from the hold it had obtained on the epidermis.

These observations were repeated upon a lot of 16 individuals for nine successive days. They were numbered as before, and daily observations made upon them. Not only did none of these larvæ burrow into the skin, but they remained attached only by their mouthparts and engorged like ticks. Later they released this hold and fell off.

DO CHIGGERS ENTER THE PORES OF THE SKIN?

Some authorities, while not believing that chiggers burrow into the skin, yet hold that because of their minute size they enter the pores and thereby cause much inflammation and other injury. This point has been carefully investigated. Of the 26 numbered individuals that were observed and studied daily, 21 were attached to the smooth surface of the skin, while 5 were attached at the bases of hairs, each having the capitulum thrust into the mouth of the hair follicle as shown in figure 4. Not a single one had penetrated a pore or hair follicle.

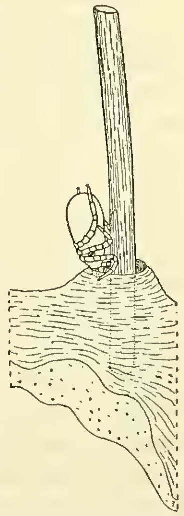

Fig. 4.—"Slice" of epidermis from the skin of calf of leg showing method of attachment of eastern chigger in mouth of hair follicle.

The species occurring in the northeastern part of the United States shows a tendency to attach at the mouth of hair follicles. It may be that the larvæ actually try to enter. They are prevented, however, from doing so under normal conditions of the skin by the small diameter of the follicles themselves. For this same reason it would be impossible for chiggers to enter the pores of the skin, unless the latter were greatly dilated as a result of some skin trouble. In diameter the pores of the skin range from 20 to 50 μ, according to Piersol. The width of an unengorged larva from either the western or eastern part of this country is approximately 150 μ. Thus it is seen that unless the pores were unusually dilated the mites could not enter if they would.

In the case of persons who have just cleaned out the pores of the skin after a long period of negligence, it would be possible for the mites to enter some of them, as, for example, pores dilated by comedones. The writer has observed such pores dilated until they were fully 400 or 500μ in diameter. These pores, however, are most frequently on the face or neck—regions seldom attacked by chiggers. In all the observations made, including many hundred, of chigger attacks, it has always been possible during the early stage of attack to locate the chiggers themselves or their evident places of attachment, and this has always been on the surface of the skin or in the mouths of hair follicles.

DIFFERENCE IN SUSCEPTIBILITY.

Another common belief among the public and entomologists is that a great difference exists between persons in susceptibility to chigger attacks. Such a difference usually has been assumed to be physiological. Observations were made to ascertain the foundation for such a belief, if any existed. Upon several occasions it was observed that there was a difference in injury to people who apparently had all been exposed equally to the attacks of chiggers. It was found in most cases, however, that although all members went on the same picnic, or collected berries in the same patch, or made the same journey, they were not equally exposed to the attacks of the mites. Particularly three fundamental differences were found: First, a great variation in the clothing, especially about the feet and ankles; second, a variation in the actions of the persons, some never sitting or reclining on the ground; and third, a great variation in the intensity of chigger infestation even over a small area. Observations clearly show that these are usually the reasons why some members of a party are but slightly attacked while others are driven almost frantic.

Laboratory tests show that chiggers attack by preference where the skin is very thin and the flesh wrinkled or tender. Field observations also have brought out the fact that women and children suffer more from a given number of chiggers than men do. In other words, a correlation exists between thin skins and seriousness of chigger attacks. This, however, is the only way in which certain differences in the seriousness of chigger attacks between individuals equally exposed could be explained. Although hundreds of people were found susceptible to chigger attacks, no one was found who was clearly shown to be immune.

LOCAL INJURY.

Since there has been so much confusion in regard to chigger injury, a careful tabulation was made daily in the case of two lots of infestations. The first lot of 10 individuals, located on various parts of the leg below the knee, were numbered and notes made daily upon the appearance of the local area around each point of attachment, with the following results:

Attachment of chiggers followed irregularly within a few hours after exposure. The itching which appeared during the latter part of the first 24 hours following attachment grew in intensity. At 24 hours after attachment not a single papule had appeared at any one of the 10 points of attachment. During the second day swelling subsided, and the pinkish coloration around the puncture points was followed, first by a light blood-red and later by a deep blood-red color. The immediate area around each larva changed to a whitish color, and the discolored area as a whole was large and in some cases mottled with light and dark red. The itching sensation reached its maximum the second day.

During the third day after infestation most of the spots changed from the pinkish or light blood red of the second day to a dark blood-red or purplish red. At the end of the third day one-half of the larvæ had become detached.

During the fourth day few changes were noticed. One more larva had dropped off, and a few of the spots were observed to be lighter in color than the day before.

During the fifth day all the remaining larvæ dropped off. Spots retained most of their color and in four instances small water blisters developed near the center of discolored spots.

On the sixth day the color of the spots continued to fade and in one instance was practically lost.

During the seventh day several of the spots regained almost their normal flesh color. Five water blisters were observed, but only one was conspicuous.

On the eighth day the discoloration had entirely disappeared in one instance and almost so in two others. Two water blisters were left.[3]

GENERAL DISTURBANCES.

As has been known for many years, general disturbances frequently follow serious attacks from chiggers. Among the most serious of these is the development of a fever and a temporary upsetting of certain nervous responses. Oudemans has recently called attention (*11, p. 10*) to the narrative of Alfred Russel Wallace relative to the latter's experience with chiggers in the Malay Archipelago. This eminent naturalist wrote:

> All the time I had been in Ceram I had suffered much from the irritating bites of an invisible acarus, which is worse than mosquitoes, ants, and every other pest, because it is impossible to guard against them. This last journey in the forest left me covered from head to foot with inflamed lumps, which after my return to Amboyna, produced a serious disease, confining me to the house for nearly two months * * *.

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[3] The appearance of these water blisters is well illustrated by Riley and Johannsen (*11, fig. 43*).

In this country Prof. Herrick (*4, p. 317–325*) has made observations on chiggers in various parts of the United States. He says:

Very often a slight fever accompanies the eruptions and the patient is liable to lose sleep and suffer almost unbearable torture.

In regard to the general disturbances caused chickens the same authority states (*5, p. 258–260*):

The chicks seem to contract a diarrhea, grow weaker and weaker, and finally die.

Where the attacks from chiggers are slight, as a rule, no general symptoms are produced. When there is a sudden attachment of several hundred larvæ general symptoms may result. The irritation produced by such a large number may prevent sleep for several nights in succession and thereby upset or disturb digestion. Also, a peculiar nervous disturbance may be caused. This may be brought about by toxins injected by the larvæ or by some other cause.

During the months of July, August, and September, 1919, the writer on many occasions was attacked by chiggers. Some of these attacks were severe and on more than one occasion blood-red spots larger than a half dollar were left. As a result of these repeated attacks a peculiar nervous effect was produced. During parts of the day a feeling of lethargy was noticed, yet to many things a hypersensitiveness was produced. This irritable state became so pronounced at times as to make productive work all but impossible. With this upsetting of the nerves, interference of bodily processes was observed to a considerable extent. It was only after the cool days of November that a normal condition was restored.

RELATION TO DISEASE.

Until the work was begun in Japan on the cause of flood or river fever ("tsutsugamushi-krankheit") some 15 years ago, chiggers had enjoyed an almost complete freedom from suspicion as actual disease carriers. As the work on this deadly disease progressed, however, they were soon held to be implicated in some way and finally shown to be the active carriers of the virus of this disease.

The results of various Japanese workers show that this disease is caused by a nonfilterable virus which is transmitted by means of the chigger bites to man. The natural reservoir is apparently the normal hosts of the chiggers, chiefly field mice, as only a small percentage of the larvæ are infected. Kitashima and Miyajima (*7, p. 232*) state that while "tsutsugamushi-krankheit" is similar to typhus fever and Rocky Mountain spotted fever in that the virus is nonfilterable and arthropod-borne, yet the disease itself is quite different from either.

River fever is a very deadly disease, as about one-third of all the cases are fatal. The only regions of the country affected are those along the water courses or in lowlands. Various attempts have been made to discover and work out the development of the causative organism, but to no avail.

Among the various substances that have been employed in medication in connection with the disease the following have been used with negative results: Quinine, iodine, quicksilver, arsenics, and staining preparations. From the beginning to the subsidence of the fever salvarsan and trypan red have been used with very poor results. An attempt has been made experimentally to utilize a serum for the disease, but without results.

As chiggers are parasitic only in their larva stage and do not change hosts, it appears that the causative organisms must be transmitted from larva to nymph, to adult, thence to egg and to larva again. Such a development, although a little unusual, already has a near parallel in the case of the protozoan *Piroplasma bigeminum*, the organism of Texas fever, which is transmitted from mother to egg to larva or to nymph, in its alternate host, the North American fever tick, *Margaropus annulatus* Say.

In view of what is already known in regard to the transmission of river fever, the biology of the chigger mites, and the general symptoms following their serious attacks on man and domestic animals, the writer now predicts that in the next 50 years other serious diseases will be shown to be transmitted by these acarids. Should these mites become the transmitters of fatal diseases of domestic animals on a large scale it would be found that the protection of cattle or sheep from them would present a very difficult problem, as the mites are so minute and so widely distributed in woodlands and along water courses.

CONTROL.

In the case of man much protection can be had from chigger attacks by properly clothing the lower extremities or by the application of repellents either directly on the skin or on the under garments.

PROTECTION AGAINST CHIGGER ATTACK.

Since the unengorged larvæ are not over 150µ in width, it is seen that they can pass through the mesh of many kinds of garments; it is easy, however, to wear those of a weave tight enough to prohibit the larvæ from passing directly through the cloth. The employment of tightly woven cloth, or other materials which are impervious to the larvæ, nevertheless, is not enough. These garments must be worn so as to fit tightly around the edges or the larvæ will yet have an avenue of entry.

It was frequently noticed that half-shoes exposed the ankles, and for that matter indirectly the whole body, to much more serious

[4] The control of chiggers affecting poultry is considered in Farmers' Bulletin 801. The measures given in the present bulletin have reference more particularly to chiggers as parasites of man.

attacks than topped shoes. This the writer demonstrated himself many times. High-top shoes or, better yet, laced boots, gave a considerable amount of protection. On several occasions the writer was accompanied on his trips by Mr. W. W. Diehl, of the Bureau of Plant Industry. Mr. Diehl demonstrated well how the body could be protected by wearing topped shoes and spiral puttees. The latter were wrapped tightly about the calves and gave almost complete protection.

Concerning this method, however, there are two objections: First, it causes a considerable discomfort to wear such tight and rather heavy clothing during the hot season, and second, if the individual sits down, reclines, or brings the hands in frequent contact with the surface of the ground, the chiggers will attack in considerable numbers.

Another method of gaining protection which has been tried in the past is to use some repellent on the skin or on the clothing. Sulphur has long been recommended for this purpose and Dr. Chittenden (*2, p. 5*) calls it "a sovereign remedy for mites." A test of its efficacy was made as follows:

At East Falls Church, Va., on July 25, 1919, before going into a well-known infested area, the left stocking and the lower part of the underwear on the left leg were dusted inside and out with flowers of sulphur. The sulphur was applied by the "pinch method," followed by rubbing. About a tablespoonful was used. From 2.30 p. m. to 4.20 p. m. there was exposure to attack in the infested area, and at the end of this time a laboratory examination was made. On the calf and ankle of the untreated leg several chiggers were observed, all unattached and running about very energetically. On the calf and ankle of the sulphured leg not a single chigger was found. Later, at 9.45 p. m., another examination was made. The untreated leg had a large number of chiggers attached, these being distributed from the ankle to the hip. The treated leg did not have a single chigger attached.

On August 4, 1919, a test was made to see if a dusting of sulphur on both sides of the clothing was any more efficacious than dusting on one side only. The stocking and underwear below the knee on the left leg were sulphured by the "pinch method," both inside and out. The stocking and underwear below the knee on the right side were sulphured as before, but only on the outside.

At 3.30 p. m., after exposure, an examination of both legs failed to reveal a single chigger. It was noticed also that there was much more sulphur adhering to the left leg than to the right. A later examination at 11.30 a. m. the next day failed to reveal a single chigger on the left leg and only one chigger wheal on the right, this being near the instep of the foot.

It would appear from this that the dusting with sulphur inside the hosiery and underwear is sufficient if it is so applied as to be well distributed. Later tests fully demonstrated that a single application was sufficient if well distributed.

The "pinch method," i. e., applying a powder insecticide by picking up small amounts with the thumb and fore finger, while well adapted for dusting lousy chickens, for example, was observed to be both tedious and wasteful, hence other methods were resorted to.

Application by means of a talcum shaker was made on August 9, 1919, followed by exposure at Vienna, Va. Examination that night showed it to be 100 per cent effective.

On August 15, 1920, application was made with a pepper shaker. A considerable tendency of the sulphur to clog the small holes of the top was noticed, but by violent agitation a fairly even application was made. Only the inside of the stockings and the lower part of the underwear were treated. Exposure for about 3 hours was made in the woods north of Chesapeake Beach, Md. Later examination showed 100 per cent efficiency. It should be added that if sulphur is dusted by means of a salt or pepper shaker, after the operation all unused sulphur should be removed and the container washed. This will prevent the tarnishing of the metal parts of the shaker.

Mr. Flint, of the State Natural History Survey of Illinois, states that he has applied sulphur by means of a small bag and also by the "pinch method," with good results. Dr. J. W. Folsom also reports good results from sulphur treatment by the "pinch method." During the summers of both 1919 and 1920 several members of the bureau staff tried the use of sulphur, and in every case good results were reported and usually complete protection.

DESTRUCTION OF BREEDING PLACES.

It is hoped that the observations made on the habits and local distribution will enable much more to be done to advantage in destroying the breeding places of chiggers. Especially is this method of attack to be recommended about private dwellings and in poorly kept public parks and at summer resorts. Already its feasibility has been demonstrated. In and around Washington many chigger-infested lots or fields have been automatically rendered free of chiggers by turning these to cultivation or cleaning away the rough growth. Prof. F. L. Washburn (*12*) has the following to say in regard to the effect of cutting down bushy growth in Minnesota:

> Capt. Zimmerman, living on Enchantment Island, Lake Minnetonka, having found this pest troublesome on his own island and upon the neighboring Phelps Island, has reduced their numbers materially by cutting out much underbrush, thus letting in the sunlight.

A well-known golf course was laid out west of the District of Columbia in a region heavily infested with chiggers. Later an investigation showed that the sodded areas where the balls were played were quite free from chiggers. When persons went into the patches of rough growth between or around these areas they were attacked by chiggers.

A chigger-infested lot in East Falls Church, Va., was cleared of rough growth and a house put on it during the summer of 1919. These operations destroyed the breeding places of the chiggers.

Of all the growths that favor the harboring of chiggers none is more favorable than wild blackberries or wild dewberries. Wild blackberry patches in Virginia and Maryland invariably were found to harbor immense numbers of chiggers. Where such patches are located at very objectionable places their obliteration would seem justified. The fruit produced by these wild canes is of a good quality, however, and constitutes not a small item in the summer food supply of the country; hence a wholesale destruction of wild blackberries would be both rash and foolish.

Dr. Chittenden has mentioned (*2*) the value of cattle and even of the passing of many persons in destroying chiggers. In 1914 (*3*) he published the results of a conversation which he had with Mr. William N. Irwin (through an error given as E. F. Erwin), who before his death was connected with the Department of Agriculture; in this conversation Mr. Irwin stated that he considered cattle inadequate where a large area was to be dealt with. He claimed, however, that he had experienced good results where sheep were used instead of cattle. The efficacy of sheep in chigger eradication thus being shown, an explanation of their agency and its effect on the chiggers is due. Dr. Chittenden claimed that the value of cattle in chigger control came from the trampling of the pests, and he would explain in the same way the benefits from the utilization of sheep, adding, however, that the sheep are probably more effective, by "keeping the grass more tightly cut than would cattle." Mr. Irwin explained the agency of the sheep as being due in part to the ascent of their legs by the chiggers and their destruction through contact with the oil in their wool. The present writer would explain this observed difference between the efficacy of cattle and sheep as being due chiefly to the food habits of the latter, the sheep not only keeping the grass more closely cropped, but also feeding to a considerable extent on the leaves of shrubbery.

Just what the value of a certain amount of shrubbery is to chiggers is not known in the case of our species. It may furnish a favorable environment for the natural hosts of the parasites, or furnish the necessary environment for either the nymphs or adults of the chiggers, or both these instars, or furnish a proper environment for the larvæ.

It has been stated that the cropping or mowing of grass lets in more sunshine and in this manner destroys the chiggers. This can hardly be the case, however, as larvæ have been handled and exposed frequently in the bright sunshine and no ill effects to them noted. In the field also, where there is only a scant growth of dewberries and an abundance of sunshine chiggers may be found in great numbers.

Chiggers are almost semiaquatic and will endure frequent submergence. In the laboratory they do well, if not their best, in an atmosphere near saturation. This humidity requirement will help explain the advantage of a rough growth to the species, which lives almost exclusively at the surface of the ground. In most situations it may be that the moisture is only sufficient when the ground is clothed with a considerable growth of vegetation. Thus the effect of sunshine would appear to be indirect and to destroy the chiggers in most situations where allowed to act by drying the surface of the ground.

DESTRUCTION OF THE CHIGGERS THEMSELVES.

It is stated that chiggers may be destroyed by a liberal application of sulphur to the field. The use of 50 pounds to the acre has been recommended. For this purpose a dust gun or dust blower could be used to advantage. On lawns the use of sulphur is unnecessary, as chiggers will automatically disappear if the grass is kept cut short.

Chiggers may best be destroyed on the body of man before they become attached or very soon afterwards. If one knows that there has been exposure to chigger attacks the shins and ankles should be examined with a hand lens for the active larvæ even before any itching sensation is felt. Only a few of the active larvæ will be observed. They will be seen to run over the skin very rapidly and can not be captured to advantage.

Larvæ on the body can be easily killed by the application of an acaricide. Various substances applied at the time of bathing have been recommended. On August 10, 1919, after exposure to chigger attacks, a thick lather of soap was applied to the affected parts. The lather was allowed to remain for 10 minutes and was worked continually over the skin. After 10 minutes it was washed off. Examination next day failed to reveal any chiggers and no itching developed.

On August 18, 1919, after exposure at Somerset, Md., and after larvæ had attached, the same application of thick soap lather was tried. On the 19th much itching was felt, yet no chiggers were found. Apparently the soap had acted as an acaricide but not as a palliative.

Dr. Maurice C. Hall, of the Bureau of Animal Industry, reports excellent results from the use of sulphur ointment against the larvæ after they have become attached.

Commercial alcohol (95 per cent) has been used by several acquaintances and by the writer himself to good advantage against the chiggers attached to the skin. When the free larvæ are immersed in alcohol and observed under the miscroscope they are seen to die in short order, usually in from 1 to 3 minutes. The alcohol is an excellent acaricide and also a good antiseptic for the unabraded or slightly abraded skin, and has a further advantageous effect in hardening the dermis. It should be applied quite freely and the application repeated two or three times.

Any of the lighter oils kill the larvæ quite rapidly, and can be used to advantage against the larvæ if the latter are confined to a small area on the body. Sulphur acts slowly, but if applied with soap and allowed several minutes to act should give good results.

PALLIATIVES.

To those who go little afield and are thus ignorant of some of nature's ways warnings that preventive measures should be taken are usually but little heeded, hence it is necessary to give directions in the use of palliatives—the most unsatisfactory of all measures. Undoubtedly most of the so-called palliatives are of value chiefly, if not entirely, because of their acaricide action or because they act antiseptically, or in both these manners.

In the Panama Canal Zone, according to Dr. W. A. Taylor, Chief of the Bureau of Plant Industry, a saturated solution of salicylic acid in alcohol, with a little olive oil added, has been used to good advantage as a palliative. Both he and Mr. H. H. Bennett, of the Bureau of Soils, used this mixture with very beneficial results in the Canal Zone.

In the Southern States, according to Mr. Bennett, butter or lard with a liberal mixture of table salt, or pure kerosene oil, is frequently used as a palliative. With regard to their benefit he says: "I am still not convinced that they are more than moderately efficacious * * *."

Among the other substances recommended as palliatives are the following: Ammonia, cooking soda, dilute solution of iodine, camphor, and alcohol. Statements made to the effect that an acid toxin is injected by the larvæ are not based on observed fact or experimental demonstration. We do not know even that a toxin is injected by these acarids. As before stated, the intelligent use of palliatives awaits experimentation on the nature of chigger injury from the physiological standpoint.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 987

Contribution from the Bureau of Markets and Crop Estimates
H. C. TAYLOR, Chief

Washington, D. C. November 9, 1921

HANDBOOK OF FOREIGN AGRICULTURAL STATISTICS.

Compiled under the direction of FRANK ANDREWS, *Chief, Division of Crop Records.*

CONTENTS.

INTRODUCTION.

This collection of official statistics of crops and live stock of foreign countries and of island possessions of the United States is intended to make available in convenient form the items in these statistics which are most generally used. Inquiries for just such information are constantly being received in the Bureau of Markets and Crop Estimates, and these inquiries have guided the selection and arrangement of the material of this publication.

The sources of the statistics are the official Government reports of the respective countries. These foreign reports have been tabulated on the office records of the Bureau of Markets and Crop Estimates and computed to United States weights and measures. The complete office records are too voluminous to print in a single volume. They are, however, accessible to any person who wishes to use them in the office where they are filed.

The publication of this collection of foreign agricultural statistics is to some extent an experiment. It is hoped to issue later editions giving later figures and embodying changes which hereafter may be found desirable. Any constructive criticism concerning this publication will be welcome.

TABLE 1.—*Crops of Algeria.*

[Source: Statistique Générale de l'Algérie.]

Crop year.	Barley.			Corn.			Wheat (hard and soft).			Oats.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1910–11	3,419	14.2	48,708	36	15.3	552	3,427	24.6	39,375	405	32.8	13,258
1911–12	3,430	9.6	32,887	31	12.2	374	3,614	16.1	27,172	476	26.0	12,351
1912–13	3,386	15.6	52,899	33	28.7	955	3,580	22.8	37,661	525	32.4	17,009
1913–14	3,327	11.7	39,041	32	14.5	465	3,633	19.9	33,241	533	27.7	14,779
1914–15	2,703	14.7	39,866				3,209	10.8	34,654	590	25.6	15,082
1915–16	3,009	12.0	35,969				3,272	8.9	29,151	536	24.5	13,140
1916–17	2,839	10.0	28,529	20	15.1	302	3,222	7.2	23,151	682	23.6	16,125
1917–18	2,794	21.7	60,742				3,186	15.6	49,774	588	39.0	22,914
1918–19	2,639	12.8	33,667	15	15.7	236	2,800	9.1	25,559	533	25.4	13,557
1919–20	2,444	5.7	14,035	22	11.5	253	2,647	5.3	13,902	576	10.2	5,890
	Rye.			Grain sorghum.			Millet.			Beans ("feves" and feveroles).		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1910–11	4	17.2	63	58	10.6	616	2	22.6	53	92	10.7	987
1911–12	(1)	10.7	4	55	9.2	511	2	11.0	21	129	6.8	869
1912–13	6	10.4	63	56	11.6	651	2	7.1	11	98	9.8	960
1913–14	3	12.2	40	56	12.4	688	1	5.7	7	97	8.5	818
	Beans (haricots).			Cotton.			Flaxseed.			Hay (from artificial meadows).		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bales.*	*1,000 bales.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1910–11	6	22.3	144				1	10.2	13	64	1.5	93
1911–12	7	21.8	153	1	1.4	2	2	9.7	17	71	1.4	98
1912–13	7	22.8	152	1	1.8	2	2	9.1	16	73	1.3	97
1913–14	7	21.0	148	(1)	1.0	(2)	2	8.8	13	67	1.3	90

[1] Less than 500 acres. [2] Less than 500 baless.

TABLE 1.—*Crops of Algeria*—Continued.

Crop year.	Hay (from natural meadows).			Peas.			Potatoes.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1910–11....	2,051	.2	442	25	12.3	313	45	36.0	1,607
1911–12....	2,343	.2	400	26	10.8	277	48	44.6	2,119
1912–13....	5,145	.1	451	27	10.6	286	44	48.0	2,096
1913–14....	4,886	.1	316	23	11.8	268	43	46.7	2,004
1916–17....	....	....	....	....	....	....	27	10.2	2,756
1917–18....	....	....	....	....	....	....	....	....	....
1918–19....	....	....	....	....	....	....	44	....	....
1919–20....	....	....	....	....	....	....	42	23.5	985

Crop year.	Tobacco.			Production.			
	Area.	Yield per acre.	Production.	Olives.	Olive oil.	Silk cocoons.	Wine.
	1,000 acres.	*Pounds.*	*1,000 lbs.*	*1,000 tons.*	*1,000 gals.*	*1,000 lbs.*	*1,000 gals.*
1910–11..........................	24	1,022.4	24,443	186	6,898	18	233,359
1911–12..........................	23	948.2	21,556	359	8,996	2	176,233
1912–13..........................	25	908.2	22,921	167	9,497	2	194,705
1913–14..........................	29	720.0	20,681	194	6,218	1	245,968
1916–17..........................	25	1,411.0	35,274	....	....	....	....
1917–18..........................	27	1,225.0	33,069	....	....	....	....
1918–19..........................	43	736.0	31,658	....	....	....	....

TABLE 2.—*Number of live stock in Algeria.*

[Source: Statistique Général de l'Algérie.]

September—	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
1911...............	1,114,000	110,000	8,529,000	3,862,000	227,000	192,000	279,000
1912...............	1,107,000	114,000	8,338,000	3,772,000	221,000	192,000	271,000
1913...............	1,108,000	112,000	8,811,000	3,848,000	216,000	192,000	272,000
1914...............	1,093,000	108,000	9,140,000	3,794,000	203,000	185,000	268,000

TABLE 3.—*Crops of Argentina.*

[Source: Estadística Agrícola; issued by the Ministerio de Agricultura de la República Argentina. These statistics begin as early as 1890–91, for some principal crops.]

Year.	Barley.			Corn.			Oats.			Rye.		
	Area.[1]	Yield[2] per acre.	Production.	Area.[1]	Yield[2] per acre.	Production.	Area.[1]	Yield[2] per acre.	Production.	Area.[1]	Yield[2] per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1910–11.....	149	......	....	7,945	3.5	27,676	1,640	28.8	47,192	......	......	....
1911–12.....	167	16.8	2,798	8,456	35.0	295,849	2,102	32.8	69,169	......	......	....
1912–13.....	267	16.7	4,455	9,464	20.8	196,642	2,487	30.5	75,783	......	......	....
1913–14.....	418	19.2	8,037	10,260	25.6	263,135	3,087	16.5	50,981	228	14.7	3,346
1914–15.....	397	13.0	5,144	10,386	31.3	325,179	2,869	20.0	57,251	229	7.9	1,811
1915–16.....	431	12.6	5,430	9,928	16.2	161,133	2,565	29.4	75,439	212	9.5	2,008
1916–17.....	268	8.1	2,165	8,969	6.6	58,839	2,525	12.6	32,009	180	4.8	858
1917–18.....	......	......	....	8,715	19.6	170,660	3,200	21.4	68,635	......	......	....
1918–19.....	......	......	....	9,800	24.5	240,144	3,080	11.0	33,762	......	......	....
1919–20.....	......	......	....	8,184	31.6	258,686	2,301	24.8	57,113	......	......	....
1920–21.....	......	......	....	8,090	28.5	230,423	2,061	......	....	......	......	....

[1] Area cultivated.
[2] Yield per acre cultivated.

TABLE 3.—*Crops of Argentina*—Continued.

Year.	Wheat.			Cotton.	Flaxseed.			Potatoes.			Tobacco.		
	Area.[1]	Yield[2] per acre.	Production.	Acres.	Area.[1]	Yield[2] per acre.	Production.	Area.[1]	Yield[2] per acre.	Production.	Area.[1]	Yield[2] per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*		*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1910–11	14,514	10.1	145,981	4,690	3,123	7.5	23,424	127	149.0	18,923	24	......	......
1911–12	15,737	10.6	166,190	4,458	3,745	6.0	22,534	267	137.6	36,743	24	......	......
1912–13	16,560	11.3	187,391	6,919	4,283	10.4	44,486	278	136.8	38,029	24	......	......
1913–14	16,243	7.0	113,904	5,478	4,397	8.9	39,171	293	96.8	28,066	37	......	......
1914–15	15,471	10.9	168,468	8,154	4,258	10.4	44,309	306	96.7	29,597	38	......	......
1915–16	16,420	11.2	184,158	9,118	4,001	10.1	40,273	322	96.7	31,138	18	......	......
1916–17	16,089	5.0	80,115	7,598	3,207	1.3	4,032	331	......	......	26	546.7	14,213
1917–18	17,875	10.3	184,000	29,096	3,229	6.1	19,588	333	......	......	27	......	......
1918–19	16,976	10.1	171,591	32,679	3,419	9.0	30,775	......	......	......	......	......	......
1919–20	14,957	14.3	214,140	33,400	3,522	11.6	41,000	......	......	......	......	......	......
1920–21	14,817	12.4	184,000	......	3,484	12.3	43,000	......	......	......	......	......	......

[1] Area cultivated. [2] Yield per acre cultivated.

TABLE 4.—*Number of live stock in Argentina.*

[Source: Estadística Agrícola, Ministry of Agriculture.]

Dec. 31—	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
1910	28,828,000	......	73,013,000	......	......	......	......
1911	28,786,000	2,900,000	80,401,000	4,302,000	8,894,000	535,000	319,000
1912	28,981,000	3,045,000	76,279,000	4,431,000	9,239,000	556,000	329,000
1913	30,796,000	3,197,000	81,485,000	4,564,000	9,366,000	584,000	345,000
1914[1]	25,867,000	2,901,000	43,225,000	4,325,000	8,324,000	565,000	260,000
1915	26,388,000	......	43,677,000	......	......	......	......
1916	27,392,000	3,227,000	45,309,000	4,670,000	9,061,000	601,000	......

[1] Census.

TABLE 5.—*Net imports or net exports of leading farm products, for Argentina.*

[Source: Anuario del Comercio Exterior de la República Argentina.]

Year.	Net exports.			Rice. Net imports.	Net exports.			Cheese. Net imports.	Cotton, unmanufactured.[3] Net exports.	Cottonseed oil. Net imports.
	Barley.[1]	Corn.[2]	Oats.[2]		Rye.[2]	Wheat.[2]	Butter.			
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	[4] 934	4,923	35,178	73,873	22	89,986	2,927	10,844	(4) (5)	960
1912	[4] 660	190,351	61,672	86,283	445	103,253	7,784	11,845	2	1,280
1913	415	189,238	61,249	113,538	861	109,634	8,329	11,106	1	1,174
1914	120	139,458	24,321	71,449	451	39,278	7,493	8,445	1	1,766
1915	2,784	170,488	40,803	80,054	194	98,155	10,191	7,293	[4] 1	2,239
1916	2,116	113,140	55,392	71,361	129	91,625	12,501	2,631	(4) (5)	658
1917	[4] 198	35,190	18,702	86,565	[4] 2	40,043	21,671	[6] 5,326	1	629
1918	[4] 666	26,171	37,341	56,289	2	119,026	41,821	[6] 14,095	3	353
1919	749	97,850	22,940	52,799	160	137,351	44,871	[6] 19,353	6	198

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.
[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net imports.
[5] Less than 500 bales.
[6] Net exports.

TABLE 5.—*Net imports or net exports of leading farm products, for Argentina*—Con.

Year.	Net exports. Flaxseed.	Net exports. Hides and skins.	Hops. Net imports.	Net exports. Meat.	Net exports. Oil cake and oil-cake meal.	Net exports. Potatoes.	Net imports. Sugar.	Net imports. Tobacco.	Wool. Net exports.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	16,369	316,588	653	1,164,338	44,594	[4] 3,377	114,446	14,033	290,867
1912	20,289	328,205	454	1,200,421	38,849	513	66,430	18,755	363,456
1913	40,026	247,265	841	1,145,164	46,191	480	166,447	17,911	264,527
1914	32,069	212,017	603	1,147,124	38,367	122	[6] 128,147	17,033	258,496
1915	38,624	259,776	283	1,103,892	46,215	[4] 1,309	[6] 118,580	17,590	259,377
1916	25,192	271,662	553	1,324,873	39,912	779	66,039	19,021	267,936
1917	5,118	257,655	379	1,425,014	37,849	293	353,057	25,224	298,697
1918	15,408	241,381	562	1,960,153	19,258	537	73,468	7,495	256,578
1919	31,512	299,082	747	1,596,408	114,024	943	178,115	15,973	339,154

[4] Net imports. [6] Net exports.

TABLE 6.—*Crops of Australia.*

[Source: Production Bulletin; issued by the Commonwealth Bureau of Census and Statistics. These statistics begin as early as 1860-61.]

Crop year.	Barley. Area.	Barley. Yield per acre.	Barley. Production.	Corn. Area.	Corn. Yield per acre.	Corn. Production.	Oats. Area.	Oats. Yield per acre.	Oats. Production.	Rye. Area.	Rye. Yield per acre.	Rye. Production.
	1,000 acres.	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*[1]	*1,000 bush.*[1]
1910-11	108	21.2	2,297	415	32.4	13,455	677	23.5	15,915	10	13.2	132
1911-12	116	18.2	2,122	340	27.1	9,222	617	16.0	9,863	6	10.3	60
1912-13	181	22.0	3,981	315	27.4	8,620	874	19.0	16,625	7	13.8	99
1913-14	223	18.2	4,044	332	28.5	9,462	859	18.3	15,712	10	12.2	117
1914-15	154	8.9	1,371	340	25.7	8,722	775	5.8	4,478	8	9.1	70
1915-16	170	23.1	3,921	324	21.6	7,008	722	23.6	17,060	11	12.3	131
1916-17	230	18.3	4,209	360	24.4	8,796	844	17.1	14,460	9	11.1	100
1917-18	205	20.1	4,123	332	27.5	9,122	616	17.4	10,715	5	10.0	47
1918-19	255	19.3	4,914	287	24.9	7,130	768	14.0	10,770	4	8.8	34

Crop year.	Wheat. Area.	Wheat. Yield per acre.	Wheat. Production.	Beans and peas. Area.	Beans and peas. Yield per acre.	Beans and peas. Production.	Grapes. Area.	Grapes. Yield per acre.	Grapes. Production.	Grass seed. Area.	Grass seed. Yield per acre.	Grass seed. Production.
	1,000 acres.	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1910-11	7,372	13.3	98,109	42	22.8	961	52	1.8	95	4	19.2	82
1911-12	7,428	9.9	73,894	49	17.0	836	50	1.9	97	6	15.3	90
1912-13	7,340	12.9	94,880	40	21.6	874	52	2.0	106	7	13.4	104
1913-14	9,287	11.5	106,601	39	17.2	462	51	2.1	105	4	10.2	39
1914-15	9,651	2.7	25,677	41	9.3	382	51	1.4	72	3	9.4	27
1915-16	12,485	14.8	184,709	26	16.2	427	51	2.5	127	5	10.7	52
1916-17	11,533	13.6	157,224	32	18.7	605	53	2.1	111	5	12.4	65
1917-18	9,775	12.1	118,349	43	17.7	768	54	2.1	112	12	22.6	276
1918-19	7,990	9.8	78,022	57	14.9	841	56	2.4	137	6	14.2	86
1919-20	6,396	7.4	47,340	......	......	......	......	......	......	......	......	......
1920-21 [2]	9,082	16.6	150,503	......	......	......	......	......	......	......	......	......

[1] Winchester bushels (the ordinary United States measure of capacity).
[2] Estimated.

TABLE 6.—*Crops of Australia*—Continued.

Crop year.	Hay.			Hops.			Mangolds.			Onions.		
	1,000 acres.	*Tons.*	*1,000 tons.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1910–11	2,258	1.6	3,557	1,163	1,618	1,882	3,526	18.6	66	7	6.7	46
1911–12	2,518	1.3	3,212	1,154	995	1,147	2,391	14.0	33	4	6.4	27
1912–13	3,217	1.4	4,430	1,383	1,503	2,078	2,715	14.4	39	6	6.4	36
1913–14	2,755	1.4	3,777	1,473	1,131	1,667	2,496	12.4	31	7	4.6	32
1914–15	2,629	.7	1,942	1,545	1,164	1,798	2,106	10.2	22	10	4.0	40
1915–16	3,598	1.8	6,310	1,515	1,404	2,128	2,329	12.8	30	10	4.6	47
1916–17	2,672	1.5	3,928	1,331	1,316	1,752	1,952	12.1	24	7	5.1	36
1917–18	2,213	1.4	3,051	1,296	1,623	2,103	1,442	11.6	17	6	4.9	28
1918–19	2,693	1.2	3,241	1,333	1,394	1,858	1,375	14.0	19	6	5.0	32

Crop year.	Potatoes.			Sugar cane.[3]			Sweet potatoes.			Tobacco.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*[4]	*1,000 acres.*	*Tons.*	*1,000 tons.*	*Acres.*	*Tons.*	*1,000 tons.*	*Acres.*	*Lbs.*	*1,000 lbs.*
1910–11	152	98.6	14,928	100	22.4	2,241	4,032	6.2	25	2,080	925	1,925
1911–12	130	86.2	11,256	101	18.6	1,884	3,725	5.7	21	2,449	1,052	2,574
1912–13	129	121.3	15,618	84	15.1	1,271	3,485	5.0	17	2,745	681	1,869
1913–14	170	94.4	16,096	109	23.3	2,544	4,029	5.4	22	3,007	941	2,828
1914–15	148	90.0	13,351	114	20.7	2,357	3,517	5.0	17	2,373	796	1,891
1915–16	121	102.7	12,421	100	14.6	1,467	2,321	4.6	11	1,906	718	1,369
1916–17	150	88.8	13,328	81	23.8	1,930	1,974	4.4	9	1,342	284	381
1917–18	136	95.2	12,969	114	28.2	3,225	2,596	5.5	14	1,162	394	459
1918–19	111	87.4	9,722	116	17.2	1,994	2,291	5.4	12	2,060	[5] 1,299	[5] 2,430

[3] For "productive" area only.
[4] Bushels of 60 pounds.
[5] Exclusive of Victoria.

NOTE.—For wheat, the imperial bushel in the British Empire, as well as the Winchester bushel in the United States, is regarded in commerce as equivalent to 60 pounds. The original Australian figures for wheat production, in imperial bushels, are:

1910–11	95,112,000	1913–14	103,344,000	1916–17	152,420,000	1919–20	45,884,000
1911–12	71,636,000	1914–15	24,892,000	1917–18	114,734,000	1920–21	145,905,000
1912–13	91,981,000	1915–16	179,066,000	1918–19	75,638,000		

TABLE 7.—*Number of live stock in Australia.*

[Source: Commonwealth Bureau of Census and Statistics, Melbourne, Australia.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.
Dec. 31:					
1910	11,745,000	1,026,000	92,047,000	314,000	2,166,000
1911	11,829,000	1,111,000	93,004,000		2,279,000
1912	11,577,000	845,000	83,254,000		2,408,000
1913	11,484,000	801,000	85,057,000	262,000	2,523,000
1914	11,052,000	862,000	78,600,000		2,521,000
1915	9,931,000	754,000	69,257,000		2,378,000
1916	10,459,000	1,007,000	76,669,000		2,437,000
1917	11,829,000	1,169,000	84,965,000		2,499,000
1918	12,739,000	914,000	87,086,000		2,528,000
1919	11,040,000	[1] 1,111,000	[2] 88,000,000		
June 30:					
1920			[2] 78,000,000		

[1] Excluding northern territory.
[2] Unofficial estimate.

TABLE 8.—*Net imports or net exports of leading farm products, for Australia.*

[Source: Trade and Customs and Excise Revenue of the Commonwealth of Australia.]

Year.	Barley.[1]		Net imports.			Net exports.			Net imports.	
	Net imports.	Net exports.	Corn.[2]	Oats.[2]	Rice.	Wheat.[2]	Butter.	Cheese.	Cotton, unmanufactured.[3]	Cottonseed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	327	....	21	[4] 473	44,810	63,213	101,699	830	3	119
1912	591	....	1,136	3,670	51,882	40,316	66,635	[5] 308	3	182
1913	107	....	275	57	46,083	53,099	75,782	1,238	4	174
1914	267	....	1,461	2,199	38,118	5,022	51,643	2,312	2	189
1915	....	11	3,439	2,776	65,322	29,737	12,145	[5] 1,404	(6)	320
1916	....	260	46	[4] 845	31,735	68,621	74,362	10,483	1	151
1917	....	419	[4] 170	[4] 629	54,442	40,158	72,269	8,381	3	119
1918	....	183	127	[4] 346	23,623	66,758	41,098	2,289	2	119
1919	....	1,120	489	[4] 294	35,461	106,243	38,970	7,488	1	29

Year.	Flaxseed, net imports.	Hides and skins, net exports.	Hops, net imports.	Net exports.			Net imports.		Wool, net exports.
				Meat.	Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco.	
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	58	10,727	886	442,932	1,399	59	72,792	14,901	710,425
1912	111	14,700	1,088	420,909	921	[5] 632	220,394	15,036	693,330
1913	139	17,945	1,510	651,687	299	24	167,676	15,804	670,931
1914	180	19,417	1,057	685,149	[5] 4,238	[5] 34	29,093	10,682	572,077
1915	260	8,644	964	197,271	[5] 3,744	[5] 625	260,018	12,540	522,435
1916	393	5,907	649	408,424	5,384	164	181,709	16,878	398,730
1917	617	2,089	[4] 80	298,371	731	124	35,130	5,707	321,012
1918	691	2,879	403	369,075	[5] 209	240	115,815	15,989	607,188
1919	369	17,414	253	519,844	[5] 384	[5] 45	252,343	16,225	680,726

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year, 1911–1913; 1914 and subsequently, year beginning July 1.

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net exports.
[5] Net imports.
[6] Less than 500 bales.

TABLE 9.—*Crops of Austria.*

[Source: Statistisches Handbuch of the Statistische Zentralkommission of the Republic of Austria. Statistics for principal crops of the area now included in this Republic are available as early as 1874 in the reports of the Ministry of Agriculture of the Kingdom of Austria.]

Year.	Barley.			Buckwheat.			Corn.			Millet and sorghum.[1]			Oats.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1913	327	25.3	8,242	77	12.0	931	122	25.2	3,081	6	11.2	69	856	37.4	32,091
1917	268	12.3	3,291	64	11.1	705	121	23.3	2,810	8	12.3	98	700	15.6	10,901
1918	255	16.5	4,233	55	10.0	549	113	20.2	2,290	10	13.5	133	651	19.8	12,933

[1] Early "first" crop only.

TABLE 9.—*Crops of Austria*—Continued.

Year.	Rye.			Wheat.			Legumes.			Flaxseed.			Flax fiber.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1913..	1,006	22.6	23,781	486	21.9	10,653	39	15.6	604	9	7.2	67	9	0.27	3
1917..	820	12.5	10,921	411	14.6	5,992	32	9.7	306	7	6.1	45	7	.22	2
1918..	773	12.8	10,604	400	12.9	5,159	20	11.2	219	6	6.1	35	7	.31	2

Year.	Potatoes.			Sugar beets.			Fodder beets.[1]			Clover hay.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1913............	398	139	55,421	44	10.0	445	146	8.9	1,296	472	1.9	909
1917............	323	102	32,890	22	4.5	99	91	4.4	396	452	1.0	462
1918............	287	75	21,495	21	8.7	188	87	6.8	591	359	1.2	415

[1] Early "first" crop only.

CATTLE AND SWINE IN AUSTRIA, 1918.

According to the Austrian Department of Agriculture and Forestry, there were in Austria, in 1918, 1,841,883 cattle and 1,269,875 swine. The cattle included 901,894 cows and 223,614 oxen.

TABLE 10.—*Number of live stock in Austria and Hungary.*

[Source: K. K. Statistichen Zentral Komission, Vienna.]

Date.	Cattle.[3]	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
Austria:[1]							
Dec. 31, 1910 [2]..	1,160,000	6,432,000	2,428,000	1,257,000	1,803,000	21,000	53,000
Hungary:[1].							
Apr. 30, 1910....	5,723,000	4,497,000	6,913,000	260,000	1,880,000	1,000	16,000
Feb. 28, 1911 [2]..	6,184,000	6,416,000	7,698,000	331,000	2,001,000	1,000	18,000
Apr. 30, 1911....	5,942,000	6,167,000	7,510,000	331,000	1,967,000	1,000	18,000
Apr. 30, 1912....	6,037,000	7,410,000	7,168,000	314,000	1,960,000	1,000	16,000
Apr. 30, 1913....	6,207,000	6,825,000	6,560,000	269,000	2,005,000	1,000	16,000

[1] Old boundaries.
[2] Census.
[3] Includes 1,000 buffaloes in 1910 in Austria. Including buffaloes in Hungary, which in 1910, numbered 161,000; in 1911, 149,000; in 1912, 157,000; in 1913, 162,000.

TABLE 11.—*Net imports or net exports of leading farm products, for Austria-Hungary.*

[Source: Statistik des Auswärtigen Handels des Vertragszollgebiets der beiden Staaten der Öster-Ungar Monarchie.]

Year.	Barley.[1] Net exports.	Net imports.								
		Corn.[2]	Oats.[2]	Rice.	Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton,[3] unmanufactured.	Cottonseed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911.......	13,282	7,730	8,165	201,234	2,049	4,584	2,011	11,620	897	13
1912.......	20,097	29,070	914	153,713	1,323	[4] 63	6,412	11,839	1,006	16
1913.......	18,918	25,814	701	165,679	255	[4] 712	11,577	12,093	935	16

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.
[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net exports.

TABLE 11.—*Net imports or net exports of leading farm products, for Austria-Hungary*—Continued.

Year.	Net imports. Flaxseed.	Net imports. Hides and skins.	Hops, net exports.	Meat, net imports.	Oil cake and oil-cakemeal, net exports.	Potatoes, net imports.	Sugar, net exports.	Tobacco, unmanufactured, net imports.	Wool, net imports.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	1,389	38,591	9,586	64,900	110,681	2,106	1,334,068	26,356	56,057
1912	1,739	8,712	27,695	31,908	53,570	2,423	1,528,007	22,902	57,258
1913	2,489	20,348	14,156	13,735	31,392	3,327	2,344,687	28,927	48,864

TABLE 12.—*Crops of Belgium.*

[Source: Rapports et Communications, Statistique Agricole; issued by the Ministère de Agriculture et des Travaux publics of Belgium. These statistics are available as early as 1846 for some principal crops.]

Year.	Barley. Area.[1]	Barley. Yield per acre.[2]	Barley. Production.	Buckwheat. Area.[1]	Buckwheat. Yield per acre.[2]	Buckwheat. Production.	Maslin. Area.[1]	Maslin. Yield per acre.[2]	Maslin. Production.	Oats. Area.[1]	Oats. Yield per acre.[2]	Oats. Production.
	1,000 acres.	*Bush.*[3]	*1,000 bush.*	*Acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	83	53.6	4,445	3,242	16.5	54	22	31.5	685	639	67.7	43,249
1912	84	50.6	4,253	3,284	22.0	72	20	30.6	625	648	54.1	35,086
1913	84	50.2	4,217	3,047	27.4	83	20	31.2	613	671	71.4	47,957
1914	84	50.4	4,232	...	...	...	...	...	...	686	72.5	49,742
1915	...	...	4,000	...	...	...	...	...	...	...	...	40,000
1919	75	48.2	3,617	...	...	...	...	...	...	550	[3] 48.9	26,920
1920	87	42.4	3,693	...	...	...	...	...	...	537	[3] 51.9	27,876

Year.	Rye. Area.	Rye. Yield.	Rye. Production.	Spelt. Area.	Spelt. Yield.	Spelt. Production.	Wheat. Area.	Wheat. Yield.	Wheat. Production.	Beans. Area.	Beans. Yield.	Beans. Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*Acres.*	*Bush.*	*1,000 bush.*
1911	648	37.6	24,360	47	45.4	2,127	399	39.5	15,745	21,246	31.2	662
1912	650	32.8	21,313	40	50.1	2,010	397	38.7	15,348	20,107	25.6	514
1913	641	35.0	22,463	43	49.2	2,138	394	37.5	14,769	20,433	35.9	733
1914	645	[3] 35.9	23,137	...	...	...	400	[3] 34.9	13,973	...	...	...
1915	...	...	18,000	...	...	...	...	...	...	...	...	...
1917	...	...	[4] 5,008	...	...	...	...	...	[4] 8,252	...	...	...
1918	...	...	[4] 5,132	...	...	...	...	...	[4] 6,189	...	...	...
1919	496	[3] 27.6	13,681	...	...	...	329	[3] 30.1	9,895	...	...	...
1920	506	[3] 27.1	13,701	...	...	...	282	[3] 28.2	7,948	...	...	...

Year.	Beets (fodder). Area.	Beets (fodder). Yield.	Beets (fodder). Production.	Carrots. Area.	Carrots. Yield.	Carrots. Production.	Chicory. Area.	Chicory. Yield.	Chicory. Production.	Rape seed. Area.	Rape seed. Yield.	Rape seed. Production.
	1,000 acres.	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Tons.*[3]	*1,000 tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*Acres.*	*Tons.*	*Tons.*
1911	175	19.9	3,488	27	24.9	672	21	13.0	278	1,450	1.0	1,520
1912	174	26.9	4,677	28	6.2	175	23	14.8	347	1,559	1.0	1,579
1913	176	28.5	5,020	26	8.2	214	21	14.3	303	1,641	1.1	1,758

[1] Area cultivated.
[2] Yield per acre harvested.
[3] Yield per acre cultivated.
[4] Unofficial.

TABLE 12.—*Crops of Belgium*—Continued.

Year.	Flax (fiber).[5]			Hay (alfalfa, and clover).			Hops.			Peas.		
	1,000 acres.	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	49	.53	27	389	2.6	1,022	5	1,306.2	6,779	12	33.9	.417
1912	54	.60	32	349	2.9	1,009	6	1,802.2	10,168	12	33.2	409
1913	57	.34	20	364	2.9	1,067	6	1,244.6	7,395	12	30.3	375
1919	48	[4] .31	15				3	[4] 646.7	1,940			

Year	Potatoes.			Sugar beets.			Tobacco.			Turnips.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1911	387	260.9	100,934	145	11.4	1,661	10,546	1,772.8	18,695	276	3.6	981
1912	387	313.8	121,481	153	12.5	1,907	9,926	2,227.8	22,109	345	6.7	2,292
1913	395	307.0	117,613	130	11.8	1,543	9,940	1,982.5	19,702	350	13.2	4,633
1914	411											
1919	319	[4] 238.4	76,064	112	[4] 7.1	793	14,707	[4] 1,626.4	23,920			
1920	331	[4] 172.5	57,094						8,848			

[4] Unofficial.
[5] Flaxseed production was as follows: 1911, 515,000 bushels; 1912, 514,000; 1913, 387,000; 1919, 407,000.

TABLE 13.—*Number of live stock in Belgium.*

[Source: Ministere de l'Interieur, Brussels.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.[1]
Dec. 31:					
1910[2]	1,880,000	1,494,000	185,000	218,000	328,000
1911	1,812,000	1,229,000			261,000
1912	1,831,000	1,349,000			263,000
1913	1,849,000	1,412,000			267,000
October:					
1919	[3] 1,152,000	328,000	112,000	37,000	174,000
1920	1,292,000	546,000	126,000	33,000	198,000

[1] Includes mules and asses in 1910, 1919, and 1920.
[2] Census.
[3] Milk cows only.

TABLE 14.—*Net imports or net exports of leading farm products, for Belgium.*

[Source: Tableau Général du Commerce de la Belgique.]

Year.	Net imports.									
	Barley.[1]	Corn.[2]	Oats.[2]	Rice.	Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton[3] unmanufactured.	Cottonseed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	16,458	15,968	7,362	76,726	5,877	56,306	11,816	29,376	328	1,295
1912	17,497	21,022	9,514	92,244	4,154	51,391	12,600	31,114	410	1,535
1913	15,193	18,902	9,482	70,174	5,699	53,892	12,375	35,605	349	991
1919	2,262	808	3,914	19,295	1,723	11,475	11,166	16,370	237	130
1920	2,388	2,555	4,559	43,668	3,704	33,538	18,341	20,695	285	255

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.

TABLE 14.—*Net imports or net exports of leading farm products, for Belgium*—Contd.

Year.	Net imports.					Potatoes. Net exports.	Sugar. Net exports.	Tobacco, unmanufactured. Net imports.	Wool. Net imports.
	Flaxseed.	Hides and skins.	Hops.	Meat.	Oil cake and oil-cake meal.				
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	2,924	61,811	[4] 135	64,959	355,339	1,199	345,704	20,655	104,830
1912	2,901	62,190	2,593	48,734	376,835	5,732	335,910	25,974	99,071
1913	4,220	80,464	1,067	42,494	442,150	4,384	240,571	21,555	110,881
1919	979	19,234	5,436	45,574	[4] 37,593	3,698	[5] 60,071	30,030	73,062
1920	716	22,590	3,460	96,771	[4] 48,013	857	32,007	35,706	88,797

NOTE.—The figures in the table are the differences between imports and exports. The year covered is the calendar year.

[4] Net exports. [5] Net imports.

TABLE 15.—*Number of live stock in Brazil.*

[Source: Ministerio da Agricultura, Industria e Commercio, Rio de Janeiro, Brazil.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules and asses.
1912-13 [1]	30,705,000	18,399,000	10,653,000	10,049,000	7,289,000	3,208,000
1916	28,962,000	17,329,000	7,205,000	6,920,000	6,065,000	3,222,000
Dec. 1918 [2]	37,500,000	....	....	....	....	....

[1] Census. [2] Unofficial estimate.

TABLE 16.—*Net imports or net exports of leading farm products, for Brazil.*

[Source: Commercio Exterior do Brazil.]

Year.	Net imports.							Cotton,[3] unmanufactured net exports.	Cotton-seed oil net imports.
	Barley.[1]	Corn.[2]	Oats.[2]	Rice.	Wheat.[2]	Butter.	Cheese.		
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	725	150	....	36,332	20,203	4,316	3,931	68	670
1912	967	247	....	22,463	23,609	4,208	6,280	77	670
1913	1,241	367	26	17,037	24,722	4,336	4,192	173	440
1914	638	56	24	14,401	20,808	2,364	3,288	140	383
1915	864	99	10	15,284	20,142	732	2,300	24	377
1916	655	[4] 125	5	[4] 1,325	21,553	138	1,423	5	181
1917	691	[4] 992	15	[4] 99,021	12,618	[4] 10	274	27	[4] 285
1918	308	[4] 1,222	25	[4] 61,724	18,499	[4] 170	126	12	[4] 604
1919	622	[4] 627	25	[4] 62,660	22,404	[4] 520	205	56	[4] 645

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net exports.

TABLE 16.—*Net imports or net exports of leading farm products, for Brazil*—Contd.

Year.	Hides and skins, net exports.	Hops, net imports.	Meat. Net imports.	Meat. Net exports.	Oil cake and oil-cake meal, net exports.	Potatoes, net imports.	Net exports. Sugar.	Net exports. Tobacco.	Net exports. Wool.
	1,000 lbs.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	76,344	481	64,134	....	7,549	656	79,591	40,201	2,148
1912	86,958	781	56,445	....	7,838	1,065	10,289	53,743	4,199
1913	84,451	781	36,896	....	8,857	1,095	11,495	63,997	2,839
1914	74,782	647	12,714	....	5,539	697	70,041	58,729	2,448
1915	109,163	638	....	6,603	9,163	322	130,354	58,383	3,658
1916	124,631	483	....	89,617	3,603	166	119,899	45,288	2,906
1917	93,863	626	....	225,367	3,260	[1] 162	304,544	55,125	2,016
1918	104,995	385	....	207,022	694	[1] 175	254,852	62,741	2,929
1919	134,964	741	....	247,998	9,874	29	152,832	92,386	4,873

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Net exports.

TABLE 17.—*Crops of British India.*

[Source: Estimates of area and yield of principal crops in India; issued by the Department of Statistics of India.]

Crop year.	Barley. Area.	Barley. Yield per acre.	Barley. Production.	Corn. Area.	Corn. Yield per acre.	Corn. Production.	Millet (great). Area.	Millet (great). Yield per acre.	Millet (great). Production.	Millet (spiked). Area.	Millet (spiked). Yield per acre.	Millet (spiked). Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1910–11	7,840	......	....	6,312	......	....	21,184	......	....	15,540	......	....
1911–12	8,378	5.4	45,500	5,567	13.8	76,760	18,565	5.3	98,920	12,473	3.7	45,760
1912–13	7,295	5.6	40,973	6,225	14.2	88,440	21,029	8.4	175,800	15,671	5.9	92,920
1913–14	7,144	17.5	125,113	6,146	13.6	83,360	21,374	7.6	161,600	14,756	5.4	79,160
1914–15	7,821	18.3	142,847	6,144	13.6	83,280	21,187	9.7	206,440	15,702	6.6	104,240
1915–16	7,924	18.6	147,653	6,679	15.0	100,080	22,993	10.5	241,600	14,283	6.7	95,172
1916–17	7,883	19.7	155,447	6,518	14.4	93,760	21,850	5.1	111,840	15,166	5.2	78,600
1917–18	8,407	18.5	155,307	6,442	15.0	96,600	21,055	8.5	179,400	12,671	6.7	85,320
1918–19	6,394	20.3	129,827	5,994	11.8	70,808	20,394	6.7	136,256	11,161	5.0	55,496

Crop year.	Wheat.			Cotton (ginned).			Flaxseed (linseed).[1]			Indigo.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 bales.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1910–11	30,565	12.3	375,629	23,040	68	3,224	3,742	5.6	22,852	276	18.6	5,152
1911–12	31,141	11.9	370,515	21,615	61	2,751	5,038	5.1	25,796	267	20.0	5,342
1912–13	30,043	12.3	367,845	22,028	84	3,858	4,125	5.3	21,684	217	20	4,379
1913–14	28,475	11.0	312,032	25,023	81	4,239	3,031	5.1	15,448	173	17	3,002
1914–15	32,475	11.6	376,581	24,567	85	4,359	3,325	4.8	15,880	148	19	2,822
1915–16	30,320	10.6	323,008	17,745	84	3,128	3,334	5.7	19,040	353	17	6,171
1916–17	32,940	11.5	379,232	21,745	79	3,576	3,564	5.8	20,800	770	14	10,718
1917–18	35,487	10.4	370,421	25,298	64	3,402	3,797	5.4	20,600	710	20	14,202
1918–19	23,798	11.8	280,299	20,497	72	3,072	1,989	4.7	9,400	301	16	4,939
1919–20	29,976	12.6	376,768	23,353	99	4,850	3,101	5.6	17,320	235	18	4,222

Crop year.	Jute.			Peanuts (groundnuts).			Pulse.			Rape and mustard seed.[1]		
	1,000 acres.	*Lbs.*	*1,000 bales.*[2]	*1,000 acres.*	*Lbs.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 tons.*
1910–11	2,938	1,080	7,932	952	1,184	564	....	......	....	6,316	443	1,400
1911–12	3,106	1,060	8,235	1,214	1,118	678	13,844	11.9	164,341	6,990	425	1,485
1912–13	2,970	1,325	9,843	1,366	1,098	750	11,716	10.8	126,037	5,956	467	1,390
1913–14	2,911	1,325	8,894	2,106	796	839	8,951	8.1	72,315	6,266	389	1,218
1914–15	3,359	1,222	10,444	2,413	879	1,061	13,778	10.5	143,397	6,507	419	1,366
1915–16	2,376	1,244	7,341	1,664	1,424	1,185	13,224	9.7	127,979	6,437	384	1,234
1916–17	2,703	1,236	8,306	2,334	1,148	1,340	15,307	9.1	147,467	6,495	411	1,323
1917–18	2,736	1,229	8,865	1,936	1,223	1,184	16,255	10.2	165,275	7,126	362	1,191
1918–19	2,500	1,296	6,956	1,312	837	549	7,367	9.7	71,699	4,847	351	850
1919–20	2,822	1,113	8,428	1,586	1,161	922	....	......	....	5,895	438	1,291

[1] Including the crops of both "pure" and "mixed" seed.
[2] Bales of 400 pounds.

TABLE 17.—*Crops of British India*—Continued.

Crop year.	Sesamum.[1]			Sugar (cane).[2]			Tea.			Rice (hulled).		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Lbs.*	*1,000 tons.*	*1,000 acres.*	*Lbs.*	*1,000 tons.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1910–11	5,206	220	573	2,115	2,298	2,484	564	467	263,269	58,029	1,077	62,489,056
1911–12	4,808	185	445	2,380	2,307	2,745	575	467	268,603	64,726	1,041	67,364,976
1912–13	4,980	212	529	2,527	2,290	2,894	592	503	297,878	71,623	891	63,805,168
1913–14	5,076	178	452	2,546	2,016	2,566	610	504	307,250	75,425	855	64,490,272
1914–15	5,565	213	617	2,311	2,386	2,757	624	501	313,301	76,625	796	61,022,080
1915–16	5,108	211	540	2,391	2,468	2,950	635	586	372,203	78,152	941	73,525,760
1916–17	5,023	229	552	2,416	2,531	2,941	649	571	370,314	80,080	973	77,931,840
1917–18	4,271	200	427	2,809	2,640	3,708	667	557	371,296	80,141	1,013	81,197,760
1918–19	4,054	158	320	2,820	1,856	2,617	678	561	380,459	79,508	695	55,218,240
1919–20	4,465	248	554	2,686	2,532	3,400	......	......	....	79,426	902	71,612,800

[1] Including the crops of both "pure" and "mixed" seed.
[2] Acreage of cane and production of cane sugar.

TABLE 18.—*Number of live stock in British India.*

[Source: Department of Statistics, Calcutta, India.]

Date.	Cattle.[1]	Sheep.[2]	Goats.[2]	Horses.[2]	Mules.[2]	Asses.[2]
1909–10 [3]	119,369,000	23,235,000	30,604,000	1,553,000	113,000	1,337,000
1910–11 [3]	120,658,000	23,281,000	30,900,000	1,565,000	113,000	1,342,000
1911–12 [3]	120,909,000	23,290,000	30,914,000	1,574,000	113,000	1,341,000
1912–13	138,129,000	22,934,000	28,684,000	1,555,000	81,000	1,364,000
1913–14	143,179,000	23,081,000	30,694,000	1,644,000	79,000	1,508,000
1914–15	147,239,000	23,005,000	33,360,000	1,654,000	72,000	1,511,000
1915–16	148,872,000	22,960,000	33,664,000	1,673,000	70,000	1,538,000
1916–17	149,353,000	22,913,000	33,423,000	1,682,000	72,000	1,536,000
1917–18	149,111,000	22,895,000	33,165,000	1,681,000	71,000	1,534,000

[1] Includes buffaloes, which numbered in 1909–10, 16,951,000; in 1910–11, 17,063,000; in 1911–12, 17,106,000; in 1912–13, 17,709,000; in 1913–14, 18,214,000; in 1914–15, 19,004,000; in 1915–16, 19,188,000; in 1916–17, 19,266,000; in 1917–18, 19,235,000.
[2] Exclusive of Bengal, subsequent to 1911–12.
[3] Exclusive of eastern Bengal.

TABLE 19.—*Net imports or net exports of leading farm products, for British India.*

[Source: Annual and monthly reports on the sea-borne and land trade of British India.]

Year.	Net exports.					Cheese, net imports.	Net exports.	
	Barley.[1]	Corn.[2]	Rice.	Wheat.[2]	Butter.		Cotton, unmanufactured.	Flaxseed.
	1,000 bush.	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.[3]*	*1,000 bush.*
1911	9,475	....	5,439,133	54,707	[4] 296	1,249	1,695	21,090
1912	31,843	871	5,998,640	68,339	[4] 316	1,333	1,500	14,116
1913	10,069	290	5,475,471	54,385	354	1,297	2,196	14,664
1914	1,290	29	4,189,087	28,868	251	1,112	2,769	14,007
1915	7,441	154	2,487,984	28,927	478	1,152	2,097	7,150
1916	7,705	126	3,340,723	27,159	953	946	2,109	15,551
1917	14,531	2,723	3,464,123	57,637	1,273	496	1,654	7,125
1918	14,848	2,378	5,146,985	23,842	885	879	792	8,448
1919	598	3	1,295,809	[4] 5,206	659	304	1,514	13,324

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net imports.

TABLE 19.—*Net imports or net exports of leading farm products, for British India*—Continued.

Year.	Hides and skins, net exports.	Net imports.		Oil cake and oil-cake meal, net exports.	Sugar, net imports.	Net exports.	
		Hops.	Meat.			Tobacco.	Wool.
	1,000 lbs.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	134,112	285	10,513	300,054	1,226,957	29,364	37,784
1912	161,444	247	11,000	332,048	1,281,314	25,910	27,282
1913	160,732	162	14,511	399,400	1,646,448	28,795	21,510
1914	129,690	118	11,893	331,534	1,168,563	17,434	21,956
1915	123,396	141	12,180	333,169	1,056,871	27,562	20,408
1916	141,819	275	10,439	290,713	939,472	28,394	21,785
1917	116,059	336	5,237	200,690	892,408	20,359	14,966
1918	67,581	532	528	189,244	1,119,342	22,740	12,006
1919	181,671	....	954	302,942	889,066	35,206	8,760

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

TABLE 20.—*Crops of Bulgaria.*

[Sources: Statistique Agricole; issued by the Direction Générale de la Statistique du Royaume de Bulgarie. Bulletin Mensuel de la Direction Générale de la Statistique du Royaume de Bulgarie. These statistics begin as early as 1898. Subsequent to 1918, the figures refer to the area within the new boundaries.]

Year.	Barley.			Corn.			Maslin.			Millet (grain).		
	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	621	20.0	12,390	1,562	[3] 19.6	30,590	235	17.9	4,208	30	[2] 16.2	485
1912	619	20.1	12,440	1,589	[3] 21.0	28,475	224	17.1	3,836	23	14.3	330
1913	502	22.6	11,366	1,449	[3] 19.8	30,455	205	18.0	3,683	22	17.9	387
1914	534	17.3	9,217	1,566	19.8	31,075	206	12.3	2,536	21	16.1	344
1915	590	20.1	11,848	1,579	18.9	29,821	200	15.1	3,013	29	16.4	477
1916	560	17.9	10,037	1,342	13.0	17,471	139	13.9	1,937	17	11.8	201
1917	593	20.2	11,980	1,385	12.8	17,780	223	15.1	3,373	16	12.5	200
1918	604	11.7	7,094	1,455	5.6	8,144	255	11.5	2,931	19	3.9	74
1919	474	22.2	10,538	1,392	28.3	39,412	......	......	......	......	......	......
1920	502	28.0	14,066	1,419	27.9	39,650	......	......	......	......	......	......

Year.	Oats.			Rice (hulled).			Rye.			Spelt.		
	1,000 acres.	*Bush.*[3]	*1,000 bush.*	*Acres.*	*Tons.*[3]	*Tons.*	*1,000 acres.*	*Bush.*[3]	*1,000 bush.*	*1,000 acres.*	*Bush.*[3]	*1,000 bush.*
1911	447	23.3	10,421	5,730	0.58	3,333	545	16.5	8,992	28	18.6	517
1912	435	20.0	8,707	7,215	.57	4,130	529	15.9	8,422	25	14.2	355
1913	386	24.3	9,375	......	......	......	488	19.0	8,808	24	20.4	486
1914	379	21.3	8,080	5,390	.60	3,208	527	13.8	7,255	24	17.6	402
1915	395	23.1	9,130	3,813	.66	2,512	507	14.0	7,107	22	17.7	389
1916	326	19.8	6,440	7,265	.58	4,202	465	11.5	5,356	24	14.7	352
1917	343	19.1	6,558	11,686	.63	7,328	442	13.4	5,901	22	14.0	309
1918	345	10.5	3,613	14,468	.42	6,129	475	9.3	4,427	24	9.6	231
1919	302	24.5	7,387	4,000	.68	2,737	446	14.6	6,490	......	......	......
1920	319	30.5	9,731	......	......	......	417	21.4	8,931	......	......	......

[1] Area cultivated.
[2] Yield per acre cultivated.
[3] Official average for yield per acre as harvested.

TABLE 20.—*Crops of Bulgaria*—Continued.

Year.	Wheat.			Anise seed.			Beans (haricots).			Cabbage.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1911	2,764	17.5	48,295	3,805	[1] 420	1,599	153	[1] 11.3	1,736	8	7.0	58
1912	2,887	15.5	44,756	3,954	439	1,736	185	12.0	2,211	8	6.0	47
1913	2,510	17.9	44,812	......	......	......	......	......	......	......	......	......
1914	2,638	9.8	25,980	......	......	......	......	......	......	......	......	......
1915	2,408	15.3	36,940	......	......	......	......	......	......	......	......	......
1916	2,220	12.5	27,764	......	......	......	......	......	......	......	......	......
1917	2,481	13.4	33,294	......	......	......	......	......	......	......	......	......
1918	2,446	10.4	25,341	......	......	......	......	......	......	......	......	......
1919	2,080	16.4	34,028	......	......	......	......	......	......	......	......	......
1920	2,154	19.1	41,189	......	......	......	......	......	......	......	......	......

NOTE.—Where the original Bulgarian reports give production both in weight and cubic measure, the figures for weight have been used in compiling this table.

[1] Official average for yield per acre as harvested.

TABLE 21.—*Number of live stock in Bulgaria.*[1]

[Source: Department of Statistics, Sophia.]

Date.	Cattle.[2]	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
Dec. 31:							
1910 [3]	2,018,000	527,000	8,632,000	1,459,000	478,000	12,000	117,000
1911	1,033,000	......	......	......	226,000	......	......
1912	1,015,000	......	......	......	219,000	......	......

[1] All figures, except for census years, are for farm animals only.
[2] Including buffaloes, which in 1910 numbered 415,000; in 1911, 167,000; in 1912, 163,000.
[3] Census.

TABLE 22.—*Net imports or net exports of leading farm products, for Bulgaria.*

[Source: Mouvement Commercial de la Bulgarie avec les Pays Etrangers.]

Year.	Net exports.			Rice. Net imports.	Net exports.				Net imports.	
	Barley.[1]	Corn.[2]	Oats.[2]		Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton, unmanufactured.[3]	Cotton seed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 galls.*
1911	3,430	13,950	466	8,554	2,949	14,512	370	7,513	5	(4)
1912	778	11,362	120	11,727	2,028	11,449	86	4,000	4	35
1915	389	3,676	......	......	93	......	......	6,483	......	......
1919	......	......	......	......	......	17	......	......	......	......
1920	......	4,185	699	......	17	668	......	......	......	......

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Less than 500 gallons.

TABLE 22.—*Net imports or net exports of leading farm products; for Bulgaria*—Contd.

Year.	Net imports.			Net exports.		Net imports.		Tobacco, unmanufactured, net exports.	Wool, net imports.
	Flaxseed.	Hides and skins.	Hops.	Meat.	Oil cake and oil-cake meal.	Potatoes.	Sugar.		
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	2	6,714	134	197	486	9	30,736	4,791	1,314
1912	[5] 13	4,579	106	281	447	...	25,700	3,577	1,690
1913	2	...	...	...	...	...	...	...	...
1914	12	...	...	...	...	...	...	...	...
1915	...	[5] 2,423	...	...	...	[5] 59	...	7,248	[5] 2,291
1916	...	...	...	...	...	...	...	...	...
1919	...	[5] 2,405	...	...	...	...	...	16,216	...
1920	...	[5] 4,521	...	...	...	...	...	38,793	...

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[5] Net exports.

TABLE 23.—*Crops of Canada.*

[Sources: Monthly Bulletin of Agricultural Statistics (since March, 1917) and Census and Statistics Monthly (March, 1917, and earlier); issued by the Dominion Bureau of Statistics of Canada. These statistics begin with decennial census, acreage 1870, production 1850; annual statistics of acreage and production begin with 1908.]

Year.	Barley.			Buckwheat.			Corn (for husking).			Mixed grains.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	1,522	29.2	44,415	372	22.7	8,441	322	59.6	19,185	525	29.9	15,712
1912	1,581	31.2	49,398	399	26.4	10,517	298	56.8	16,950	497	34.6	17,198
1913	1,613	30.0	48,319	381	22.0	8,372	278	60.3	16,773	474	33.3	15,792
1914	1,496	24.2	36,201	354	24.3	8,626	256	54.4	13,924	463	35.4	16,383
1915	1,718	31.5	54,017	344	22.9	7,866	253	56.7	14,368	467	37.5	17,518
1916	1,803	23.7	42,770	342	17.5	5,976	173	36.3	6,282	413	25.8	10,585
1917	2,392	23.0	55,058	396	18.0	7,149	234	33.0	7,763	497	32.5	16,157
1918	3,154	24.5	77,287	548	20.8	11,376	250	56.8	14,205	922	38.8	35,662
1919	2,646	21.2	56,389	445	23.5	10,551	265	64.0	16,940	902	31.0	27,852
1920	2,552	24.8	63,311	378	23.8	8,995	292	49.2	14,335	812	40.0	32,421

Year.	Oats.			Rye.			Wheat.			Beans.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	9,631	37.9	365,179	131	19.0	2,492	11,101	20.8	230,924	53	19.4	1,027
1912	9,966	39.3	391,629	127	19.1	2,428	10,997	20.4	224,159	53	17.5	921
1913	10,434	38.8	404,669	119	19.3	2,300	11,015	21.0	231,717	47	17.2	801
1914	10,062	31.1	313,078	111	18.1	2,017	10,294	15.7	161,280	44	18.2	798
1915	11,556	40.2	464,954	122	20.4	2,486	15,109	26.0	393,543	43	16.7	723
1916	10,996	37.3	410,211	148	19.4	2,876	15,370	17.1	262,781	32	12.7	413
1917	13,313	30.2	403,010	212	18.2	3,857	14,756	15.8	233,743	92	13.8	1,274
1918	14,790	28.8	426,312	555	15.2	8,504	17,354	11.0	189,075	229	15.5	3,563
1919	14,952	26.2	394,387	753	13.5	10,207	19,126	10.0	193,260	84	16.5	1,389
1920	15,850	33.5	530,710	650	17.5	11,306	18,232	14.5	263,189	72	17.5	1,265

TABLE 23.—*Crops of Canada*—Continued.

Year.	Corn (fodder).			Flaxseed.			Hay (alfalfa).			Hay (other, including clover).		
	1,000 acres.	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1911	294	9.1	2,671	879	11.5	10,076	97	2.4	228	8,617	1.6	13,989
1912	299	10.2	3,038	2,022	12.9	26,130	101	2.8	286	8,276	1.5	12,117
1913	304	8.6	2,616	1,553	11.3	17,539	94	2.5	238	8,169	1.3	10,859
1914	317	10.2	3,251	1,084	6.6	7,175	90	2.4	218	7,997	1.3	10,259
1915	332	10.2	3,383	462	13.2	6,114	98	2.6	261	7,777	1.4	10,612
1916	293	6.6	1,908	658	12.6	8,260	99	2.9	287	7,821	1.9	14,527
1917	367	7.3	2,690	920	6.5	5,935	110	2.4	262	8,225	1.7	13,685
1918	502	9.5	4,788	1,068	5.8	6,055	196	2.2	446	10,545	1.4	14,772
1919	512	9.8	4,943	1,093	5.0	5,473	227	2.2	494	10,595	1.6	16,348
1920	589	9.6	5,642	1,428	5.6	7,998	239	2.4	584	10,379	1.3	13,339

Year.	Peas.			Potatoes.			Sugar beets.			Turnips and mangolds.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	295	15.8	4,666	479	148.7	71,238	21	8.5	175	208	377.6	78,497
1912	260	15.1	3,913	484	175.4	84,885	19	10.6	201	198	403.7	80,016
1913	219	18.1	3,952	474	165.9	78,544	17	8.7	148	186	358.3	66,788
1914	206	17.6	3,363	476	180.0	85,672	12	9.0	109	175	394.3	69,003
1915	196	17.7	3,464	486	124.2	60,353	18	7.8	141	157	384.0	60,175
1916	152	14.5	2,218	473	133.8	63,297	15	4.8	71	142	264.2	36,921
1917	199	15.2	3,026	657	121.5	79,892	14	8.4	118	218	290.8	63,451
1918	236	18.2	4,313	735	142.0	104,346	18	10.0	180	325	377.5	122,700
1919	230	14.8	3,406	819	153.5	125,575	24	9.8	240	317	354.0	112,289
1920	186	19.0	3,528	785	170.5	133,831	36	11.4	412	290	401.0	116,391

TABLE 24.—*Number of live stock in Canada.*

[Source: Dominion Bureau of Statistics, Ottawa.]

Date.	Cattle.	Swine.	Sheep.	Horses.	Mules.
June:					
1910	7,115,000	2,754,000	2,598,000	2,213,000	
1911 [1]	6,533,000	3,610,000	2,175,000	2,596,000	
1912	6,432,000	3,477,000	2,082,000	2,692,000	
1913	6,656,000	3,448,000	2,129,000	2,866,000	
1914	6,037,000	3,434,000	2,058,000	2,948,000	
1915	6,066,000	3,112,000	2,039,000	2,996,000	
1916	6,594,000	3,475,000	2,023,000	3,258,000	
1917	7,921,000	3,619,000	2,369,000	3,413,000	
1918	10,056,000	4,290,000	3,053,000	3,609,000	
1919	10,084,000	4,040,000	3,422,000	3,667,000	15,000
1920	9,477,000	3,517,000	3,721,000	3,401,000	9,000

[1] Census.

TABLE 25.—*Net imports or net exports of leading farm products, for Canada.*

[Sources: Annual Reports of the Trade of Canada; also (to compute calendar year figures), Monthly Reports of the Trade of Canada.]

Year.	Barley.[1] Net exports.	Corn.[2] Net imports.	Oats.[2] Net exports.	Rice. Net imports.	Net exports.				Net imports.	
					Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton, unmanufactured.[3]	Cotton-seed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	1,216	16,413	10,153	9,903	38	76,069	7,836	168,316	157	1,830
1912	4,751	9,309	9,417	35,925	[4] 88	103,808	[4] 6,293	152,996	165	2,911
1913	13,546	8,988	31,666	41,298	([4]) ([5])	151,229	[4] 6,666	147,318	166	4,104
1914	6,707	8,090	19,235	41,529	39	89,201	[4] 4,750	137,116	152	4,079
1915	4,594	10,811	15,528	33,293	440	176,563	[4] 2,068	159,508	197	4,900
1916	9,969	7,310	70,416	42,710	961	226,558	5,696	169,488	205	4,745
1917	7,182	7,620	59,760	39,420	807	185,943	3,878	175,925	178	5,246
1918	4,548	11,709	20,257	18,673	503	92,914	19,055	163,939	226	6,255
1919	13,097	6,229	13,051	32,055	1,887	113,472	15,044	107,380	179	5,515
1920	9,750	10,681	15,563	47,150	3,122	44,120	12,256	142,288	241	6,091

Year.	Flaxseed. Net exports.	Hides and skins.		Hops. Net imports.	Net exports.			Net imports.		
		Net exports.	Net imports.		Meat.	Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco.	Wool.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	548	....	4,697	1,254	49,115	30,284	287	598,247	17,295	6,495
1912	8,175	....	16,218	1,473	3,217	58,759	149	650,679	19,649	7,739
1913	22,944	15,369	....	1,441	[4] 1,589	54,440	1,612	668,318	21,773	7,373
1914	7,953	1,755	....	1,587	85,143	14,943	452	689,638	16,427	2,834
1915	1,943	....	18,297	619	166,019	10,516	537	597,544	17,753	11,264
1916	4,824	....	11,135	45	119,543	16,976	986	641,263	20,000	15,587
1917	6,273	4,128	....	782	160,223	[4] 5,273	3,576	653,915	16,910	225
1918	2,075	1,360	....	835	269,188	[4] 41,793	1,398	651,054	21,749	16,279
1919	1,133	8,082	....	1,773	335,639	28,910	5,535	812,918	23,385	[6] 2,065
1920	902	....	758	1,594	132,899	5,200	4,659	703,898	20,343	5,979

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net imports.
[5] Less than 500 bushels.
[6] Net exports.

TABLE 26.—*Crops of Chile.*

[Source: Anuario Estadístico, Agricultura; issued by the Oficina Central de Estadística. These statistics are available as early as 1901-2.]

Year.	Barley.			Corn.			Oats.			Rye.		
	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1910-11	85	40.0	3,379	46	26.6	1,221	58	32.1	1,861	3	15.9	45
1911-12	103	30.0	3,251	56	27.1	1,527	69	48.8	3,380	6	23.6	139
1912-13	131	35.1	4,596	65	25.3	1,647	94	47.4	4,443	7	22.1	147
1913-14	153	36.4	5,567	59	25.7	1,505	122	36.5	4,437	6	26.0	161
1914-15	147	37.1	5,144	80	23.1	1,842	154	46.8	7,104	4	17.7	185
1915-16	121	35.9	5,430	66	23.7	1,540	161	39.6	6,350	11	17.2	187
1916-17	117	38.7	2,165	49	27.4	1,338	126	44.1	5,564	6	14.8	92
1917-18	98	33.9	3,303	65	23.1	1,446	79	39.9	3,177	8	21.2	176
1918-19	98	[3] 40.6	3,977	65	[3] 26.1	1,702	79	[3] 41.1	3,250	8	[3] 24.0	192
1919-20	......	......	......	......	......	1,689	......	......	......	......	......	......

[1] Area cultivated.
[2] Yield per acre harvested.
[3] Yield per acre cultivated.

TABLE 26.—*Crops of Chile*—Continued.

Year.	Wheat.			Beans.			Hay (alfalfa and clover).			Peas (chickpeas and other).		
	1,000 acres.	*Bush.*[3]	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*[3]	*1,000 bush.*
1910–11	968	18.8	18,184	72	18.9	1,360	.....	.....	271	25	12.3	308
1911–12	1,093	20.6	22,468	90	18.4	1,669	.....	.....	392	27	18.7	504
1912–13	1,103	21.4	23,575	85	18.3	1,551	.....	.....	393	34	13.9	474
1913–14	1,018	16.1	16,403	76	18.1	1,377	.....	.....	335	25	13.4	335
1914–15	1,074	17.7	19,000	106	17.8	1,876	.....	.....	.....	.....	.....	.....
1915–16	1,143	17.7	20,184	.....	17.4	1,914	.....	.....	.....	.....	.....	.....
1916–17	1,272	17.7	22,498	.....	19.9	.....	.....	.....	.....	.....	.....	.....
1917–18	1,302	17.8	23,120	.....	19.3	.....	.....	.....	.....	.....	.....	.....
1918–19	1,313	16.4	21,591	.....	.....	.....	.....	.....	.....	.....	.....	.....
1919–20	.....	.....	21,845	.....	.....	.....	.....	.....	.....	.....	.....	.....

Year.	Potatoes.			Seed (alfalfa).			Seed (clover).			Tobacco.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*Acres.*	*Bush.*[3]	*1,000 bush.*	*Acres.*	*Bush.*	*1,000 bush.*	*Acres.*	*Lbs.*[3]	*1,000 lbs.*
1910–11	68	109.4	7,440	373	56.3	21	959	[3] 6.3	6	64	2,344	150
1911–12	66	146.5	9,656	2,313	39.8	92	.....	.....	26	2,478	2,049	5,077
1912–13	78	112.1	8,753	.....	.....	151	.....	.....	57	3,430	2,485	8,524
1913–14	81	112.7	9,169	.....	.....	56	.....	.....	90	.....	.....	6,282
1914–15	78	121.6	9,546	.....	.....	.....	.....	.....	.....	1,033	3,157	3,261
1915–16	79	147.2	11,598	.....	.....	.....	.....	.....	.....	.....	.....	.....
1916–17	70	129.1	9,091	.....	.....	.....	.....	.....	.....	4,000	2,740	10,958
1917–18	81	118.8	9,768	.....	.....	.....	.....	.....	.....	3,000	2,310	6,929
1918–19	78	[3] 123.6	9,640	.....	.....	.....	.....	.....	.....	.....	.....	.....
1919–20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

[3] Yield per acre cultivated.

TABLE 27.—*Number of live stock in Chile.*

[Source: Statistical abstract of the Republic of Chile.]

Year.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
1911	1,640,000	160,000	3,535,000	210,000	352,000	30,000	33,000
1912	1,760,000	166,000	4,169,000	273,000	421,000	37,000	33,000
1913	2,084,000	184,000	4,567,000	288,000	489,000	34,000	30,000
1914	1,969,000	221,000	4,602,000	299,000	458,000	38,000	33,000
1915	1,944,000	229,000	4,545,000	394,000	458,000	42,000	37,000
1916	1,869,000	260,000	4,569,000	386,000	443,000	39,000	36,000
1917	2,030,000	301,000	4,183,000	376,000	403,000	52,000	36,000
1918	2,225,000	326,000	4,434,000	452,000	411,000	53,000	38,000

TABLE 28.—*Net imports or net exports of leading farm products, for Chile.*

[Source: Estadistica Comercial de la Republica de Chile.]

Year.	Barley,[1] net exports.	Corn,[2] net imports.	Oats,[2] net exports.	Rice, net imports.	Wheat,[2] net exports.	Net imports.		
						Butter.	Cheese.	Cotton,[3] unmanufactured.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*
1911	941	25	1,095	27,785	348	761	738	[4]
1912	86	49	2,713	36,044	2,686	1,065	885	4
1913	401	23	3,687	40,351	2,215	1,347	830	[5] [4]
1914	3,032	7	3,371	28,835	[6] 2,674	976	496	[5] [4]
1915	1,537	30	7,298	47,724	[6] 3,150	285	419	[4]
1916	1,149	17	4,386	28,103	202	231	137	2
1917	1,054	6	3,440	41,963	956	300	285	1
1918	1,450	38	466	30,181	4,260	587	477	[4]

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Less than 500 bales.
[5] Net exports.
[6] Net imports.

TABLE 28.—*Net imports or net exports of leading farm products, for Chile*—Continued.

Year.	Flaxseed, net imports.	Hides and skins, net exports.	Hops, net imports.	Net exports. Meat.	Net exports. Oil cake and oil-cake meal.	Net exports. Potatoes.	Net imports. Sugar.	Net imports. Tobacco.	Wool, net exports.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	[5] 1	10,715	494	7,258	2,858	134	190,613	158	22,272
1912	(7)	13,770	648	4,662	2,804	76	149,393	322	25,742
1913	8	16,485	589	11,982	5,649	51	197,046	157	26,589
1914	(7)	12,368	151	[6] 10,477	4,651	47	185,422	133	23,925
1915	(7)	20,057	279	22,208	8,469	7	156,612	193	30,535
1916	8	14,027	386	45,010	2,905	79	167,720	231	29,403
1917	.17	12,513	368	33,363	....	265	191,215	261	28,884
1918	....	269	278	20,575	....	31	188,524	362	24,998

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[5] Net exports. [6] Net imports. [7] Less than 500 bushels.

TABLE 29.—*Crops of Czechoslovakia (Bohemia, Moravia, and Silesia only).*

[Source: Bulletin Du Ministère de L'Agriculture de La République Tchécoslovaque. Statistics of principal crops in Bohemia and Moravia are available in the Austrian reports as early as 1870; for Silesia, in the German Empire's reports as early at least as 1878.]

Year.	Barley. Area.	Barley. Yield per acre.	Barley. Production.	Oats. Area.	Oats. Yield per acre.	Oats. Production.	Rye. Area.	Rye. Yield per acre.	Rye. Production.	Wheat. Area.	Wheat. Yield per acre.	Wheat. Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1914	1,287	36.8	47,500	1,875	50.7	95,287	2,004	25.7	51,529	895	26.3	23,541
1915	1,154	19.5	22,464	1,737	20.6	35,997	2,034	15.8	32,309	909	19.0	17,262
1916	1,077	24.2	26,010	1,609	31.2	50,265	1,960	14.2	27,809	902	15.9	14,363
1917	1,058	13.0	13,765	1,512	14.2	21,509	1,925	11.9	22,869	897	12.2	10,972
1918	947	15.8	14,986	1,429	23.1	32,969	1,922	13.4	25,632	898	12.8	11,549
1919	899	23.8	21,568	1,375	23.4	32,320	1,824	17.8	32,734	842	18.1	15,369
1920	927	23.4	21,742	1,399	32.3	45,533	1,689	15.1	25,781	864	18.4	15,970

Year.	Hops. Area.	Hops. Yield per acre.	Hops. Production.	Potatoes. Area.	Potatoes. Yield per acre.	Potatoes. Production.	Sugar beets. Area.	Sugar beets. Yield per acre.	Sugar beets. Production.
	1,000 acres.	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1914	40	825.2	32,628	1,213	173.4	210,392	558	12.7	7,076
1915	35	490.7	16,975	1,186	139.8	165,896	418	11.6	4,831
1916	30	438.7	13,007	1,151	88.5	101,838	457	10.3	4,695
1917	22	565.1	12,566	998	91.0	90,899	437	7.0	3,086
1918	21	212.8	4,558	955	90.3	85,334	455	11.0	2,560
1919	21	452.2	9,594	898	93.7	84,091	437	9.2	4,008
1920	21	532.4	10,998	1,018	109.1	111,174	429	10.3	4,425

LIVE STOCK IN CZECHOSLOVAKIA, 1919.

Official reports give the following for 1919: Cattle, 3,256,000; swine, 1,384,000; sheep, 706,000; goats, 952,000; horses, 481,000. Figures for Ruthenia are not included in these totals.

TABLE 30.—*Crops of Denmark.*

[Source: Statistisk Aarborg. These statistics begin as early as 1888.]

Year.	Barley.			Buckwheat.			Maslin.			Oats.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	578	37.4	21,584	15	5.2	78	419	40.8	17,883	996	43.3	43,094
1912	597	39.5	23,539	6	15.5	93	446	42.0	18,784	1,059	42.4	44,868
1913	597	41.9	24,997	6	13.8	82	446	44.0	19,579	1,059	44.2	46,755
1914	597	34.8	20,780	6	18.1	108	446	36.8	16,418	1,059	36.5	38,653
1915	644	40.2	25,890	8	14.0	114	807	41.1	18,347	1,024	41.9	42,858
1916	633	35.2	22,317	9	8.5	80	829	38.5	17,676	1,042	40.6	42,287
1917	592	30.2	17,881	6	15.5	86	483	21.7	10,159	981	38.4	37,653
1918	551	39.0	21,465	9	14.4	123	478	25.8	12,349	937	44.4	41,571
1919	569	43	24,600	9	11.0	102	482	29.8	14,406	961	50	47,585
1920	585	40	23,548	......	......	......	......	......	......	1,001	47	47,275

Year.	Rye.			Wheat.			Carrots.			Kohlrabi.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	......	28.3	17,275	......	44.6	5,676	22	463	9,992	187	896	167,166
1912	......	27.2	16,083	......	44.0	5,045	20	588	11,631	253	910	230,759
1913	607	27.5	16,637	134	50.1	6,692	20	575	11,366	253	885	224,253
1914	......	22.9	10,905	134	43.2	5,785	20	583	11,532	253	723	183,187
1915	521	24.9	13,001	164	48.7	7,978	17	552	9,416	223	845	188,871
1916	481	22.0	10,567	152	39.7	6,041	16	449	7,375	246	808	198,808
1917	436	20.4	8,870	131	32.7	4,296	11	373	4,090	305	708	215,834
1918	543	23.4	12,726	140	45.6	6,330	13	391	5,102	253	710	179,494
1919	559	26.6	14,909	124	47.6	5,923	13	......	......	262	......	......
1920	......	25	12,613	165	42	6,944	......	......	......	......	......	......

Year.	Mangolds.			Potatoes.			Sugar beets.			Turnips and other forage roots.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	207	838	173,830	134	226	30,247	40	20.5	810	171	656	112,306
1912	207	992	205,216	151	201	30,368	80	14.5	1,159	167	847	141,228
1913	207	960	198,595	151	260	39,304	80	12.8	1,025	167	859	143,269
1914	207	998	206,574	151	230	34,748	80	13.3	1,066	167	718	119,783
1915	305	913	278,031	164	240	39,415	79	11.5	910	162	807	131,149
1916	276	......	......	159	156	24,765	78	10.4	811	150	754	113,218
1917	190	871	165,892	143	223	31,882	76	12.8	973	182	596	108,285
1918	258	805	207,339	185	220	40,605	89	11.6	1,041	155	592	91,904
1919	274	......	......	226	235	53,087	102	......	......	142	......	......
1920	......	......	......	216	......	......	......	......	......	......	......	......

Year.	Production.				
	Beans and peas.	Chicory.	Hay (cultivated).	Hay (meadow).	Straw.
	1,000 bush.	*1,000 lbs.*	*1,000 tons.*	*1,000 tons.*	*1,000 tons.*
1911	285	......	1,188	771	3,899
1912	240	......	1,069	829	3,977
1913	255	......	1,176	804	3,766
1914	211	50,564	1,024	762	2,972
1915	192	38,955	661	606	3,172
1916	269	54,127	1,500	848	3,881
1917	190	51,352	757	529	1,799
1918	417	53,750	378	454	2,420
1919	644	......	652	592	2,939

TABLE 31.—*Number of live stock in Denmark.*

[Source: Statistiske Department Copenhagen.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.
July 15, 1914 [1]	2,463,000	2,497,000	515,000	41,000	567,000
May 15, 1915 [1]	2,417,000	1,919,000	533,000	....	526,000
Feb. 29, 1916 [1]	2,290,000	1,983,000	255,000	....	515,000
July 2, 1917	2,458,000	1,651,000	480,000	31,000	575,000
July 15, 1918	2,124,000	621,000	470,000	41,000	545,000
July 15, 1919	2,188,000	716,000	509,000	45,000	558,000
July 15, 1920	2,286,000	1,008,000	504,000	45,000	563,000

[1] Census.

TABLE 32.—*Net imports or net exports of leading farm products, for Denmark.*

[Source: Danmarks Vareinførsel og—Udførsel.]

Year.	Barley.[1]		Net imports.					Net exports.		Net imports.	
	Net exports.	Net imports.	Corn.[2]	Oats.[2]	Rice.	Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton, unmanufactured.[3]	Cottonseed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	....	322	11,077	4,165	21,068	7,451	5,214	191,455	[4] 834	25	773
1912	3,026	....	13,802	3,732	19,485	7,874	7,947	181,789	[4] 513	28	1,114
1913	1,687	....	15,929	4,030	20,369	9,527	7,801	194,428	[4] 814	28	1,188
1914	1,169	....	10,393	3,572	18,911	5,352	4,798	207,030	19	22	1,016
1915	....	4,829	27,349	215	38,355	2,386	4,119	223,278	8,639	33	1,860
1916	....	462	17,760	4	26,483	1,965	3,527	210,900	9,515	38	1,158
1917	....	433	9,507	65	10,189	[5] 112	1,593	135,501	13,042	13	564
1918	424	....	105	(6) (6)	4,203	[5] 641	340	32,305	7,025	1	....
1919	....	2,522	7,780	532	30,451	[5] 352	383	80,181	5,340	32	1,118
1920	843	....	9,801	66	16,454	[5] 574	1,118	164,804	21,112	20	880

Year.	Flaxseed, net imports.	Hides and skins, net exports.	Hops, net imports.	Meat, net exports.	Oil cake and oil-cake meal, net imports.	Net exports.		Net imports.	
						Potatoes.	Sugar.	Tobacco.	Wool.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	325	10,891	1,007	299,336	931,920	1,445	[4] 12,935	10,661	625
1912	458	12,609	1,235	366,125	1,092,672	751	72,935	10,211	743
1913	778	10,048	751	343,013	1,229,911	467	74,180	10,390	1,042
1914	922	11,676	1,633	419,987	953,237	706	52,116	12,597	687
1915	1,305	4,910	1,250	415,431	1,266,765	105	13,794	12,782	5,173
1916	1,462	2,890	1,262	332,158	1,034,496	692	[4] 8,718	15,587	2,435
1917	257	1,779	1,459	275,017	338,950	31	[4] 110	6,077	795
1918	(6)	7,077	2,142	59,542	753	1,703	23,155	3,680	[5] 22
1919	709	6,498	1,416	695	292,102	4,610	16,166	30,189	4,109
1920	1,054	5,682	763	131,822	603,697	7,846	33,830	16,359	2,152

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net imports.
[5] Net exports.
[6] Less than 500 bushels.

TABLE 33.—*Crops of the Dutch East Indies.*

[Source: Jaarcijfers voor het Koninkrijk der Nederlanden, Kolonien; issued by Bewerkt door het Centraal Bureau voor de Statistiek. These statistics for acreage begin as early as 1881; for production, as early as 1876.]

Year.	Indigo (Java and Madura).	Rice (rough) Dutch East Indies).		Sugar (Java).	Tobacco.	
	Area.	Area.	Production.	Production.	Area, Java and Madura.	Production, Dutch East Indies (Java and east coast Sumatra).
	1,000 acres.	*1,000 acres.*	*1,000 lbs.*	*1,000 tons.*	*1,000 acres.*	*1,000 lbs.*
1911	32	5,896	12,339,472	1,627	422	190,983
1912	26	5,862	11,643,369	1,468	461	111,670
1913	25	6,310	12,880,691	1,578	413	164,295
1914	21	6,346	12,678,162	1,503	395	123,804
1915	......	6,546	12,901,274	1,481	429	125,603
1916	......	......	12,817,435	1,785	......	140,267
1917	......	......	13,483,460	2,056	......	101,848

Year.	Production.						
	Cacao (Java).	Cinchona (Dutch East Indies).	Coffee (Dutch East Indies).	Mace (Dutch East Indies).	Nutmegs[1] (Dutch East Indies).	Rubbers and gutta-percha (Dutch East Indies).	Tea (Java).
	1,000 lbs.	*1,000 lbs.*	*1,000 tons.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	3,921	21,457	47	1,438	7,355	5,516	55,814
1912	5,011	27,224	40	1,230	5,903	7,392	64,843
1913	3,294	16,516	49	1,394	7,370	14,249	52,336
1914	2,615	18,734	50	1,445	6,956	28,490	66,014
1015	4,613	16,408	60	......	......	40,744	90,166
1916	2,711	19,823	66	......	......	71,120	94,155
1917	306	21,488	61	......	......	87,452	87,559

[1] Native exports and prepared nuts, produced on private lands, etc.

TABLE 34.—*Number of live stock in Dutch East Indies (Java and Madura only).*

[Source: Jaarcijfers voor het Koninkrijk der Nederlanden: Kolonien.

Year.	Cattle.	Buffaloes.	Horses.
1905 (census)	2,654,000	2,187,000	364,000
1915 (census)	3,243,000	2,541,000	304,000

TABLE 35.—*Net imports or net exports of leading farm products, for the Dutch East Indies.*

[Source: Statistiek van den Handel en de In- en Uitvoerrechten in Nederlandsch-Indië.]

Year.	Barley,[1] net imports.	Corn,[2] net exports.	Net imports.					
			Oats.[2]	Rice.	Rye.[2]	Wheat.[2]	Butter.	Cheese.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*
1911	......	18	......	1,244,100	......	(3)	4,035	701
1912	......	673	......	873,721	1	1,871	4,670	771
1913	......	2,308	......	972,662	2	2,446	4,550	918
1914	(3)	3,709	......	949,561	1	2,041	4,965	907
1915	(3)	6,017	......	1,206,405	1	1,285	4,381	820
1916	......	1,876	3	1,497,329	1	1,540	5,121	652
1917	3	159	4	1,656,701	(3)	1,453	4,547	405
1918	32	[4] 8	3	1,578,500	......	1,433	4,385	261
1919	4	[4] 4	4	601,551	(3)	1,937	5,681	974

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Less than 500 bushels.
[4] Net imports.

TABLE 35.—*Net imports or net exports of leading farm products, for the Dutch East Indies*—Continued.

Year.	Net exports.		Meat, net imports.	Net exports.			
	Cotton, unmanufactured.[3]	Hides and skins.		Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco.
	1,000 bales.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*
1911	12	16,806	910	4,124	....	2,916,371	154,427
1912	21	17,009	963	8,373	....	2,935,656	177,165
1913	19	15,885	1,619	9,608	....	2,816,821	183,867
1914	5	11,490	1,468	8,200	....	2,907,349	138,288
1915	8	15,440	4,160	17,984	152	2,654,214	175,447
1916	15	20,479	4,214	25,160	169	3,187,231	199,575
1917	5	16,826	3,171	2,844	195	2,605,759	22,246
1918	10	9,138	2,658	[5] 1,601	163	3,389,834	13,502
1919	9	31,830	1,251	119,065	177	4,109,319	297,208

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight. [5] Net imports.

TABLE 36.—*Crops of the Dutch West Indies* (*Surinam*).

[Source: Jaarcijfers voor het Koninkrijk der Nederlanden, Koloniën; issued by Bewerkt door het Centraal Bureau voor de Statistiek. These statistics are available as early as 1880.]

Year.	Sugar cane area.	Production.							
		Sugar.	Molasses.	Rum.	Bananas.	Cacao.	Coffee.	Corn.	Rice (hulled).
	1,000 acres.	*1,000 tons.*	*1,000 gals.*	*1,000 gals.*	*1,000 bunches.*	*Tons.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*
1911	6	16	37	277	460	1,966	593	44	4,838
1912	6	11	52	262	257	952	434	51	5,863
1913	6	15	21	360	342	1,629	703	42	4,918
1914	7	17	12	429	344	1,606	1,060	35	6,913
1915	6	16	30	447	447	1,614	1,344	74	11,641
1916	7	14	115	386	520	2,062	1,685	89	16,471
1917	7	16	174	221	563	2,190	3,408	63	11,769

TABLE 37.—*Crops of Egypt.*

[Source: Monthly Agricultural Statistics. Egyptian Ministry of Finance.]

Crop year.	Barley.			Corn.			Rice (rough).		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1910–11	384	31.3	12,015	1,672	36.8	61,558	225	53.3	12,002
1911–12	378	30.8	11,631	1,692	38.6	65.294	240	64.3	15,463
1912–13	383	31.7	12,147	1,751	34.3	60,018	233	71.1	16,571
1913–14	398	28.4	11,294	1,889	38.7	73,192	44	49.5	2,187
1914–15	463	30.3	14,013	1,844	40.1	73,956	332	59.8	19,826
1915–16	439	30.6	13,417	1,740	37.6	65,485	154	54.0	8,294
1916–17	497	27.9	13,863	1,685	38.7	65,198	273	64.2	17,538
1917–18	336	29.9	10,063	1,812	36.8	66,756	285	....	....
1918–19	357	28.8	10,283	1,792	....	....	150	....	....
1919–20	340	....	....	....	....	....	....	....	....

TABLE 37.—*Crops of Egypt*—Continued.

Crop year.	Wheat.			Beans.			Bersim[1] area.	Millet area.	Sesame area.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*1,000 acres.*	*1,000 acres.*
1910–11	1,285	28.1	36,087	562	24.2	13,603	1,434	219	....
1911–12	1,332	23.5	31,335	537	26.7	14,346	1,444	225	....
1912–13	1,355	28.4	38,503	496	29.9	14,857	1,463	208	....
1913–14	1,301	25.7	33,488	445	23.9	10,616	1,373	252	....
1914–15	1,592	25.1	39,905	647	24.2	15,644	1,346	283	6,835
1915–16	1,447	25.7	37,253	522	21.6	11,296	1,232	252	6,126
1916–17	1,117	27.2	30,414	490	24.5	12,012	1,398	274	6,887
1917–18	1,286	25.5	32,765	492	25.6	12,644	1,604	314	9,122
1918–19	1,323	23.2	30,722	524	24.3	12,711	1,472	267	12,372
1919–20	1,190	....	....	434	....	....	1,408	....	11,872

Crop year.	Cotton.			Cotton seed.		Sugar cane.			Sugar.	Molasses
	Area.	Yield per acre.	Production.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Production.	Production.
	1,000 acres.	*Lbs.*	*1,000 bales.*	*Lbs.*	*1,000 tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 tons.*	*1,000 gals.*
1910	1,705	436	1,555	859	733	47	12.88	521	54	3,655
1911	1,776	412	1,530	810	719	52	12.70	592	61	4,402
1912	1,787	416	1,554	813	726	50	12.88	817	83	6,822
1913	1,788	424	1,588	782	700	50	12.36	792	76	6,781
1914	1,821	351	1,337	670	611	54	12.85	811	83	6,254
1915	1,231	384	989	788	485	61	12.88	1,070	109	8,118
1916	1,719	292	1,048	601	517	65	13.21	1,069	112	8,574
1917	1,741	358	1,304	740	644	66	12.71	898	88	6,858
1918	1,366	350	999	723	494	59	12.50	878	84	7,674
1919	1,634	338	1,155	699	571	53	....	....	....	....
1920	1,897	....	....	....	....	....	....	....	....	....

Year.	Fenugreek.	Lentils.	Lupines.	Melons.	Onions.	Peanuts.	Vetches.
	1,000 acres.	*1,000 acres.*	*1,000 acres.*	*1,000 acres.*	*1,000 acres.*	*1,000 acres.*	*1,000 acres.*
1910–11	....	....	....	....	27	....	....
1911–12	....	....	....	....	27	....	....
1912–13	51	62	....	....	29	....	....
1913–14	39	37	....	....	17	....	....
1914–15	50	66	12	38	24	12	22
1915–16	60	65	13	34	31	12	21
1916–17	96	95	20	34	39	14	26
1917–18	107	71	25	36	45	14	25
1918–19	95	65	22	36	30	15	24
1919–20	93	73	22	36	34	15	26

[1] Egyptian clover.

TABLE 38.—*Number of live stock in Egypt.*

[Source: Ministry of Agriculture, Cairo, Egypt.]

Date.	Cattle.[1]	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
1910	1,347,000	....	....	....	52,000	39,000	691,000
1911	1,313,000	....	....	....	51,000	25,000	654,000
1912	1,272,000	....	....	....	47,000	21,000	691,000
1913	1,270,000	....	....	....	48,000	23,000	682,000
1914	1,169,000	....	816,000	331,000	40,000	22,000	632,000
1915	1,092,000	7,000	755,000	290,000	35,000	22,000	547,000
1916	1,008,000	9,000	688,000	308,000	34,000	17,000	526,000
1917	1,081,000	13,000	808,000	263,000	31,000	17,000	586,000
1918	1,088,000	19,000	854,000	231,000	30,000	15,000	583,000
1919	1,039,000	....	754,000	286,000	31,000	22,000	....

[1] Including buffaloes, which in 1910 numbered 675,000; in 1911, 657,000; in 1912, 652,000; in 1913, 633,000; in 1914, 568,000; in 1915, 538,000; in 1916, 515,000; in 1917, 566,000; in 1918, 571,000; in 1919, 540,000.

TABLE 39.—*Crops of Finland.*

[Source: Statistisk Årsbok För Finland; issued by the Statistiska Centralbyrån of Finland. Statistics for production begin as early as 1810; for seed sown as early as 1878, and for area 1910.]

Year.	Production.										
	Barley.	Buckwheat.	Maslin.	Oats.	Rye.	Wheat.	Flax fiber.	Hay.	Peas and beans.	Potatoes.	Turnips and other root crops.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 tons.*	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*
1911	4,935	9,257	614	18,966	9,414	140	[1] 2,555	2,064	236	18,437	9,791
1912	5,094	6,623	739	21,044	10,376	120	[1] 2,793	2,610	299	18,814	9,344
1913	4,894	6,805	760	22,020	10,268	165	[1] 2,418	2,635	326	18,351	8,368
1914	4,316	6,737	599	19,572	11,291	196	[1] 2,158	2,460	244	18,736	7,887
1915	5,021	5,982	578	23,905	11,270	260	2,658	2,605	312	20,531	9,292
1916	4,885	5,919	458	22,067	9,899	247	2,472	2,608	278	19,666	7,065

[1] Includes hemp.

TABLE 40.—*Number of live stock in Finland.*

[Source: Statistiska Centralbyrån, Helsingfors.]

Date.	Cattle.[1]	Swine.	Sheep.	Goats.	Horses.[2]
1910	1,573,000	418,000	1,309,000	13,000	361,000
1911	1,188,000				298,000
1912	1,189,000				298,000
1913	1,178,000				297,000
1914	1,167,000				294,000
1915	1,150,000				288,000
1916	1,111,000				276,000
May 30, 1918	1,400,000				309,000

[1] Exclusive of animals under 2 years of age, 1911–1916.
[2] Exclusive of animals under 3 years of age, 1911–1916.

TABLE 41.—*Net imports or net exports of leading farm products, for Finland.*

[Source: Finland's Handel.]

Year.	Net imports.						Net exports.	
	Barley.[1]	Corn.[2]	Oats.[2]	Rice.	Rye.[2]	Wheat.[2]	Butter.	Cheese.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*
1911	519	158	1,035	24,733	17,680	5,063	25,915	1,634
1912	497	288	680	23,945	12,822	4,849	23,086	1,485
1913	645	249	546	27,378	15,774	5,791	24,534	2,179
1914	292	31	687	23,432	9,859	4,548	21,608	2,490
1915	530	39	[4] 89	3,250	13,423	4,460	15,100	3,636
1916	486	102	8	13,018	12,637	6,984	8,957	4,077
1917	254	5	52	9,536	554	717	4,103	656
1918	61	26	57	1,382	345	45	817	[5] 226
1920	71	287	265	2,562	2,518	1,660	2,503	2,106

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[4] Net exports.
[5] Net imports.

TABLE 41.—*Net imports or net exports of leading farm products, for Finland*—Contd.

Year.	Net imports.								
	Cotton,[3] unmanufactured.	Hides and skins.	Hops.	Meat.	Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco, unmanufactured.	Wool.
	1,000 bales.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	35	[4] 295	113	13,481	22,882	576	98,181	9,376	1,625
1912	37	2,088	136	11,251	29,165	439	103,818	10,294	1,849
1913	39	4,758	120	13,943	23,989	375	105,106	9,450	1,892
1914	30	4,421	67	8,210	21,246	401	97,524	10,674	1,573
1915	40	11,763	97	2,736	88,546	408	101,774	13,719	2,089
1916	55	8,142	166	3,302	127,175	107	110,427	14,933	5,647
1917	18	2,463	46	3,797	71,816	330	52,101	9,582	5,122
1918	3	117	1,350	7,768	3,015	264	7,548	3,124	769
1920	30	4,234	....	1,123	22,779	172	55,203	4,706	2,427

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[3] Bales of 478 pounds net weight; equivalent to 500 pounds, gross weight.
[4] Net exports.

TABLE 42.—*Crops of Formosa (Tai-Wan).*

[Source: Statistical Report of the Department of Agriculture and Commerce, Japan. These statistics are available as early as 1898.]

Year.	Barley.			Millet.			Rice (hulled).			Wheat.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	Acres.	*Bush.*	*Bush.*	*Acres.*	*Bush.*	*Bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Bush.*	*Bush.*
1911	3,276	14	46,173	11,776	21	249,828	1,183	1,193	1,410,750	13,077	12	151,584
1912	4,736	13	60,435	12,415	16	196,846	1,189	1,069	1,271,265	13,532	12	164,274
1913	5,798	14	81,899	11,812	21	248,323	1,222	1,318	1,610,461	16,037	12	195,003
1914	5,036	12	61,582	11,783	19	225,379	1,235	1,172	1,447,709	16,444	11	181,028
1915	5,002	12	61,090	....	......	....	1,214	1,238	1,503,101	16,138	10	160,895
1916	4,645	11	50,391	....	......	....	1,166	1,253	1,460,563	14,273	10	138,428
1917	4,544	11	49,516	....	......	....	1,152	1,318	1,518,569	13,412	9	124,561

Year.	Beans, peas, and other pulse.			China grass.			Hemp.			Indigo.		
					Lbs.	*1,000 lbs.*	*Acres.*	*Lbs.*			*Lbs.*	*1,000 lbs.*
1911	81,216	7	603,561	4,146	419	1,738	9,352	4,258	39,818	6,378	4,468	28,499
1912	82,275	6	526,003	4,175	454	1,894	9,656	4,681	45,202	5,731	......	....
1913	84,166	8	703,479	4,089	459	1,877	10,259	4,868	49,938	3,878	......	....
1914	89,523	8	681,129	4,089	528	2,159	11,376	4,449	50,617	....	......	....
1915	88,514	9	785,618	4,321	482	2,081	....	......	....	....	......	....
1916	87,603	9	779,598	4,254	493	2,097	....	......	....	....	......	....
1917	83,473	8	661,354	4,484	476	2,133	....	......	....	....	......	....

Year.	Jute.			Peanuts in the shell.			Sesame.			Sugar cane.		
		Lbs.	*1,000 lbs.*		*Bush.*	*1,000 bu.*		*Bush.*	*Bush.*		*Tons.*	*1,000 tons.*
1911	5,206	890	4,633	44,849	2	80	30,056	6	193,206	215,897	14	3,119
1912	5,481	974	5,339	44,516	19	838	31,118	4	110,002	185,153	11	2,089
1913	6,169	991	6,113	46,531	24	1,126	26,252	5	138,315	164,737	6	1,012
1914	7,286	815	5,940	47,641	21	1,007	25,878	4	107,586	186,560	9	1,748
1915	6,430	836	5,373	50,527	24	1,225	23,666	5	121,146	204,088	13	2,602
1916	6,318	925	5,845	51,598	23	1,182	24,790	7	179,702	281,116	13	3,793
1917	6,447	878	5,662	53,360	26	1,401	24,109	5	123,271	315,031	18	5,614

TABLE 42.—*Crops of Formosa (Tai-Wan)*—Continued.

Year.	Sweet potatoes.			Tea.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	Acres.	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*
1911	259,324	5,763	1,494,609			32,584
1912	272,380	5,448	1,483,873			29,603
1913	288,647	6,283	1,813,519			29,784
1914	281,557	6,430	1,810,388			30,059
1915	272,085	6,561	1,785,074			33,642
1916	265,537	5,960	1,582,618			33,294
1917	265,707	6,091	1,618,533			37,843

TABLE 43.—*Number of live stock in Formosa (Tai-Wan).*

[Source: Statistical Report of the Department of Agriculture and Commerce of Japan.]

Dec. 31—	Cattle.	Buffaloes.[1]	Goats.
1911	1,000	477,000	129,000
1912	1,000	445,000	126,600
1913	1,000	418,000	129,000
1914	2,000	398,000	125,000
1915	2,000	397,000	117,000
1916	2,000	385,000	118,000
1917	1,000	376,000	100,000

[1] Includes zebus.

TABLE 44.—*Crops of France.*

[Source: Statistique Agricole Annuelle; issued by the Ministère de l'Agriculture de la France. These statistics begin as early as 1815.]

Year.	Barley.			Buckwheat.			Corn.			Maslin.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	1,907	26.1	49,863	1,139	8.7	9,922	1,049	16.1	16,860	314	18.6	5,859
1912	1,877	26.9	50,587	1,140	20.2	22,996	1,177	20.2	23,734	318	18.6	5,909
1913	1,878	25.5	47,939	1,115	23.3	26,016	1,133	18.9	21,380	304	18.6	5,666
1914	1,780	25.2	44,818	1,117	21.9	24,453	1,128	20.0	22,530	295	17.4	5,145
1915	1,575	20.2	31,787	1,069	18.7	21,337	935	18.3	17,104	265	15.7	4,174
1916	1,538	24.9	38,268	990	12.7	12,582	882	18.9	16,635	248	16.6	4,102
1917	1,699	21.9	37,265	934	18.7	17,495	847	17.8	14,902	235	13.8	3,252
1918	1,371	20.0	27,475	769	13.4	10,296	754	12.9	9,760	206	17.7	3,648
1919	1,194	19.8	23,626			12,491	736	15.9	9,976			
1920	1,497	23.6	35,399			16,668	792	21.2	16,793			

Year.	Millet.			Oats.			Rye.			Wheat.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	53	9.3	492	9,863	35.4	349,247	2,902	16.1	46,749	15,897	20.3	322,339
1912	52	11.6	608	9,839	36.1	355,089	2,969	17.6	48,746	16,238	20.6	334,333
1913	52	14.1	733	9,833	36.3	357,049	2,905	17.2	50,055	16,166	19.8	319,370
1914	43	12.6	539	8,873	35.9	318,333	2,614	16.8	43,884	14,975	18.9	282,689
1915	64	12.0	762	8,062	29.6	238,551	2,308	14.3	33,148	11,093	16.4	222,776
1916	54	11.3	606	7,777	35.6	277,117	2,148	15.5	33,351	12,429	16.5	204,908
1917	40	12.4	500	7,308	29.3	214,259	1,834	13.4	24,650	10,357	13.0	134,575
1918	42	8.2	350	6,721	26.3	176,504	1,745	16.6	28,935	10,993	20.5	225,736
1919			394	7,055	23.9	168,303	1,907	15.1	28,736	11,515	15.9	182,444
1920			562	8,065	36.1	290,925	2,001	16.6	33,174	11,995	19.2	230,404

TABLE 44.—*Crops of France*—Continued.

Year.	Beets (forage and distillery).			Dry beans.			Dry peas and lentils.			Cole seed (colza).		
	1,000 acres.	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 tons.*
1911	1,798	10.4	18,780	578	14.2	8,187	73	15.6	1,137	73	1,266	46
1912	1,844	16.0	29,475	558	17.5	9,739	73	17.5	1,277	63	1,051	33
1913	1,916	15.7	30,060	583	17.6	10,235	66	17.8	1,178	59	1,209	35
1914	1,761	15.1	26,568	547	17.1	9,354	61	18.3	1,116	58	1,228	36
1915	1,511	11.1	16,801	494	16.6	8,177	49	17.4	854	51	1,240	48
1916	1,439	12.5	17,948	489	12.4	6,053	44	17.2	757	41	1,089	22
1917	1,432	13.3	19,050	497	13.2	6,572	43	14.8	640	37	950	18
1918	1,313	9.4	12,301	478	11.1	5,283	47	14.0	657	43	1,073	23
1919	......	......	12,025	......	......	......	......	......	663	......	......	......
1920	......	......	17,707	......	......	......	......	......	776	......	......	......

Year.	Flaxseed.			Hay (alfalfa, clover and sainfoin).			Hempseed.			Hops.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911	59	8.5	496	7,539	1.6	12,318	39	11.9	449	7	825	5,799
1912	69	8.4	576	7,439	1.9	13,787	34	7.6	261	7	1,251	8,758
1913	75	9.8	740	7,694	2.0	15,039	31	11.2	347	7	1,101	8,028
1914	46	7.3	336	7,109	1.9	13,630	31	11.4	346	7	1,042	7,034
1915	20	8.0	161	6,998	1.9	13,110	22	10.7	232	5	897	4,909
1916	17	7.5	131	6,690	1.8	12,000	22	9.6	207	4	991	4,357
1917	22	7.3	158	6,533	1.8	11,547	20	10.1	205	4	968	4,354
1918	28	6.7	188	6,455	1.5	9,544	23	10.0	225	3	300	924
1919	38	9.1	347	......	......	......	19	7.3	138	3	618	1,854
1920	70	6.3	445	......	......	......	18	11.2	202	4	562	2,250

Year.	Potatoes.			Sugar beets.			Tobacco.			Turnips and swedes.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1911	3,853	122	469,386	600	7.8	4,669	39	1,026	40,433	431	5.8	2,384
1912	3,863	143	552,074	631	12.6	7,961	38	1,307	49,884	439	8.4	3,697
1913	3,825	130	499,194	616	10.6	6,547	39	1,473	57,325	458	8.3	3,810
1914	3,676	120	440,652	331	12.5	4,135	38	1,397	53,292	433	8.0	3,451
1915	3,323	104	345,351	187	6.8	1,266	20	1,726	33,990	368	7.7	2,847
1916	3,163	102	318,973	201	10.9	2,192	27	1,218	32,444	372	7.5	2,775
1917	3,386	113	382,647	187	11.6	2,169	25	1,264	31,246	383	7.6	2,901
1918	2,940	81	239,556	163	7.7	1,259	20	970	19,568	361	6.6	2,254
1919	3,041	93	284,047	184	7.5	1,375	23	1,273	29,270	......	......	......
1920	3,332	114	379,029	221	10.2	2,266	26	1,118	29,080	......	......	......

NOTE.—Where the original French reports give production both in weight and in cubic measure, the figures for weight have been used in compiling this table.

TABLE 45.—*Number of live stock in France.*

[Source: Ministere de l'Agriculture, France.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
Dec. 31:							
1910	14,532,000	6,900,000	17,111,000	1,418,000	3,198,000	193,000	370,000
1911	14,552,000	6,720,000	16,425,000	1,424,000	3,236,000	194,000	361,000
1912	14,706,000	6,904,000	16,468,000	1,409,000	3,222,000	196,000	359,000
1913	14,807,000	7,048,000	16,213,000	1,453,000	3,231,000	193,000	360,000
1914 [1]	12,668,000	5,926,000	14,038,000	1,317,000	2,105,000	152,000	337,000
1915 [1]	12,514,000	4,916,000	12,379,000	1,230,000	2,156,000	144,000	324,000
1916 [1]	12,342,000	4,362,000	10,845,000	1,177,000	2,246,000	148,000	327,000
1917	12,242,000	4,165,000	9,882,000	....	2,303,000	144,000	319,000
1918	12,251,000	3,080,000	9,061,000	1,197,000	2,232,000	139,000	312,000
1919	12,374,000	4,081,000	8,991,000	1,167,000	2,413,000	167,000	303,000

[1] Excludes invaded area.

TABLE 46.—*Net imports or net exports of leading farm products, for France.*

[Source: Tableau Général du Commerce.]

Year.	Net imports.						Butter, net exports.	Net imports.		
	Barley.[1]	Corn.[2]	Oats.[2]	Rice.	Rye.[2]	Wheat.[2]		Cheese.	Cotton, unmanufactured.[3]	Cottonseed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	8,903	19,674	37,219	472,856	5,010	78,801	8,282	25,382	1,164	2,432
1912	5,672	23,834	14,846	335,038	3,681	25,264	23,393	19,868	1,272	3,525
1913	4,973	23,177	39,806	472,891	3,702	56,572	25,326	20,460	1,251	2,333
1914	4,581	15,807	34,513	638,085	1,437	62,257	25,961	23,197	750	1,194
1915	3,201	16,665	55,200	412,192	24	71,126	42,855	30,502	1,014	3,232
1916	9,816	28,252	72,191	409,807	[4] 4	104,743	18,312	12,435	1,068	1,870
1917	8,851	6,219	42,711	515,633	[4] 6	86,213	[5] 694	4,643	1,176	1,889
1918	10,926	6,736	33,321	373,835	1,344	71,757	1,636	5,994	627	474
1919	14,894	6,860	31,567	326,358	650	85,398	[5] 11,633	7,896	925	1,372
1920	[4] 878	16,751	13,257	160,128	16,337	86,598	[5] 13,993	10,159	933	2,592

Year.	Net imports.				Oil cake and oil-cake meal, net exports.	Potatoes.		Net imports.		
	Flaxseed.	Hides and skins.	Hops.	Meat.		Net imports.	Net exports.	Sugar.	Tobacco, unmanufactured.	Wool.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	4,037	20,341	7,025	34,702	245,366	....	4,204	91,361	61,119	521,897
1912	5,387	17,290	3,639	25,115	129,459	....	2,252	298,415	70,802	490,634
1913	9,305	23,533	4,315	[4] 20,172	249,622	1,836	....	[4] 189,119	81,707	514,181
1914	4,782	17,853	2,146	54,609	236,345	4,769	....	138,819	61,333	389,019
1915	1,249	[4] 8,001	[4] 1,157	520,437	236,544	....	2,536	964,558	51,421	132,822
1916	2,410	52,904	[4] 723	671,623	245,114	758	....	1,045,274	65,888	150,669
1917	1,837	96,610	747	689,463	5,724	....	129	1,000,647	70,198	123,244
1918	1,001	40,054	276	753,911	[5] 28,498	458	....	238,833	110,114	88,754
1919	....	98,441	1,239	1,210,869	3,706	10,364	....	1,080,428	107,778	339,212
1920	1,217	56,708	1,706	513,038	80,944	....	5,438	11,471,305	119,736	329,102

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net exports.
[5] Net imports.

TABLE 47.—*Crops of Germany.*

[Source: Vierteljahrshefte zur Statistik des Deutschen Reichs; issued by the Statistisches Reichsamt of Germany. These statistics are available as early as 1878. Alsace and Lorraine are included prior to 1916, but not in 1916 or subsequently.]

Year.	Barley.			Oats.			Spelt and emmer.			Rye.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	3,917	37.0	145,132	10,694	49.6	530,764	696	31.9	22,196	15,161	28.2	427,776
1912	3,928	40.7	159,924	10,841	54.1	586,987	698	32.1	22,434	15,489	29.5	456,600
1913	4,087	41.3	168,709	10,967	61.1	669,231	673	35.9	24,166	15,849	30.4	481,169
1914	3,909	36.8	144,125	10,843	57.4	622,674	665	30.8	20,424	15,565	26.4	410,478
1915	4,002	28.4	114,077	11,404	36.3	412,400	641	32.6	20,884	15,843	22.8	360,310
1916	....	34.2	....	8,759	54.4	....	....	....	....	4,737	23.7	350,486
1917	3,738	23.8	89,886	8,625	29.0	249,964	....	....	....	13,650	20.1	274,677
1918	3,251	28.8	93,504	7,510	40.1	301,839	381	27.7	10,515	11,720	22.4	262,832
1919	3,121	28.1	87,741	7,396	41.8	309,587	327	24.5	8,019	10,880	22.1	240,161
1920	3,273	26.8	87,741	8,006	29.7	237,600	....	....	9,858	10,703	17.7	189,556

TABLE 47.—*Crops of Germany*—Continued.

Year.	Wheat.			Hay (alfalfa).[1]			Hay (clover).[1]			Hops.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911	4,878	30.6	149,411	599	2.0	1,204	4,969	1.6	7,794	66	357	23,430
1912	4,759	33.6	160,224	608	2.7	1,643	4,269	2.1	8,762	67	678	45,334
1913	4,878	35.1	171,075	620	3.0	1,831	4,911	2.5	12,327	67	348	23,408
1914	4,932	29.6	145,944	606	3.0	1,839	4,891	2.5	12,069	68	749	51,227
1915	4,950	28.5	141,676	....	....	....	4,892	1.7	8,523	59	553	32,106
1916	3,950	28.0	110,207	....	....	....	....	....	....	....	....	....
1917	3,573	22.9	81,791	....	....	....	....	....	....	33	625	20,621
1918	3,375	25.4	85,865	525	2.2	1,158	3,944	1.7	6,537	27	68	1,833
1919	3,209	24.8	79,701	471	2.3	1,066	4,679	2.0	9,194	20	427	8,532
1920	3,427	23.0	78,924	....	....	....	....	....	12,588	....	....	....

Year.	Potatoes.			Sugar beets.			Tobacco.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911	8,207	153.9	1,263,024	[2] 1,247	[2] 8.0	[2] 9,987	42	1,530	64,332
1912	8,257	223.5	1,844,863	[2] 1,353	[2] 13.6	[2] 18,345	39	2,200	85,662
1913	8,432	235.8	1,988,591	[2] 1,317	[2] 14.2	[2] 18,673	35	1,627	56,953
1914	8,367	200.1	1,674,377	1,406	13.3	18,650	26	1,962	50,192
1915	8,827	224.7	1,983,161	989	12.2	12,085	....	....	....
1916	6,782	133.8	907,236	989	10.7	10,550	....	....	....
1917	6,186	204.3	1,264,374	950	10.7	9,077	....	....	....
1918	5,720	159.0	909,183	849	11.2	9,492	....	....	....
1919	5,389	146.5	789,210	745	8.6	6,413	....	....	....
1920	6,054	124.0	750,885	....	....	8,779	....	....	....

[1] 1 ton = 2,000 pounds. [2] Sugar beets used by factories.

TABLE 48.—*Number of live stock in Germany.*

[Source: Das Statistisches Reichsamt, Berlin.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.[1]
Census for Dec. 1:					
1912	20,182,000	21,924,000	5,803,000	3,410,000	4,523,000
1913	20,994,000	25,659,000	5,521,000	3,548,000	3,227,000
1914	21,829,000	25,341,000	5,471,000	3,538,000	3,435,000
1915	20,317,000	17,287,000	5,073,000	3,438,000	3,342,000
1916	20,874,000	17,002,000	4,979,000	3,940,000	3,304,000
1917 [2]	19,650,000	10,778,000	4,918,000	4,021,000	3,257,000
1918 [2]	16,446,000	9,227,000	4,905,000	4,021,000	2,977,000
1919	16,524,000	11,594,000	5,373,000	4,143,000	3,503,000
Sept 1:					
1920	16,904,000	14,269,000	6,630,000	4,875,000	....

[1] Excluding army horses, 1914–1918. [2] Excluding Alsace-Lorraine subsequent to 1916.

NOTE.—13,000 mules and asses were reported in 1912.

TABLE 49.—*Net imports or net exports of leading farm products, for Germany.*

[Source: Statistik des Deutschen Reichs. Auswärtiger Handel.]

Year.	Net imports.				Rye.[2] Net exports.	Net imports.				
	Barley.[1]	Corn.[2]	Oats.[2]	Rice.		Wheat.[2]	Butter.	Cheese.	Cotton, unmanufactured.[3]	Cottonseed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	168,518	29,265	22,876	467,035	15,837	72,623	123,064	43,775	1,994	6,391
1912	137,869	44,971	19,341	544,566	30,283	64,708	121,990	45,465	2,255	7,900
1913	150,570	36,164	[4] 10,791	646,503	38,033	64,813	118,974	56,300	2,161	4,786

Year.	Net imports.		Hops. Net exports.	Net imports.			Sugar. Net exports.	Net imports.	
	Flaxseed.	Hides and skins.		Meat.	Oil cake and oil-cake meal.	Potatoes.		Tobacco.	Wool.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	10,630	281,796	10,644	465,631	1,154,191	22,876	1,886,426	161,180	433,131
1912	12,783	296,769	6,464	570,905	1,169,690	25,606	947,970	177,361	467,377
1913	21,892	371,184	8,758	584,043	1,178,082	1,822	2,457,427	181,733	433,797

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net exports.

TABLE 50.—*Crops of Greece.*

[Source: Statistique Annuelle du Rendument Agricole of Greece.]

Year.	Barley.			Corn.			Maslin.			Oats.		
	Area.	Yield per acre.[1]	Production.	Area.	Yield per acre.[1]	Production.	Area.	Yield per acre.[1]	Production.	Area.	Yield per acre.[1]	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1917	390	14.9	5,796	433	14.1	6,112	146	11.6	1,717	165	21.6	3,566
1918	414	17.5	7,258	419	15.4	6,466	153	13.4	2,054	181	25.1	454
1919	300	16.7	5,020	393	17.8	7,016	......	......	......	......	......	......
1920	581	12.1	7,025	......	......	......	......	......	......	......	......	......

Year.	Rye.			Wheat.			Beans (haricots).[2]			Beans (other dry).		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1917	56	12.4	695	1,045	11.0	11,505	42	[2] 6.7	281	32	11.5	365
1918	70	14.5	1,011	1,092	12.6	13,722	26	[2] 8.6	218	40	12.1	483
1919	......	......	......	936	10.4	9,693	......	......	......	......	......	......
1920	......	......	......	1,399	8.7	12,194	......	......	......	......	......	......

Year.	Chick peas.			Peas (dry).			Potatoes.			Tobacco.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1917	27	9.1	247	34	10.2	345	26	67.1	1,714	99	220	21,778
1918	35	8.4	296	35	10.9	377	31	56.3	1,742	116	220	25,654

[1] Computed from figures for area and production.
[2] Not including haricots sown with corn.

TABLE 50.—*Crops of Greece*—Continued.

Year.	Currants.			Grapes (table).			Raisins (Sultana).		
	Area.	Yield per acre.[1]	Production.	Area.	Yield per acre.[1]	Production.	Area.	Yield per acre.[1]	Production.
	1,000 acres.	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1817	200	1,479	295,858	30	1,902	57,068	14	1,167	16,344
1918	242	1,098	265,690	28	2,182	61,084	9	894	8,049

[1] Computed from figures for area and production.

TABLE 51.—*Number of live stock in Greece.*

[Source: Statistique Annuelles du Rendument Agricole of Greece.]

[In thousands.]

Year.	Animals not used for farm work.						Work animals.				Other animals.		
	Buffaloes.	Cows.	Horses.	Mares.	Mules.	Asses.	Cattle.	Buffaloes.	Horses.	Mules.	Sheep.	Swine.	Goats.
1917	95	191	70	60	75	275	285	11	88	44	5,548	351	3,575
1918	112	207	71	54	72	243	329	8	60	40	5,468	365	3,473

TABLE 52.—*Crops of Italy.*

[Source: Notizie Periodiche di Statistica Agraria; issued by the Ministero per l'Agricoltura of Italy These statistics are available as early as 1880, for some principal crops.]

Year.	Barley.			Corn.			Oats.			Rice (rough).		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911	612	17.8	10,882	4,066	23.0	93,680	1,270	32.2	40,973	357	3,000	1,056,488
1912	604	13.9	8,403	3,938	25.1	98,668	1,254	22.6	28,306	360	2,700	968,922
1913	620	17.4	10,803	3,888	27.9	108,388	1,251	34.8	43,469	362	3,300	1,197,539
1914	610	11.3	6,917	3,844	27.3	104,967	1,213	22.1	26,827	361	3,300	1,200,846
1915	608	18.2	11,051	3,887	31.3	121,824	1,208	26.0	31,443	356	3,500	1,235,899
1916	596	17.0	10,109	3,918	20.8	81,547	1,102	23.7	26,076	353	3,300	1,147,053
1917	469	15.8	7,422	3,853	21.5	82,771	1,107	30.6	33,889	341	3,400	1,160,502
1918[1]	478	20	9,686	3,558	22	76,590	1,211	37	45,353	342	3,400	1,154,108
1919[1]	480	17	8,327	3,709	23	85,846	1,129	31	34,695	325	3,300	1,072,979
1920[1]	494	12	5,870	3,707	23	86,661	1,159	21	24,223	277	3,600	994,716

Year.	Rye.			Wheat.			Artichokes.			Asparagus.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911	302	17.5	5,297	11,741	16.4	192,395	14	8,400	114,749	3,632	3,900	14,021
1912	305	17.3	5,285	11,751	14.1	165,720	16	10,300	163,140	4,201	3,100	13,228
1913	307	18.2	5,589	11,721	18.3	214,772	19	8,100	156,527	3,459	2,500	8,818
1914	303	17.4	5,260	11,785	14.4	169,582	17	7,000	121,253	3,212	2,900	9,259
1915	294	14.8	4,362	12,502	13.6	170,541	17	8,300	138,890	3,459	2,700	9,480
1916	285	18.7	5,342	11,679	15.1	176,530	17	7,100	123,458	3,459	2,700	9,259
1917	279	16	4,460	10,556	13.3	139,999	17	7,300	125,662	2,718	2,800	7,496
1918[1]	270	19	5,232	10,788	17	183,294	......	......	......	......	......	......
1919[1]	272	17	4,571	10,571	16	169,769	16	6,300	100,089	2,718	2,352	6,393
1920[1]	281	16	4,539	11,292	13	141,337	16	6,800	108,246	2,718	2,596	7,055

[1] The average yield per acre for 1918–1920 was computed from figures for area and production; for other years the average yield is as reported in the official returns, and converted to the United States equivalent.

TABLE 52.—*Crops of Italy*—Continued.

Year.	Beans (haricots).			Beans (field beans).			Cardoons, celery, and fennel.			Citrus fruits.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911	......	......	4,663	1,510	12.6	18,990	3,138	14,300	44,886	283	6,100	1,733,918
1912	1,384	3.7	5,144	1,476	10.0	14,778	5,683	13,600	77,161	268	5,500	1,470,468
1913	1,395	4.7	6,592	1,444	11.5	16,568	6,178	11,800	72,752	268	7,200	1,932,332
1914	1,386	3.8	5,236	1,319	8.9	11,762	5,683	14,000	79,366	265	6,700	1,767,207
1915	1,366	5.3	7,202	1,336	13.0	17,427	5,683	15,100	85,979	268	6,200	1,673,512
1916	1,343	2.6	3,498	1,212	11.5	13,874	6,178	15,000	92,593	268	7,000	1,886,476
1917	1,351	2.7	3,667	1,087	11.9	12,945	......	......	......	......	5,200	......
1918	1,152	3.4	3,935	1,064	14	15,362	......	......	......	......	......	......
1919	1,334	2.7	3,612	968	11	10,927	7,166	13,600	97,223	268	5,500	1,461,209
1920	1,262	2.3	2,917	1,055	9	9,535	......	......	......	......	......	......

Year.	Flax fiber.			Flaxseed.			Hemp fiber.			Melons.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911	15	400	6,078	22	15.6	341	185	800	148,480	27	14,200	381,837
1912	22	300	5,512	43	15.7	343	211	1,000	209,217	26	15,200	396,828
1913	22	300	5,732	44	17.8	405	214	900	198,414	23	15,900	370,373
1914	22	200	5,071	46	13.1	323	215	1,000	214,728	24	14,200	343,918
1915	21	300	5,512	43	15.0	323	218	1,000	224,649	26	15,400	407,851
1916	21	300	5,512	44	15.6	362	213	700	159,613	26	13,100	343,918
1917	20	300	5,291	......	......	323	222	800	184,525	25	12,900	321,872
1918	21	300	5,291	......	......	472	225	916	206,130	......	......	......
1919	20	300	5,291	47	9.2	433	226	920	207,894	31	13,100	413,583
1920	19	300	5,071	50	7.7	386	235	917	215,610	33	12,000	396,828

Year.	Onions and garlic.			Potatoes.			Pulse (excluding beans).			Sugar beets.		
	1,000 acres.	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1911	11	11,600	128,197	712	87.3	62,140	1,833	300	557,323	131	13.3	1,747
1912	13	10,800	141,094	712	79.1	56,313	1,853	300	518,081	133	14 4	1,921
1913	18	11,300	200,619	722	91.0	65,741	1,977	300	645,507	153	19.7	3,009
1914	18	10,800	195,328	727	84.1	61,104	2,224	200	532,411	101	14.8	1,488
1915	19	10,800	202,823	725	78.3	56,768	1,730	400	613,320	123	13.3	1,639
1916	19	9,600	185,186	729	74.4	54,277	......	300	......	123	12.1	1,486
1917	19	9,400	176,368	732	65,7	48,112	......	300	......	116	10.0	1,166
1918	......	......	......	739	70.0	51,808	......	......	......	106	11.8	1,250
1919	18	8,300	148,590	763	67.0	50,989	......	......	......	128	13.1	1,671
1920	22	7,900	174,163	744	70.0	52,260	......	......	......	......	......	......

Year.	Tobacco.			Tomatoes.		
	1,000 acres.	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911	14	1,100	15,322	61	17,800	1,077,168
1912	12	1,100	13,874	74	17,800	1,322,760
1913	11	1,200	13,022	72	19,400	1,388,898
1914	11	1,200	13,327	62	17,000	1,058,208
1915	20	1,300	......	62	13,200	815,702
1916	17	1,200	19,841	67	12,600	844,362
1917	16	700	11,684	80	14,500	1,161,163
1918	17	1,200	19,841	......	......	......
1919	21	1,000	21,164	73	13,000	952,167
1920	......	......	......	76	11,500	872,360

TABLE 52.—*Crops of Italy*—Continued.

Year.	Apples, pears, quinces, and pomegranates, production.	Dried figs and prunes, production.	Pulp fruits, production.	Almonds, walnuts, and hazelnuts, production.	Chestnuts, production.
	1,000 lbs.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	468,698	156,527	169,313	348,988	1,827,613
1912	476,194	147,267	205,028	452,384	1,097,891
1913	593,699	141,535	250,002	181,659	1,272,275
1914	532,631	154,763	260,143	509,042	941,805
1915	712,086	214,949	260,584	257,718	1,458,343
1916	420,197	170,195	276,016	345,681	1,392,866
1917	722,447	237,215	257,497	240,522	1,459,886
1918	....	....	....	....	....
1919	463,848	247,577	287,700	194,225	1,100,095
1920	504,633	237,215	303,794	394,623	1,372,143

TABLE 53.—*Number of live stock in Italy.*

[Source: Ministero per l'Agricoltura, Rome.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
1914	[1] 6,646,000	2,722,000	13,824,000		[2] 2,235,000	....	....
Apr. 6, 1918 [3]	[4] 6,264,000	2,339,000	11,754,000	3,083,000	[5] 990,000	497,000	949,000

[1] Includes some buffaloes.
[2] Includes mules and asses.
[3] Census.
[4] Including buffaloes, which in 1918, numbered 24,000.
[5] Including 855 in transit and 186,328, belonging to the Royal Army.

TABLE 54.—*Net imports or net exports of leading farm products, for Italy.*

[Source: Movimento Commerciale del Regno d'Italia.]

Year.	Net imports.			Rice, net exports.	Net imports.		Net exports.		Net imports.	
	Barley.[1]	Corn.[2]	Oats.[2]		Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton,[3] unmanufactured.	Cottonseed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	782	14,965	8,795	156,776	292	47,829	5,630	49,488	876	3,598
1912	871	20,990	10,741	188,401	621	62,858	7,944	57,437	987	5,387
1913	711	13,485	7,272	137,887	1,243	61,837	5,124	59,966	931	3,957
1914	1,046	3,028	4,437	182,316	376	33,459	9,116	56,166	879	700
1915	617	7,788	27,610	8,635	4	82,028	7,392	62,291	1,343	472
1916	256	2,143	37,964	83,889	1	72,893	656	39,070	1,169	145
1917	1,360	7,914	19,732	[4] 139,437	1,440	76,227	44	2,324	828	71
1918	7,525	10,855	19,255	[4] 770,763	3,506	78,348	35	192	601	4
1919	1,194	8,232	11,862	[4] 102,708	369	94,589	[4] 1,829	[4] 9,330	824	1,052
1920	1,585	12,595	3,146	1,322	2,390	78,297	[4] 3,008	[4] 3,103	824	4,028

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net imports.

TABLE 54.—*Net imports or net exports of leading farm products, for Italy*—Continued.

Year.	Net imports.				Net exports.		Net imports.		
	Flaxseed.	Hides and skins.	Hops.	Meat.	Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco.	Wool.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	1,618	19,724	565	89,563	77,967	2,703	20,276	38,205	23,694
1912	1,688	5,062	440	92,320	49,168	3,453	15,602	42,916	31,088
1913	1,787	[5] 8,044	540	84,849	36,881	5,042	13,075	53,307	32,991
1914	1,274	[5] 3,862	512	59,024	118,224	6,266	[5] 55,698	39,611	27,470
1915	1,509	63,710	355	147,736	6,663	375	[5] 102,003	33,373	130,222
1916	1,055	70,996	571	275,318	31,568	2,066	158,872	30,619	125,382
1917	888	38,952	155	286,466	22,857	546	122,161	49,466	83,045
1918	141	68,158	104	489,100	6,736	148	81,403	40,776	83,064
1919	519	86,603	498	520,066	34,369	505	175,169	62,445	70,990
1920	871	38,148	1,279	166,200	78,031	3,073	25,020	74,166	62,375

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[5] Net exports.

TABLE 55.—*Crops of Japan.*

[Source: Statistical Report of the Department of Agriculture and Commerce, Japan. These statistics are available as early as 1877.]

Year.	Barley.			Barley (naked).			Buckwheat.			Corn.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	1,467	32.8	48,059	1,635	23.5	38,421	370	16.79	6,227	132	26.86	3,543
1912	1,466	34.2	50,119	1,667	24.2	40,441	359	14.20	5,103	138	27.49	3,802
1913	1,530	35.6	54,480	1,767	26.6	46,996	371	14.35	5,328	144	19.55	2,807
1914	1,510	32.4	48,880	1,782	20.7	36,894	396	17.69	7,007	146	26.99	3,940
1915	1,460	36.0	52,488	1,753	24.2	42,476	378	17.00	6,428	143	28.07	4,022
1916	1,395	35.0	48,795	1,680	24.1	40,541	365	16.44	5,999	144	27.15	3,917
1917	1,315	35.7	46,935	1,573	26.7	41,961	350	13.68	4,788	138	27.47	3,791
1918	1,299	33.0	42,838	1,563	25.5	39,813	334	13.05	4,363	141	23.58	3,320
1919	1,309	38.5	50,346	1,584	24.6	39,010	....	....	....	....	....	....

Year.	Millet.			Rice (hulled).			Wheat.			Beans (small red).		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	674	24.2	16,278	7,286	2,230	16,245,745	1,223	20.97	25,647	346	14.14	4,892
1912	662	22.8	15,100	7,360	2,144	15,777,677	1,216	21.81	26,514	335	14.48	4,848
1913	662	22.4	14,849	7,425	2,126	15,787,969	1,185	22.58	26,757	346	8.90	3,078
1914	646	25.1	16,215	7,434	2,409	17,908,918	1,173	19.59	22,975	319	14.66	4,672
1915	633	27.0	17,119	7,491	2,345	17,569,018	1,227	21.83	26,773	321	15.35	4,925
1916	616	28.7	17,702	7,527	2,439	18,359,997	1,304	23.12	30,137	325	13.97	4,540
1917	580	26.5	15,357	7,557	2,268	17,142,858	1,393	24.94	34,745	302	14.77	4,460
1918	561	26.5	14,860	7,581	2,267	17,184,019	1,390	23.69	32,923	294	12.68	4,152
1919	......	....	....	....	....	....	1,344	24.21	32,561	......	....	....

Year.	Beans (soy).			Burdock (edible).			Cabbage.			Carrots.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*
1911	1,199	15.77	18,905	31,960	11,605	370,424	6,325	16,361	103,506	20,792	12,381	257,124
1912	1,166	15.42	17,975	31,918	11,099	354,672	6,815	15,889	108,176	20,434	11,436	233,646
1913	1,165	13.14	15,322	32,888	11,031	363,183	8,769	13,966	122,613	21,868	11,031	241,079
1914	1,139	16.48	18,759	32,910	10,997	361,700	9,401	15,315	143,995	21,819	11,267	245,676
1915	1,154	16.90	19,492	....	....	....	......	....	....	....	....	....
1916	1,142	16.79	19,195	....	....	....	......	....	....	....	....	....
1917	1,064	17.34	18,452	34,979	10,255	359,001	12,116	13,629	164,945	22,390	9,952	223,021
1918	1,059	16.69	17,667	....	....	....	......	....	....	....	....	....

TABLE 55.—*Crops of Japan*—Continued.

Year.	Chile peppers.			Cotton (unginned.)[1]			Cucumbers.			Eggplant.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	Acres.	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*
1911....	2,750	2,092	5,744	6,862	877	6,044	24,730	15,788	390,187	53,303	13,190	702,564
1912....	2,051	2,969	6,055	6,759	1,046	7,251	26,198	14,236	373,273	57,283	12,752	730,573
1913....	1,495	3,104	4,664	6,178	1,046	6,399	27,320	18,183	496,816	56,878	12,752	725,325
1914....	1,529	2,901	4,464	6,058	1,113	6,793	28,703	14,135	405,624	58,408	12,819	749,387
1915....	1,887	1,990	3,766	6,565	1,046	6,941	....	....	....	....	....	....
1916....	4,889	1,552	7,556	5,686	1,113	6,252	....	....	....	....	....	....
1917....	2,583	1,653	4,233	5,867	1,012	6,003	32,898	13,426	441,911	62,187	13,123	817,146
1918....	2,066	1,754	3,646	6,200	911	5,630	....	....	....	....	....	....

Year.	Flax fiber.[2]			Ginger (green).			Hemp fiber.			Indigo (leaf).		
	Acres.	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*
1911....	9,972	2,496	24,850	6,997	9,513	66,510	28,636	742	21,099	12,405	1,653	20,384
1912....	11,979	2,598	31,078	6,600	10,930	72,233	29,776	675	19,652	12,496	1,855	23,283
1913....	18,606	2,429	45,459	6,666	10,626	70,865	29,886	742	22,096	9,626	1,788	17,108
1914....	27,708	2,294	63,700	5,779	11,234	64,837	26,999	776	20,876	11,060	1,619	18,026
1915....	33,489	2,024	71,401	5,972	11,571	69,154	28,448	708	20,452	16,341	1,822	29,827
1916....	36,047	2,867	104,022	6,791	10,761	73,043	28,090	675	18,714	22,551	2,193	49,429
1917....	48,222	2,092	101,435	7,261	9,648	70,009	28,886	675	19,558	17,349	1,653	28,397
1918....	85,444	1,687	143,027	7,239	9,041	65,324	28,967	742	21,198	13,650	1,653	22,469

Year.	Lilies (food).			Lotus (Indian).			Muskmelon.			Onions.		
	Acres.	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*
1911....	1,691	3,441	5,833	4,722	9,277	43,768	7,886	11,807	93,068	3,416	13,595	46,420
1912....	1,669	3,171	5,316	5,070	10,491	53,251	8,597	10,120	87,010	3,622	12,482	45,190
1913....	1,635	3,272	5,352	5,173	10,424	55,186	8,408	8,940	75,360	3,808	12,718	48,471
1914....	1,674	....	5,578	4,833	10,559	54,394	7,840	11,436	89,584	4,264	13,089	55,830
1915....	....	....	....	....	....	....	....	....	....	4,345	13,021	56,526
1916....	....	3,340	....	....	....	....	....	....	....	4,855	13,123	63,731
1917....	1,561	3,610	5,636	6,744	10,154	68,441	9,624	12,111	116,589	4,754	12,853	61,174
1918....	....	....	....	....	....	....	....	....	....	5,494	12,414	68,177

Year.	Onions (Welsh).			Peas.			Peanuts, in the shell.			Peppermint (dried).		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	Acres.	*Lbs.*	*1,000 lbs.*	*Acres.*	*Bush.*	*1,000 bush.*	*Acres.*	*Bush.*	*1,000 bush.*	*Acres.*	*Lbs.*	*1,000 lbs.*
1911....	26,830	10,323	274,806	75,827	20.62	1,564	19,142	81.94	1,568	10,237	3,272	33,505
1912....	27,857	10,660	266,546	89,683	21.41	1,914	24,622	81.34	2,003	15,574	3,272	52,448
1913....	28,776	10,862	312,513	106,169	18.24	1,936	22,542	97.76	2,204	27,872	3,272	91,569
1914....	29,668	10,761	319,293	107,630	20.14	2,168	23,350	94.91	2,216	30,626	5,836	179,040
1915....	....	....	....	109,742	19.20	2,123	24,767	83.36	2,065	29,965	4,251	127,184
1916....	....	....	....	126,128	18.46	2,329	30,092	81.53	2,453	29,440	4,824	141,679
1917....	33,722	9,210	310,856	221,879	17.57	3,898	32,989	70.81	2,336	22,319	3,205	71,565
1918....	....	....	....	169,348	16.17	2,736	30,785	92.47	2,847	9,303	3,002	27,942

[1] The production estimated in terms of ginned cotton, in bales of 478 pounds net weight, was: 1911, 4,215; 1912, 5,057; 1913, 4,462; 1914, 4,737; 1915, 4,840; 1916, 4,360; 1917, 4,186; 1918, 3,926.
[2] Production in terms of "dried stalks."

TABLE 55.—*Crops of Japan*—Continued.

Year.	Potatoes.			Radishes.			Silk.[1]			Squashes.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	Acres.	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*Acres.*	*Lbs.*	*1,000 lbs.*
1911....	168, 902	8, 940	1, 510, 104	257, 865	21, 927	5, 655, 730	1, 099	19. 7	21, 680	40, 449	13, 325	538, 853
1912....	172, 931	8, 906	1, 540, 135	253, 522	22, 130	5, 609, 982	1, 112	20. 5	22, 791	42, 424	13, 426	568, 920
1913....	185, 998	8, 434	1, 568, 310	261, 821	23, 007	6, 025, 593	1, 107	21. 2	23, 504	45, 517	11, 503	524, 336
1914....	205, 413	9, 446	1, 938, 704	258, 056	23, 142	5, 969, 930	1, 104	20. 5	22, 586	47, 877	13, 595	651, 337
1915....	224, 553	9, 378	2, 106, 171	....	....	....	1, 112	21. 4	23, 790	....	....	....
1916....	253, 883	9, 142	2, 316, 758	....	....	....	1, 141	25. 6	29, 222	....	....	....
1917....	299, 110	9, 547	2, 856, 983	261, 544	18, 217	4, 768, 128	1, 190	27. 4	32, 610	50, 654	12, 853	650, 813
1918....	323, 713	8, 265	2, 678, 029	....	....	....	1, 247	28. 0	34, 973	....	....	....
1919....	....	....	....	....	....	....	1, 305	......	....	....	....	....

Year.	Sugar cane.			Taro.			Tea.			Tobacco.		
	Acres.	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*	*Lbs.*	*1,000 lbs.*
1911....	52, 153	36, 332	1, 894, 696	149, 537	9, 108	1, 355, 482	123, 057	583	71, 764	68, 022	1, 113	74, 896
1912....	51, 293	34, 308	1, 759, 244	151, 735	8, 805	1, 334, 042	119, 334	622	74, 265	71, 997	1, 349	96, 095
1913....	53, 300	35, 826	1, 909, 516	153, 617	8, 164	1, 253, 371	120, 048	605	72, 590	77, 175	1, 451	111, 955
1914....	55, 388	39, 840	2, 206, 993	151, 804	8, 130	1, 232, 699	119, 643	599	71, 671	88, 671	1, 417	126, 206
1915....	58, 062	37, 580	2, 181, 458	....	....	....	117, 925	642	75, 663	75, 423	1, 451	108, 415
1916....	60, 547	38, 390	2, 324, 237	....	....	....	119, 932	702	84, 186	70, 747	1, 484	105, 642
1917....	75, 501	44, 664	3, 372, 475	156, 953	5, 026	1, 315, 886	118, 932	732	87, 106	65, 326	1, 383	90, 607
1918....	71, 970	36, 399	2, 618, 631	....	....	....	121, 712	731	88, 925	59, 893	1, 316	79, 780
1919....	....	....	....	....	....	....	119, 700	......	....	....	....	....

Year.	Production.						
	Apples.	Cherries.	Figs.	Grapes.	Loquats.	Mandarins.	Navel oranges.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
1911..............	89, 202, 844	1, 966, 179	5, 950, 596	28, 573, 707	20, 959, 234	309, 545, 536	10, 634, 187
1912..............	69, 295, 756	2, 341, 365	7, 295, 247	30, 419, 067	21, 575, 801	383, 684, 525	16, 080, 246
1913..............	78, 571, 005	2, 142, 768	7, 201, 215	31, 404, 050	21, 149, 994	376, 362, 227	18, 057, 263
1914..............	78, 847, 406	2, 560, 102	7, 107, 431	32, 696, 179	20, 967, 088	330, 128, 889	17, 160, 658
1915..............	58, 409, 764	2, 643, 643	....	37, 439, 138	20, 457, 698	345, 417, 913	19, 048, 876
1916..............	76, 854, 879	2, 602, 802	....	41, 211, 854	21, 551, 289	478, 761, 757	24, 413, 816
1917..............	83, 388, 956	2, 588, 492	....	42, 941, 274	19, 682, 333	222, 975, 744	20, 626, 914
1918..............	55, 346, 482	3, 099, 444	....	46, 867, 489	20, 798, 286	338, 311, 846	21, 901, 954

Year.	Other citrus fruits.	Peaches.	Pears (sand).	Pears (other).	Persimmons.	Plums.	Quinces.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Bushels.*	*Lbs.*
1911..............	60, 785, 406	77, 830, 322	151, 255, 884	4, 299, 790	358, 586, 961	2, 420, 642	1, 604, 137
1912..............	85, 152, 438	90, 629, 574	164, 978, 031	4, 929, 493	331, 051, 735	2, 657, 575	1, 394, 735
1913..............	81, 766, 317	89, 255, 714	171, 804, 026	5, 461, 502	388, 898, 943	2, 414, 760	1, 510, 279
1914..............	68, 141, 831	86, 502, 959	167, 125, 710	5, 225, 620	321, 690, 762	2, 231, 930	1, 551, 227
1915..............	53, 302, 069	100, 168, 674	177, 988, 297	6, 675, 349	396, 119, 330	2, 116, 558	....
1916..............	61, 920, 093	107, 178, 451	197, 417, 014	6, 253, 047	331, 016, 830	1, 749, 643	....
1917..............	42, 710, 095	110, 781, 101	237, 592, 356	5, 712, 729	374, 391, 865	1, 700, 184	....
1918..............	48, 328, 371	102, 580, 410	224, 785, 638	5, 243, 155	249, 884, 334	1, 962, 251	....

[1] Area of mulberry trees, and production of cocoons.

TABLE 56.—*Number of live stock in Japan.*

[Source: Department of Agriculture and Commerce, Japan.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.
Dec. 31—					
1910	1,384,000	279,000	4,000	92,000	1,565,000
1911	1,405,000	299,000	3,000	100,000	1,576,000
1912	1,399,000	309,000	3,000	101,000	1,582,000
1913	1,389,000	310,000	3,000	89,000	1,582,000
1914	1,387,000	332,000	3,000	95,000	1,579,000
1915	1,388,000	333,000	3,000	97,000	1,580,000
1916	1,343,000	328,000	3,000	109,000	1,572,000
1917	1,304,000	360,000	3,000	110,000	1,560,000
1918	1,307,000	398,000	5,000	92,000	1,511,000

TABLE 57.—*Net imports or net exports of leading farm products for Japan.*

[Source: Annual Return of the Foreign Trade of the Empire of Japan.]

Year.	Net imports.					
	Rice.	Wheat.[1]	Cotton, unmanufactured.[2]	Sugar.	Tobacco.	Wool.
	1,000 lbs.	*1,000 bush.*	*1,000 bales.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	526,893	2,063	1,125	73,382	[3] 861	8,323
1912	701,987	3,114	1,655	182,870	2,225	13,451
1913	1,170,957	7,129	1,821	501,728	1,619	11,741
1914	620,040	4,893	1,705	267,737	3,022	12,736
1915	2,155	160	2,015	121,708	1,054	52,771
1916	[3] 67,888	[3] 271	2,299	16,016	[3] 1,083	40,758
1917	[3] 9,263	[3] 4,644	1,947	[3] 121,706	[3] 9,280	47,305
1918	1,491,312	5	1,886	237,528	[3] 323	49,590
1919	1,527,648	11,541	2,190	454,616	10,738	56,552

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Including flour, in terms of grain.
[2] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[3] Net exports.

TABLE 58.—*Crops of Korea (Chosen).*

[Source: Statistical Report of the Department of Agriculture and Commerce, Japan. These statistics are available as early as 1909.]

Year.	Barley.			Barley (naked).			Corn.			Millet.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	875	23.5	20,554	51	16.9	858	139	11.5	1,603	1,461	15.3	22,374
1912	945	23.2	21,926	70	15.2	1,065	133	13.6	1,802	1,371	17.1	23,419
1913	1,044	25.7	26,792	74	17.5	1,301	133	15.1	2,012	1,522	17.2	26,221
1914	1,107	21.4	23,708	76	14.8	1,124	144	14.1	2,032	1,556	14.7	22,794
1915	1,182	22.4	26,527	79	16.3	1,287	148	13.6	2,020	1,616	15.3	24,709
1916	1,233	19.9	24,577	81	13.2	1,076	152	15.4	2,344	1,641	16.2	26,585
1917	1,322	19.7	25,989	87	16.5	1,430	173	13.3	2,308	1,746	15.9	27,759

Year.	Oats.			Rice (hulled).			Wheat.			Beans (small red).		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	111	13.9	1,547	2,359	1,328	3,132,982	377	13.2	4,967	411	8.8	3,604
1912	104	12.9	1,344	2,406	1,173	2,821,745	410	13.6	5,577	406	10.5	4,275
1913	125	18.7	2,341	2,564	1,237	3,170,032	465	14.0	6,506	418	9.6	4,020
1914	129	17.7	2,295	2,645	1,444	3,819,843	474	12.3	5,848	437	8.9	3,914
1915	155	17.3	2,679	2,764	1,293	3,573,193	499	12.3	6,146	448	8.6	3,859
1916	170	16.9	2,874	2,839	1,387	3,936,685	520	12.3	6,387	447	9.2	4,112
1917	171	15.5	2,643	2,865	1,341	3,841,182	560	11.7	6,540	458	9.2	4,194

TABLE 58.—*Crops of Korea (Chosen)*—Continued.

Year.	Beans (soy).			China grass.			Cotton (unginned).[1]			Hemp.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*Acres.*	*Lbs.*	*Lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911......	840	12.8	10,737	1,816	270	491,036	118	254	30,036	34	387	13,156
1912......	920	13.6	12,553	2,936	250	734,087	125	320	40,054	37	425	15,552
1913......	994	12.4	12,364	3,039	278	845,836	142	331	47,018	37	516	19,208
1914......	1,043	12.1	12,616	2,980	321	957,750	151	317	47,784	40	497	19,942
1915......	1,129	12.6	14,223	2,701	303	819,504	160	372	59,535	41	488	20,092
1916......	1,149	13.2	15,138	2,642	281	741,461	175	344	59,970	43	492	20,964
1917......	1,204	12.5	15,042	2,186	316	690,402	226	407	92,231	46	538	24,925

[1] Production, estimated in terms of ginned cotton, in bales of 478 pounds, net weight; 1911, 20,945; 1912, 27,931; 1913, 32,788; 1914, 33,322; 1915, 41,516; 1916, 41,820; 1917, 64,317.

TABLE 59.—*Number of live stock in Korea (Chosen).*

[Source: Statistical Report of the Department of Agriculture and Commerce of Japan.]

Dec. 31—	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
1911...............	906,000	573,000	....	8,000	41,000	(1)	10,000
1912...............	1,041,000	617,000	(1)	10,000	47,000	1,000	12,000
1913...............	1,211,000	761,000	....	10,000	51,000	....	13,000
1914...............	1,338,000	758,000	....	12,000	53,000	1,000	14,000
1915...............	1,354,000	767,000	....	14,000	55,000	1,000	13,000
1916...............	1,353,000	780,000	....	14,000	53,000	1,000	13,000
1917...............	1,385,000	832,000	1,000	15,000	55,000	2,000	12,000

[1] Less than 500.

TABLE 60.—*Crops of Mexico.*

[Source: Anuario Estadistica Mexicana. These statistics begin as early as 1892.]

Crop.	1905	1906	1907
GRAINS.			
Barley..1,000 bush..	6,616	7,615	10,840
Corn..........do....	86,544	110,065	205,737
Oats..........do....	5	52	28
Rice......1,000 lbs..	55,151	69,932	72,499
Rye....1,000 bush..	72	24	66
Wheat........do....	11,120	12,862	11,468
FRUITS.			
Apples....1,000 lbs..	9,748	110,898	112,096
Apricots......do....	1,878	2,385	2,079
Avocados.....do....	23,330	26,269	36,846
Coconuts, for milk (cocoa de agua) 1,000 lbs.......	19,634	27,646	17,092
Figs......1,000 lbs..	5,170	8,378	5,298
Grapes........do....	6,291	6,494	3,409
Guavas.......do....	21,187	34,740	25,913
Lemons.......do....	12,801	7,215	14,353
Limes.........do....	27,037	33,887	25,345
Mangoes......do....	48,021	44,257	47,003
Oranges......do....	118,469	99,895	83,814
Peaches.......do....	31,380	57,107	73,047
Pears.........do....	9,577	17,782	15,484
Pineapples...do....	10,207	10,093	11,483
Plums.........do....	13,336	12,578	10,546
Pomegranates.do....	7,782	4,553	2,345
Quince.......do....	9,269	9,681	10,289
Sapodilla plums, 1,000 lbs...........	9,576	11,050	14,102
OTHER CROPS.			
Beans, peas, etc.:			
Kidney beans, (frijoles), 1,000 bush..........	5,288	6,311	5,997
OTHER CROPS—con.			
Beans, peas, etc.—Continued.			
Other beans (habas), 1,000 bush..........	537	513	973
Chick peas, 1,000 bush..........	1,206	2,316	1,543
Lentils, 1,000 bush..........	51	57	42
Cacao.....1,000 lbs..	6,054	5,959	6,854
Coffee........do....	88,478	86,961	110,480
Cotton bales (478 lbs., net)	325,714	129,007	74,145
Ixtle......1,000 lbs..	30,081	134,298	138,378
Peanuts.1,000 bush..	779	480	460
Peppers, red:			
Dry...1,000 lbs..	15,316	16,247	29,350
Fresh.....do....	2,640	3,694	3,804
Potatoes, 1,000 bush.	477	924	623
Sarsaparilla, 1,000 lbs................	5,730	7,496	6,397
Sugar cane and products:			
Sugar cane, 1,000 lbs............	3,719,284	3,982,879	6,089,148
Sugar.1,000 lbs..	208,906	205,862	257,440
Panocha (hard molasses),1,000 lbs............	193,198	177,776	185,719
Molasses, 1,000 lbs............	97,348	144,607	212,167
Rum.1,000 gals..	15,146	33,393	34,926
Sweet potatoes, 1,000 lbs................	126,665	43,871	60,136
Tobacco......do....	40,575	34,710	42,870
Vanilla.......do....	717	541	626

LIVE STOCK IN MEXICO.

The Mexican census for June 30, 1902, gave the following numbers of live stock in that country: Cattle, 5,142,000; swine, 616,000; sheep, 3,424,000; goats, 4,206,000; horses, 859,000; mules, 334,000; and asses, 288,000.

TABLE 61.—*Crops of Netherlands.*

[Source: Verslag over den Landbouw in Nederland; issued by the Departement van Landbouw, Nijverheid en Handel. These statistics begin as early as 1851.]

Year.	Barley (summer).			Barley (winter).			Buckwheat.			Oats.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	14	40.2	567	55	51.7	2,849	32	11.8	379	341	51.9	17,724
1912	12	40.8	507	54	53.4	2,857	29	17.2	498	341	47.8	16,317
1913	15	39.6	592	51	49.5	2,539	26	18.5	480	348	54.3	18,909
1914	14	41.3	571	53	46.3	2,449	24	17.9	430	348	55.6	19,368
1915	14	44.0	594	50	56.0	2,786	19	14.9	283	358	57.8	20,692
1916	12	40.1	489	48	39.7	1,890	18	15.9	286	343	52.3	17,925
1917	21	39.3	806	31	43.9	1,352	20	13.7	274	383	46.6	17,858
1918	24	39.7	942	36	......	1,673	21	9.8	205	392	47.4	18,617
1919	23	......	900	34	......	1,453	19	12.8	243	389	......	21,338
1920	......	......	......	[1] 56	......	[2] 2,846	......	......	......	392	......	24,285

Year.	Spelt.			Rye.			Wheat.			Beans.		
	Acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	741	53.3	40	557	28.9	16,110	142	38.7	5,511	46	26.6	1,240
1912	635	53.7	34	563	28.6	16,094	143	39.2	5,604	41	34.5	1,430
1913	662	54.3	36	564	30.0	16,895	141	36.5	5,164	42	32.0	1,341
1914	707	60.4	43	563	24.0	13,471	148	38.9	5,779	40	32.0	1,280
1915	974	53.7	52	546	29.5	16,116	163	43.5	7,090	39	31.6	1,221
1916	1,058	50.9	54	494	23.5	11,645	134	35.7	4,786	37	31.6	1,171
1917	1,268	45.8	58	467	28.4	13,261	121	32.7	3,949	57	24.0	1,324
1918	1,223	......	47	472	27.6	13,022	148	36.6	5,431	61	34.6	2,095
1919	887	......	31	497	......	14,714	168	......	5,856	38	......	966
1920	......	......	......	489	......	14,222	156	......	6,677	......	......	......

Year.	Beans (wild).			Chicory.			Flax fiber.[2]			Hops.
	1,000 acres.	*Bush.*	*1,000 bush.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*Acres.*
1911	17	25.3	424	2,350	21,774	51,169	39	535	20,929	35
1912	17	29.7	508	2,921	21,922	64,034	36	580	21,217	25
1913	19	25.8	480	1,769	22,177	39,231	36	459	16,606	27
1914	19	34.3	666	1,648	24,407	40,223	19	567	10,811	32
1915	20	35.0	683	2,431	26,296	63,925	22	584	12,922	......
1916	22	25.8	571	3,363	23,697	79,694	37	589	21,844	......
1917	35	34.1	1,202	2,451	23,147	56,733	30	459	13,961	......
1918	57	30.8	1,748	1,806	25,695	46,405	15	522	7,674	......
1919	60	......	1,975	2,508	22,701	56,934	24	......	11,351	......

Year.	Peas.			Potatoes.			Sugar beets.			Tobacco.
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*Acres.*
1911	55	33.2	1,838	411	251	103,468	137	16.1	2,210	991
1912	64	29.4	1,870	426	286	121,878	160	15.0	2,399	1,023
1913	68	21.8	1,488	420	261	109,260	149	12.3	1,836	1,149
1914	65	28.8	1,871	424	285	120,780	156	14.1	2,198	929
1915	61	29.7	1,818	438	289	126,741	140	13.5	1,889	860
1916	61	26.3	1,600	425	248	105,140	160	11.8	1,892	870
1917	89	28.4	2,529	428	288	123,978	113	14.2	1,607	904
1918	88	33.2	2,932	440	296	130,288	95	14.5	1,372	976
1919	79	......	2,264	445	......	125,132	131	12.5	1,647	......
1920	......	......	......	421	......	91,303	157	......	2,281	......

[1] Includes summer barley.

[2] Flaxseed production on same acreage as is reported for flax fiber, was: 1911, 579,000 bushels; 1912, 428,000 bushels; 1913, 335,000 bushels; 1914, 218,000 bushels; 1915, 295,000 bushels; 1916, 378,000 bushels; 1917, 326,000 bushels; 1918, 182,000 bushels.

TABLE 62.—*Number of live stock in Netherlands.*

[Source: Departement van Landbouw, Nijverheid en Handel, The Hague.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.
May 20, June 20, 1910[1]	2,027,000	1,260,000	889,000	224,000	227,000
June —, 1913	2,097,000	1,350,000	842,000	232,000	334,000
May —, 1915	2,390,000	1,487,000	....	....	....
Apr. 11, 1917	2,304,000	1,185,000	521,000	....	....
Aug. —, 1918	2,049,000	600,000	642,000	311,000	378,000
Mar. —, 1919	1,969,000	450,000	437,000	....	362,000

[1] Census.

TABLE 63.—*Net imports or net exports of leading farm products for Netherlands.*

[Source: Statistiek van den In-Uit-en Doorvoer.]

Year.	Net imports.						Net exports.		Net imports.	
	Barley.[1]	Corn.[2]	Oats.[2]	Rice.	Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton, unmanufactured.[3]	Cotton-seed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	13,147	19,804	6,694	261,452	13,196	21,629	60,474	112,957	133	3,501
1912	9,388	24,705	9,988	255,008	11,341	22,866	81,671	130,454	161	7,008
1913	12,183	27,621	7,580	359,654	11,982	25,033	76,173	145,295	167	7,734
1914	10,210	21,329	5,565	243,470	7,120	20,368	80,526	149,011	134	6,296
1915	6,418	42,529	4,299	121,211	2,206	26,936	92,447	189,994	184	14,757
1916	6,682	27,513	4,885	136,062	1,141	30,198	78,819	199,312	175	8,045
1917	2,337	8,528	2,712	35,390	356	11,799	54,163	123,624	46	2,508
1918	136	346	(4)	10,752	751	2,224	5,372	32,893	1	....
1919	7,082	9,596	2,743	44,607	1,423	17,865	29,627	27,329	109	4,128
1920	1,853	15,529	1,647	47,128	[5] 1,487	19,099	45,445	99,249	115	1,871

Year.	Net imports.			Meat. Net exports.	Oil cake and oil-cake meal. Net imports.	Net exports.		Net imports.	
	Flaxseed.	Hides and skins.	Hops.			Potatoes.	Sugar.	Tobacco.	Wool.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	5,048	6,260	1,757	91,398	432,199	14,225	227,994	53,553	7,944
1912	5,852	10,517	1,555	132,288	569,754	16,034	296,231	51,837	5,830
1913	7,861	12,695	1,381	188,930	538,006	13,238	293,815	62,459	8,246
1914	7,573	8,286	1,987	324,191	453,393	13,923	106,733	56,045	6,517
1915	13,264	8,900	2,363	387,084	565,332	8,740	290,205	48,680	15,618
1916	6,693	[5] 11,592	2,021	411,344	452,663	8,038	84,422	53,343	12,541
1917	539	2,042	2,163	29,660	180,136	2,273	67,947	920	8,535
1918	[5] 175	[5] 773	4,586	1,513	213	464	51,003	[5] 6,440	274
1919	3,718	[5] 17,033	[5] 293	[6] 69,935	210,399	13,441	[6] 18,894	172,607	12,519
1920	3,647	[5] 1,471	[5] 1,451	[6] 72,689	[5] 5,946	14,380	75,002	76,623	8,554

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Less than 500 bushels.
[5] Net exports.
[6] Net imports.

TABLE 64.—*Crops of New Zealand.*

[Source: Monthly Abstract of Statistics; issued by Government Statistician of the Dominion of New Zealand. These statistics begin as early as the crop year 1879-80 for the principal crops.]

Crop year.	Barley.			Corn.			Oats.			Wheat.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*[1]	*1,000 bush.*[1]
1910-11	33	28.6	956	13	45.0	588	303	34.5	10,438	322	26.5	8,551
1911-12	32	40.9	1,294	6	47.1	287	404	50.2	20,282	216	34.8	7,490
1912-13	37	37.9	1,421	5	48.9	229	387	36.2	14,012	190	28.1	5,343
1913-14	32	38.8	1,244	6	53.4	317	362	42.0	15,206	167	32.4	5,397
1914-15	18	33.6	616	5	51.8	284	288	41.0	11,797	230	29.9	6,854
1915-16	30	28.0	846	8	43.4	351	213	37.1	7,894	329	22.3	7,332
1916-17	30	26.4	783	6	44.5	283	177	31.2	5,541	219	24.0	5,243
1917-18	19	31.1	587	8	46.5	379	156	32.6	5,099	281	25.0	7,022
1918-19	19	39.1	733	10	43.5	427	173	41.1	7,102	208	32.6	6,775
1919-20							410			193	22.0	4,229

Crop year.	Cocksfoot (seed).			Peas.			Potatoes.			Rye grass seed.		
	1,000 acres.	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Bush.*	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*	*1,000 bush.*[2]	*1,000 acres.*	*Bush.*	*1,000 bush.*[3]
1910-11	42	140.0	5,869	15	35.6	528	29	181.8	5,283	47	25.0	1,168
1911-12	38	182.1	6,975	20	33.4	666	28	191.5	5,410	78	28.4	2,199
1912-13	34	238.4	8,106	20	26.6	524	23	234.8	5,514	63	23.2	1,459
1913-14	26	191.1	4,956	14	32.6	453	29	201.2	5,869	56	19.6	1,099
1914-15	18	135.5	2,378	13	27.6	367	22	226.2	4,952	51	21.0	1,063
1915-16	13	118.6	1,577	9	18.3	168	30	162.4	4,809	43	18.5	795
1916-17	16	118.2	1,908	12	21.1	251	26	190.8	4,989	79	14.6	1,154
1917-18	17	138.7	2,411	12	27.6	322	23	163.5	3,756	70	19.2	1,356
1918-19				18	29.0	522	19	205.3	3,938			

[1] Winchester bushels.
[2] Bushels of 60 pounds.
[3] Bushels of 20 pounds.

NOTE.—For wheat, the original reports give the following, in imperial bushels (equivalent in trade custom to 60-pound units): 1910-11, 8,290,000; 1911-12, 7,261,000; 1912-13, 5,180,000; 1913-14, 5,232,000; 1914-15, 6,644,000; 1915-16, 7,108,000; 1916-17, 5,083,000; 1917-18, 6,808,000; 1918-19, 6,568,000; 1919-20, 4,100,000.

TABLE 65.—*Number of live stock in New Zealand.*

[Source: Government Statistician, Dominion of New Zealand, Wellington.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.
1910			24,270,000		
1911 [1]	2,020,000	349,000	23,996,000	6,000	404,000
1912			23,750,000		
1913			24,192,000		
1914			24,799,000		
1915			24,901,000		
1916	2,417,000	298,000	24,788,000	18,000	371,000
1917	2,575,000	284,000	25,270,000	18,000	374,000
1918	2,869,000	259,000	26,538,000	18,000	378,000
1919	3,035,000	235,000	25,829,000	17,000	363,000
1920	3,059,000	260,000	23,915,000		344,000

[1] Census.

TABLE 66.—*Net imports or net exports of leading farm products for New Zealand.*

[Source: Statistics of the Dominion of New Zealand, Trade and Shipping.]

Year.	Barley.[1] Net exports.	Barley.[1] Net imports.	Corn,[2] net imports.	Oats.[2] Net imports.	Oats.[2] Net exports.	Rice, net imports.	Rye,[2] net exports.	Wheat,[2] net imports.	Butter, net exports.	Cheese, net exports.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*
1911	26	....	40	235	....	9,519	....	[3] 1,136	33,736	49,187
1912	222	....	31	....	4,117	10,907	3	[3] 419	42,343	64,625
1913	2	....	39	....	237	8,939	4	64	41,691	68,499
1914	52	....	83	....	1,623	9,381	2	610	48,612	96,738
1915	....	15	145	....	759	13,650	(4)	863	46,808	91,524
1916	....	122	78	83	....	11,730	(4)	206	40,167	106,289
1917	....	116	88	10	....	14,276	(4)	1,121	28,492	99,144
1918	....	141	150	169	....	12,543	[5] 1	1,414	48,274	98,882
1919	....	126	44	....	169	6,085	2	1,088	38,727	176,068

Year.	Net exports. Flaxseed.	Net exports. Hides and skins.	Net exports. Hops.	Net exports. Meat.	Oil cake and oil-cake meal, net imports.	Potatoes, net exports.	Net imports. Sugar.	Net imports. Tobacco.	Wool, net exports.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	18	21,737	153	297,097	....	46	122,517	29	175,826
1912	39	24,407	207	342,379	....	744	134,173	20	194,834
1913	19	27,298	411	337,260	....	57	136,322	21	193,222
1914	17	26,409	382	415,879	171	64	107,843	18	226,303
1915	[5] 4	5,723	450	464,213	122	730	138,987	16	199,368
1916	[5] 9	6,029	453	426,807	157	[5] 14	129,658	34	188,573
1917	[5] 7	22,550	295	310,127	170	26	141,596	28	178,282
1918	20	31,312	196	270,664	163	[5] 230	109,145	147	108,719
1919	61	32,224	220	551,764	92	131	125,754	182	274,242

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Net exports.
[4] Less than 500 bushels.
[5] Net imports.

TABLE 67.—*Crops of Norway.*

[Source: Aarsberetning Angaaende de Offentlige Foranstaltninger til Landbrukets fremme; issued by Landbruksdirektoren, at Kristiania, Norway. These statistics are available as early as 1900.]

Year.	Barley. Area.	Barley. Yield per acre.	Barley. Production.	Maslin. Area.	Maslin. Yield per acre.	Maslin. Production.	Oats. Area.	Oats. Yield per acre.	Oats. Production.	Rye. Area.	Rye. Yield per acre.	Rye. Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	89	28.7	2,550	15	30.4	463	263	33.3	8,746	37	25.5	948
1912	89	34.8	3,086	15	43.2	657	263	44.2	11,607	37	28.0	1,042
1913	89	35.8	3,202	15	44.3	670	270	43.5	11,734	37	26.0	973
1914	89	27.5	2,463	15	30.2	458	270	29.7	8,002	37	27.9	1,046
1915	89	30.0	2,682	15	36.8	557	270	38.3	10,317	37	22.1	829
1916	97	35.1	3,415	15	42.9	655	307	44.0	13,502	48	19.5	943
1917	116	33.0	3,822	17	38.9	656	356	41.0	14,591	58	20.1	1,160
1918	156	34.2	5,344	29	39.8	1,173	343	41.5	14,229	37	27.6	1,013
1919	156	32.1	5,013	29	38.6	1,138	343	37.8	12,963	37	26.8	984

TABLE 67.—*Crops of Norway*—Continued.

Year.	Wheat.			Hay.			Peas.			Potatoes.			Turnips.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911..	12	21.8	271	1,967	1.41	2,763	......	......	......	102	216.5	22,017	......	......	......
1912..	12	26.7	332	1,967	1.75	3,450	10	24.2	249	102	293.2	29,825	19	853.6	16,221
1913..	12	26.2	325	2,005	1.69	3,386	10	25.8	265	104	265.6	27,577	22	818.4	17,831
1914..	12	21.7	270	2,005	1.62	3,238	10	18.3	187	104	265.3	27,548	22	628.9	13,703
1915..	12	23.0	285	2,005	1.43	2,873	10	17.2	176	104	192.0	19,940	22	568.5	12,388
1916..	14	23.2	317	2,006	1.69	3,390	10	22.6	231	114	274.5	31,310	23	734.6	17,241
1917..	20	22.1	432	2,006	1.39	2,785	11	22.9	243	145	292.7	42,584	24	741.3	17,916
1918..	41	26.6	1,090	1,227	1.51	1,858	9	22.4	204	133	234.2	31,057	24	708.5	17,136
1919..	41	24.2	989	1,244	1.52	1,891	9	22.1	202	132	306.9	40,666	24	775.1	18,750

TABLE 68.—*Number of live stock in Norway.*

[Source: Landbruks Departementet; Kristiana, Norway.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.
Sept. 30:					
1910	1,146,000	334,000	1,398,000	288,000	168,000
1914	1,146,000	228,000	1,327,000	237,000	182,000
1915	1,121,000	209,000	1,330,000	240,000	186,000
1916	1,119,000	221,000	1,281,000	230,000	189,000
June 20:					
1918 [1]	1,038,000	209,000	1,185,000	199,000	210,000

[1] Incomplete.

TABLE 69.—*Net imports or net exports of leading farm products for Norway.*

[Source: Norges Handel.]

Year.	Net imports.						Butter, net exports.	Net imports.		
	Barley.[1]	Corn.[2]	Oats.[2]	Rice.	Rye.[2]	Wheat.[2]		Cheese.	Cotton,[3] unmanufactured.	Cottonseed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	5,142	1,019	843	7,534	11,265	3,686	3,178	213	18	1,492
1912	3,862	1,471	772	4,134	9,188	3,087	2,317	270	18	1,554
1913	3,994	1,149	562	9,909	11,042	4,227	596	476	18	1,542
1914	4,007	1,672	498	8,665	8,095	5,453	406	217	30	1,912
1915	1,368	1,925	586	11,317	7,876	6,050	3,533	[4] 190	51	3,539
1916	2,465	1,889	8	10,783	7,322	7,326	941	324	25	3,157
1917	2,255	1,305	22	5,240	5,095	5,314	[5] 1,017	231	17	3,658
1918	557	2,531	11	12,401	3,095	4,260	[5] 2,498	222	5	101
1919	782	2,742	[4] 732	10,400	6,190	7,387	[5] 8,199	4,923	23	1,584
1920	1,221	2,574	[4] 169	10,533	8,364	5,718	[5] 8,095	2,983	12	2,821

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net exports.
[5] Net imports.

TABLE 69.—*Net imports or net exports of leading farm products for Norway*—Continued.

Year.	Flaxseed, net imports.	Hides and skins.		Net imports.						
		Net exports.	Net imports.	Hops.	Meat.	Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco.	Wool.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	361	2,225	....	245	40,026	62,324	409	106,228	3,731	3,402
1912	395	....	887	336	37,140	64,547	7	98,505	4,355	3,525
1913	579	....	262	298	39,987	56,981	51	118,049	4,044	3,593
1914	470	3,813	....	466	43,098	80,239	157	130,787	4,645	3,012
1915	519	....	6,827	357	38,734	69,814	60	129,930	4,591	4,791
1916	492	950	....	403	53,767	74,962	483	136,824	5,171	4,407
1917	239	....	4,133	310	70,175	69,521	[4] 1	124,531	5,021	1,049
1918	(6)	....	809	409	27,645	48,432	412	75,635	3,416	758
1919	351	....	4,748	462	80,273	45,341	199	187,229	11,193	5,339
1920	332	1,327	....	436	62,900	28,002	[4] 472	200,313	6,753	2,401

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[4] Net exports.
[6] Less than 500 bushels.

TABLE 70.—*Crops of Poland, 1919.*

[Source: Official statistics of the area and production of the principal crops in Poland for the year 1919 as contained in the first issue of the Revue Mensuelle de Statistique published by the Central Statistical Office of the Polish Republic.]

Crop.	Former Russian Poland.		Former Western Galicia.		Posen.	
	Area.	Production.	Area.	Production.	Area.	Production.
	1,000 acres.	*1,000 bush.*	*1,000 acres.*	*1,000 bush.*	*1,000 acres.*	*1,000 bush.*
Wheat	663	19,066	310	3,460	90	135
Rye	4,556	67,106	704	8,648	1,284	27,289
Barley	846	18,027	237	3,130	232	681
Oats	1,601	52,691	580	12,881	259	10,709
Potatoes	1,879	256,647	420	33,383	547	93,285
Peas, lentils, kidney beans, broad beans	99	1,203	14	180	[1] 28	419
Linseed	64	477	11	78	[2] 5	....
Buckwheat	291	3,111	24	194	7	86
		1,000 short tons.		*1,000 short tons.*		*1,000 short tons.*
Fodder beets	90	753	31	229	48	382
Sugar beets	68	446	(3)	2	94	920
Carrots	55	523	2	12	19	175
Cabbage	67	360	17	79	....	....
Millet	89	27	23	5	....	....
Clover for seed	321	18	72	7	....	....
Colza	67	32	1	(3)	[4] 17	....
Hemp	16	4	5	1	....	....

[1] Vetches and horse beans included.
[2] Hemp and nettles included.
[3] Less than 500.
[4] Mustard, poppy, camelina, and sunflowers included.

TABLE 71.—*Number of live stock in Poland (Russian).*

[Source: Same as European Russia.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.
In summer—					
1910	2,301,000	612,000	1,050,000	9,000	1,222,000
1913	2,011,000	491,000	683,000	9,000	1,116,000
1914	2,014,000	452,000	565,000	....	1,098,000

TABLE 72.—*Crops of Portugal.*

[Source: Estatistica Agrícola; issued by the Ministerio das Finanças of Portugal. These statistics begin with acreage as early as 1873 and production as early as 1847 (not complete for a series of years).]

Crop.	1904	1911	1916
Barley.......bush..	....	....	1,195,492
Corn.......do....	15,262,152	....	9,523,409
Oats.......do....	....	....	3,288,310
Rice (hulled).......lbs..	....	....	45,019,916
Rye.......bush..	4,494,698	....	2,761,448
Wheat.......do....	7,953,874	11,684,164	7,342,833
Beans.......do....	....	....	1,985,602
Chickpeas.......do....	....	....	187,754
Potatoes.......do....	....	....	6,082,651

LIVE STOCK IN PORTUGAL, 1920.

Official reports give the following numbers for March, 1920: Cattle, 741,000; swine, 921,000; sheep, 3,851,000; goats, 1,493,000. In October, 1906, there were: Cattle, 703,000; swine, 1,111,000; sheep, 3,073,000; goats, 1,034,000; horses, 88,000; mules, 58,000; asses, 144,000.

TABLE 73.—*Crops of Rumania.*

[Source: Statistica Agricolă A Românici; issued by the Ministerul Industriei si Comerţulue; and other official sources. These statistics begin as early as 1862 for principal crops.]

Year.	Barley.			Buckwheat.			Corn.			Millet.		
	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*Acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911........	1,253	20.8	26.118	1,532	11.0	17	5,153	21.5	110,712	97	16.6	1,626
1912........	1,235	16.9	20,934	1,470	11.1	16	5,138	20.2	103,921	109	13.8	1,502
1913........	1,390	19.9	27,662	1,898	10.2	19	5,305	21.6	114,663	136	12.5	1,704
1914........	1,405	17.5	24,647	1,317	4.8	6	5,104	20.1	102,552	94	13.8	1,292
1915........	1,371	21.2	29,031	680	11.0	8	5,207	16.6	86,412	125	13.2	1,654
1916........	1,454	[3] 20.7	30,038	....	....	....	5,056	....	....	....	....	....
1918........	[1] 2,120	[3] 2.4	[4] 4,993	....	....	....	[4] 5,728	....	....	....	....	....
1919........	[5] 1,942	[8] 16.3	[5] 31,641	[6] 2,000	[3] 10.0	[6] 20	6,751	[3] 20.4	[5] 137,412	171	[5] 12.2	[6] 2,088
1920........	[7] 3,308	[3] 14.6	[8] 48,184	....	....	....	7,330	....	[8] 92,950	....	....	....

Year.	Oats.			Rye.			Wheat.			Beans (haricots).		
	1,000 acres.	*Bush.*[3]	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*[3]	*1,000 bush.*
1911........	992	27.9	27,671	326	15.3	4,989	4,769	20.1	95,656	1,344	3.4	4,593
1912........	943	22.2	20,948	265	13.5	3,583	5,114	17.5	89,412	1,418	3.3	4,638
1913........	1,290	29.4	37,990	224	16.5	3,711	4,011	21.0	84,191	1,473	3.9	5,747
1914........	1,056	24.0	25,311	208	9.4	1,959	5,218	8.9	46,296	1,570	3.7	5,780
1915........	1,065	28.1	29,932	187	15.6	2,911	4,705	19.0	89,786	1,640	3.4	5,558
1916........	1,068	27.1	28,935	200	....	....	4,844	[3] 16.2	78,520	....	....	....
1918........	[4] 1,084	5.4	[4] 5,890	[4] 624	[3] 2.7	[4] 1,694	[9] 5,684	[3] 3.2	[9] 18,447	....	....	....
1919........	[5] 952	24.0	[5] 22,824	[5] 748	[3] 13.4	[5] 10,046	[5] 4,271	[3] 15.5	[5] 66,000	....	....	....
1920........	[7] 2,053	....	[8] 37,206	[7] 680	....	[8] 5,750	[7] 5,156	....	[8] 41,815	....	....	....

[1] Area cultivated.
[2] Yield per acre harvested.
[3] Yield per acre cultivated.
[4] Includes Bessarabia but excludes Dobrudja.
[5] Former kingdom, Bessarabia and Bukowina.
[6] Former kingdom.
[7] Former kingdom, Bessarabia, Bukowina, and Transylvania.
[8] Former kingdom and Bessarabia.
[9] Excludes Dobrudja.

TABLE 73.—*Crops of Rumania*—Continued.

Year.	Beans (other).			Cabbage.			Flax fiber.[10]			Hay (cultivated).		
	Acres.	*Bush.*	*Bush.*	*1,000 acres.*	*Number.*	*Thousands.*	*1,000 acres.*	*Lbs.*	*Tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1911	539	16.8	9,004	13	3,703	49,728	52	89.2	2,265	400	1.5	615
1912	655	15.7	10,295	13	3,853	51,875	78	116.0	4,477	424	1.4	590
1913	672	14.6	9,841	13	3,606	47,516	67	71.4	2,379	467	1.4	656
1914	674	12.3	8,320	14	3,379	47,605	21	107.0	1,069	477	1.4	682
1915	684	11.7	8,019	14	3,695	51,790	14	80.3	593	469	1.4	646
1918	....	....	....	....	....	....	[4] 186	[3] 23.9	[4] 4,453	....	....	....
1919	....	....	....	....	....	....	[8] 48	....	[5] 2,293	....	....	....

Year.	Hay (natural meadows).			Hemp fiber.[11]			Melons.			Plums.		
	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.	Area.[1]	Yield per acre.[2]	Production.
	1,000 acres.	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Lbs.*	*Tons.*	*1,000 acres.*	*Number.*	*Thousands.*	*1,000 acres.*	*Lbs.*	*1,000 tons.*
1911	985	0.88	864	15	348.0	2,617	18	1,076	19,004	180	1,285	116
1912	941	.83	784	16	267.7	2,105	20	1,028	20,664	183	901	82
1913	989	.86	847	12	294.4	1,756	22	773	16,768	190	1,874	203
1914	944	.93	877	11	285.5	1,570	20	789	15,920	193	1,891	183
1915	982	.81	791	10	312.3	1,604	22	943	20,404	173	....	....
1916	....	....	....	....	....	....	....	....	....	209	....	....

Year.	Potatoes. Grown alone.			Potatoes. Grown with corn.			Pumpkins.			Rapeseed.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Number.*[3]	*Thousands.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	30	142.6	4,240	61	23.9	1,429	1,103	150	165,285	158	11.4	1,801
1912	30	126.4	3,748	60	18.1	1,084	1,164	139	161,264	159	9.8	1,560
1913	25	100.7	2,523	60	17.7	1,066	1,225	136	166,418	199	11.2	2,228
1914	26	101.7	2,654	56	19.3	1,083	1,275	110	140,180	180	9.2	1,658
1915	28	135.0	3,765	52	16.8	865	1,315	120	157,582	94	8.6	810
1916	35	....	....	....	....	....	....	....	....	....	....	....
1918	[8] 78	....	2,431	[9] 38	[3] 6.6	[9] 250	....	....	....	....	....	....
1919	[5] 142	[3] 74.0	[5] 10,442	[6] 38	[3] 10.6	[6] 401	....	....	....	....	....	....
1920	[7] 248	....	[12] 3,226	....	....	....	....	....	....	....	....	....

[1] Area cultivated.
[2] Yield per acre harvested.
[3] Yield per acre cultivated.
[4] Includes Bessarabia but excludes Dobrudja.
[5] Former kingdom, Bessarabia and Bukowina.
[6] Former kingdom.
[7] Former kingdom, Bessarabia, Bukowina, and Transylvania.
[8] Former kingdom and Bessarabia.
[9] Excludes Dobrudja.
[10] The production of flaxseed on same acreage as reported for flax fiber was: 1911, 603,000 bushels; 1912, 772,000 bushels; 1913, 569,000 bushels; 1914, 165,000 bushels; 1915, 134,000 bushels. (Statistics for later dates not available.)
[11] Production of hemp seed on same acreage as reported for hemp fiber was: 1911, 103,000 bushels; 1912, 106,000 bushels; 1913, 100,000 bushels; 1914, 78,000 bushels; 1915, 65,000 bushels. (Statistics for later dates not available.)
[12] Bessarabia only.

TABLE 73.—*Crops of Rumania*—Continued.

Year.	Sugar beets.			Sunflower seed.			Tobacco.			Vines[13] (bearing).		
	1,000 acres.	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Gals.*	*1,000 gals.*
1911	34	8.6	290	10	20.8	206	25	829.7	20,509	177	149	26,244
1912	35	9.1	322	13	20.0	264	23	571.0	13,146	174	242	42,002
1913	32	9.7	311	15	20.4	309	27	776.2	20,941	179	223	40,124
1914	37	6.8	348	15	20.0	310	27	624.5	16,970	177	98	17,453
1915	34	6.0	204	28	18.6	512	32	579.9	18,567	171	309	52,762
1917	......	......	......	......	......	......	24	......	......	......	......	......
1918	[4] 18	[3] 3.0	[4] 54	......	......	......	[8] 32	[3] 420.9	[8] 13,470	......	......	......
1919	[5] 8	[3] 4.6	[5] 37	......	......	......	[8] 36	[3] 735.5	[8] 26,477	......	......	......

[13] Area of vines and production of wine.
[4] Includes Bessarabia but excludes Dobrudja.
[3] Yield per acre cultivated.
[8] Former kingdom and Bessarabia.
[5] Former kingdom, Bessarabia and Bukowina.

TABLE 74.—*Number of live stock in Rumania.*

[Source: Ministerul Industriei si Comertului, Directiunea Comertului, Biuroul Statistic, Bucarest.]

Date.	Cattle.[1]	Swine.	Sheep.	Goats.	Horses.	Asses.
1911	2,667,000	1,021,000	5,269,000	187,000	825,000	[2] 4,000
Apr. —, 1916	2,938,000	1,382,000	7,811,000	301,000	1,219,000	12,000
Feb. 15, 1917[3]	1,050,000	371,000	1,655,000	84,000	299,000	......
1919[3]	1,125,000	84,000	445,000	......	149,000	......

[1] Includes buffaloes, in 1911 and 1916.
[2] Including mules.
[3] Unofficial estimate.

TABLE 75.—*Net imports or net exports of leading farm products, for Rumania.*

[Source: Comertul Exterior al României.]

Year.	Net exports.			Rice, net imports.	Net exports.		Net imports.			
	Barley.[1]	Corn.[2]	Oats.[2]		Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton, unmanufactured.[3]	Cotton-seed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	21,947	60,918	16,051	37,711	5,080	56,682	[4] 31	380	3	805
1912	10,819	42,285	1,870	[4] 485	2,441	54,022	91	[4] 27	2	593
1913	17,253	38,175	11,886	9,482	2,565	48,506	257	368	1	481
1914	9,909	44,840	5,750	23,173	1,236	23,791	240	96	2	441
1915	6,996	17,830	2,199	21,309	396	3,098	4	[4] 1,748	1	224
1919	[5] 20	[5] 570	[5] 330	11,958	[5] 101	[5] 8,614	364	24	1	41

Year.	Flaxseed, net exports.	Net imports.		Net exports.					
		Hides and skins.	Hops.	Meat.	Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco, unmanufactured.	Wool.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	105	7,587	269	2,298	26,626	144	12,047	1,728	849
1912	93	5,129	337	4,776	27,153	103	6,239	2,659	[5] 648
1913	104	3,456	235	2,603	21,196	[5] 64	[5] 1,757	1,996	1,277
1914	135	4,665	588	2,886	28,085	[5] 127	[5] 11,819	1,612	1,285
1915	[5] 77	3	162	3,068	36,393	......	[5] 3,447	3,851	[5] 80
1919	[5] 6	393	5	[5] 14,056	4,091	[5] 1	[5] 42,265	[5] 46	[5] 51

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net exports.
[5] Net imports.

TABLE 76.—*Crops of Russia.*

[Source: Recueil des Données Statistiques et Économiques; issued by the Ministère de l'Agriculture of Russia. These statistics begin with acreage in 1881 and production in 1883.]

Crop and year.	Russian Empire.			European Russia (except Poland and northern Caucasia).			Russian Poland.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
Barley:	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	30,910	14.1	436,569	23,013	13.9	320,959	1,241	22.5	27,935
1912	30,973	16.0	496,352	23,057	15.4	354,685	1,257	23.3	29,321
1913	33,697	17.8	600,232	24,558	17.8	437,634	1,283	23.3	29,859
1914	33,142	13.1	432,615						
Buckwheat:									
1911	5,398	9.6	50,901	4,778	9.6	45,855	251	11.0	2,764
1912	5,196	11.3	58,555	4,672	11.4	53,173	244	13.4	3,262
1913	5,474	10.0	54,535	4,938	9.9	48,945	251	13.4	3,365
1914	5,029	7.9	39,922						
Corn:									
1911	4,910	19.4	95,193	3,177	21.4	67,842			
1912	5,111	18.4	94,118	3,393	18.5	62,904			
1913	5,278	15.8	83,559	3,385	17.7	59,798			
1914	4,885	18.5	90,131						
Millet:									
1911	8,611	8.4	72,334	5,976	8.6	51,566	80	15.5	1,240
1912	8,396	13.6	114,392	6,050	13.8	83,566	77	19.1	1,471
1913	8,866	11.9	105,814	6,212	13.1	81,594	81	17.9	1,452
1914	8,690	9.2	79,868						
Oats:									
1911	48,338	18.1	876,013	38,398	18.0	690,753	2,894	27.1	78,465
1912	46,899	23.2	1,089,365	37,270	23.1	862,783	2,832	28.5	80,807
1913	48,737	25.7	1,250,590	38,049	26.0	990,957	2,891	29.2	84,412
1914	47,806	19.1	914,913						
Rice (rough):		*Lbs.*	*1,000 lbs.*		*Lbs.*	*1,000 lbs.*		*Lbs.*	*1 000 lbs*
1911	682	909.2	620,068						
1912	494	913.2	451,125						
1913	668	1,244.0	830,974						
1914	636	969.3	616,485						
Rye:		*Bush.*	*1,000 bush.*		*Bush.*	*1,000 bush.*		*Bush.*	*1,000 bush.*
1911	73,994	10.4	768,650	65,058	9.9	642,173	5,258	18.2	95,453
1912	74,121	14.2	1,050,837	65,043	14.0	908,410	5,228	18.2	95,014
1913	75,983	13.3	1,011,316	66,008	13.2	872,711	5,361	17.1	91,653
1914	71,926	12.1	869,657						
Spelt:									
1911	871	4.3	3,703	807	3.6	2,872	(1)	30.3	4
1912	568	12.5	7,117	504	12.0	6,045	3	32.0	96
1913	552	17.5	9,680	486	18.1	8,781	7	19.0	133
1914	565	12.3	6,972						
Wheat:									
1911	80,086	7.0	563,485	52,557	6.6	346,372	1,255	19.2	24,129
1912	78,109	10.3	801,497	49,581	9.5	472,389	1,248	19.7	24,626
1913	82,680	12.4	1,027,662	50,506	13.0	656,324	1,312	18.3	24,011
1914	83,862	9.9	833,639						
Cotton:		*Lbs.*	*1,000 bales.*[2]						
1911	1,630	293	998						
1912	1,588	298	990						
1913	1,787	287	1,073						
1914	1,807	350	1,324						
Flax fiber:					*Tons.*[3]	*1,000 tons.*[3]			
1911				[4] 2,771	.14	[4] 393			
1912				[4] 2,806	.21	[4] 586			
1913				[4] 2,969	.19	[4] 576			
1914				[4] 2,761	.16	[4] 434			
Flaxseed:		*Bush.*	*1,000 bush.*		*Bush.*	*1,000 bush.*			
1911	3,831	5.8	22,402	3,237	5.8	18,877	95	9.8	935
1912	3,832	6.4	24,486	3,237	6.4	20,574	81	9.8	793
1913	4,097	6.6	27,037	3,443	6.7	22,898	87	10.1	878
1914	[5] 4,006	4.7	[5] 18,957	3,401	4.2	14,222			

[1] Less than 500 acres.
[2] Bales of 478 pounds, net weight. (Equivalent to American bales of 500 pounds, gross weight.)
[3] Tons of 2,000 pounds.
[4] Twenty-seven governments, 25 of Russia Proper, 2 of Siberia.
[5] Not including Poland.

TABLE 76.—*Crops of Russia*—Continued.

Crop and year.	Russian Empire.			European Russia (except Poland and Northern Caucasia).			Russian Poland.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Tons.*[3]	*1,000 tons.*[3]	*1,000 acres.*	*Tons.*[3]	*1,000 tons.*[3]	*1,000 acres.*	*Tons.*[3]	*1,000 tons.*[3]
Hay:									
1911	95,755	.51	49,096	61,330	.53	32,658	2,280	.95	2,172
1912	97,272	.69	67,296	62,478	.69	43,141	2,237	1.0	2,231
1913	93,885	.62	58,614	60,127	.63	37,765	2,315	1.1	2,553
1914	93,531	.57	53,684	59,928	.55	32,680	851	1.	928
Hemp fiber:									
1911	1,715	.17	298	1,504	.18	264	16	.31	5
1912	1,676	.26	440	1,466	.27	393	15	.33	5
1913	1,655	.28	465	1,440	.29	417	15	.27	4
1914	[5] 1,600	.27	[5] 436	1,420	.27	387			
		Bush.	*1,000 bush.*		*Bush.*	*1,000 bush.*		*Bush.*	*1,000 bush.*
Hemp seed:									
1911	1,715	10.7	18,311	1,504	11.0	16,475	16	11.6	185
1912	1,676	12.4	20,784	1,466	12.9	18,943	15	12.1	182
1913	1,655	13.3	21,959	1,440	13.8	19,887	15	11.6	174
1914	[5] 1,600	11.8	[5] 18,828	1,420	11.8	16,741			
Lentils, beans, and haricots:									
1911	1,242	8.4	10,489	1,138	8.2	9,355	28	17.1	480
1912	1,196	11.2	13,431	1,088	11.0	12,011	33	18.5	611
1913	1,203	11.1	13,306	1,111	11.0	12,199	25	17.6	439
1914	1,239	7.4	9,155						
Peas:									
1911	2,557	10.3	26,439	2,093	9.7	20,303	370	14.5	5,367
1912	2,597	12.6	32,815	2,138	12.7	27,080	368	13.5	4,978
1913	2,728	12.4	33,698	2,265	11.9	26,930	367	15.7	5,776
1914	2,283	8.1	18,520						
Potatoes:									
1911	11,397	103.2	1,176,055	8,166	104.2	851,120	2,606	106.8	278,309
1912	11,646	119.8	1,395,620	8,321	111.3	925,775	2,656	154.8	411,281
1913	12,056	109.4	1,318,894	8,664	100.9	873,999	2,662	144.2	383,736
1914	9,546	102.2	975,828						
		Lbs.	*1,000 lbs.*		*Lbs.*	*1,000 lbs.*			
Sunflower seed:									
1911				[6] 1,961	647.8	[6] 1,270,298			
1912	2,109	759.7	1,602,127	[7] 1,349	678.0	[7] 914,613			
1913	2,234	682.6	1,524,835	[7] 1,434	704.1	[7] 1,009,634			
1914	2,414	744.0	1,796,041	[7] 1,368	729.1	[7] 997,406			
Tobacco:[8]									
1911	200	1,393	278,680						
1912	178	1,495	266,196						
1913	154	1,516	233,451						
1914	185	1,214	224,674						

[3] Tons of 2,000 pounds.
[5] Not including Poland.
[6] Twenty governments, including Northern Caucasia.
[7] Eleven governments.
[8] Does not include the entire Russian Empire.

TABLE 77.—*Number of live stock in Russia (European).*[1]

[Source: Ministry of Agriculture; Division of Rural Economy and Statistics, Petrograd.]

Date.	Cattle.[2]	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
In summer—							
1910	31,777,000	12,049,000	40,734,000	857,000	21,868,000	4,000	3,000
1911	31,484,000	12,654,000	40,157,000	854,000	21,820,000	5,000	3,000
1912	31,481,000	12,636,000	39,622,000	766,000	22,131,000	6,000	3,000
1913	32,579,000	13,458,000	41,426,000	873,000	22,771,000	6,000	7,000
1914	32,704,000	11,581,000	37,240,000		22,529,000		
1915[3]	32,886,000	12,301,000	41,553,000		22,375,000		
1916[4]	38,373,000	16,603,000	63,833,000		23,476,000		

[1] Fifty-one governments, (Poland excluded) prior to 1915.
[2] Including reindeer, which in 1910, numbered 462,000; in 1911, 461,000; in 1912, 464,000; in 1913, 605,000
[3] Fifty-three governments.
[4] Total for 48 governments.

TABLE 78.—*Number of live stock in Russia (Asiatic) (33 governments of the Caucasus, Central Asia, and Siberia).*

[Source: Same as European Russia.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.
In summer—					
1910 [1]	17,788,000	2,709,000	38,716,000	4,162,000	11,822,000
1911 [1]	17,628,000	2,421,000	39,774,000	4,179,000	11,913,000
1912 [1]	17,535,000	2,447,000	37,876,000	4,082,000	11,666,000
1913	18,404,000	2,895,000	38,696,000	4,791,000	11,959,000
1914	18,817,000	3,184,000	49,181,000	4,498,000	12,041,000
1915	[2] 14,772,000	2,962,000	34,468,000	....	11,346,000

[1] Thirty-one governments and provinces.
[2] Twenty-seven governments and provinces.

TABLE 79.—*Net imports or net exports of leading farm products, for the Russian Empire.*

[Source: Official reports on foreign trade.]

Year.	Net exports.			Rice. Net imports.	Net exports.				Net imports.	
	Barley.[1]	Corn.[2]	Oats.[2]		Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton, unmanufactured.[3]	Cottonseed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	196,800	52,420	94,949	252,419	40,766	142,874	166,896	4,936	935	1
1912	126,295	30,010	57,257	249,621	22,904	97,532	158,017	3,602	830	8
1913	179,365	22,238	38,701	263,059	25,401	125,625	168,621	3,828	908	12
1914	90,148	10,699	17,336	262,901	14,845	89,514	116,027	[4] 363	801	[5] 244
1915	372	(6)	[4] 235	300,863	13,331	8,505	116,744	[4] 2,743	636	[5] 323
1916 [7]	488	97	23	166,779	12,315	15,112	[4] 5,901	[4] 1,961	44	[5] 111

Year.	Net exports.			Meat. Net imports.	Net exports.				Wool. Net imports.
	Flaxseed.	Hides and skins.	Hops.		Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco, unmanufactured.	
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	6,279	[4] 21,701	1,179	88,683	1,452,291	10,843	987,952	21,910	73,454
1912	6,496	41,979	669	80,672	1,552,042	8,903	829,652	22,637	57,417
1913	4,202	[4] 15,729	2,708	63,811	1,620,106	2,612	324,318	27,457	83,491
1914	3,593	[4] 19,389	18	65,232	948,526	515	280,900	9,002	81,282
1915	388	1,051	484	22,630	176,460	32	206,248	6,146	39,952
1916 [7]	829	9,657	542	[5] 1,488	160,630	43	113,575	15,601	12,206

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.
[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight, equivalent to 500 pounds, gross weight.
[4] Net imports.
[5] Net exports.
[6] Less than 500 bushels.
[7] Includes only trade over the European frontier.

TABLE 80.—*Crops of Spain.*

[Sources: Boletín de Agricultura Técnica y Económica; issued by the Organo Oficial de la Dirección General de Agricultura, Minas y Montes, of Spain. Estadistica de la Producción de Cereales y Leguminosas; issued by the Junta Consultiva Agronómica of Spain. Estadística de las Producciones Vitícola y Olivarera; issued by the Junta Consultiva Agronómica of Spain. Memoria sobre el Estado de la Renta de Aduanas; issued by the Dirección General de Aduanas of Spain. These statistics begin as early as 1891.]

Year.	Barley.			Corn.			Kafir corn.			Maslin.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*Acres.*	*Bush.*	*Bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	3,567	24.3	86,792	1,145	25.1	28,730	3,459	11.3	39,010	121	11.0	1,329
1912	3,298	18.2	59,994	1,149	21.8	25,069	3,541	8.3	29,301	116	7.5	873
1913	3,869	17.8	68,772	1,105	22.8	25,140	3,504	5.9	20,645	91	9.9	902
1914	3,404	21.2	72,272	1,137	26.7	30,325	3,548	6.8	24,282	108	9.0	975
1915	3,786	21.9	82,763	1,152	25.3	29,096	3,830	9.0	34,364	103	9.9	1,011
1916	3,886	22.4	86,863	1,154	24.8	28,642	3,934	12.3	48,241	103	10.2	1,051
1917	......	......	77,957	......	......	29,369	......	......	......	......	......	......
1918	4,209	20.7	90,496	1,169	20.7	24,141	3,820	11.3	43,238	108	11.4	1,231
1919	4,254	19.2	81,808	1,179	21.7	25,555	3,657	7.9	28,939	109	10.3	1,123
1920	4,319	20.9	90,462	1,168	23.7	27,692	3,534	8.5	30,006	106	10.4	1,106

Year.	Millet.			Oats.			Rice (rough).			Rye.		
	Acres.	*Bush.*	*Bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*Acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	976	12.7	12,377	1,268	26.7	33,858	94,511	1,499	141,626	1,987	14.5	28,897
1912	3,672	13.2	48,521	1,279	18.0	23,035	95,129	5,660	538,420	1,944	9.7	18,867
1913	4,875	14.4	70,362	1,351	18.8	25,333	95,924	5,122	491,362	1,918	14.6	27,916
1914	5,723	24.4	139,661	1,304	24.0	31,227	96,863	5,634	545,820	1,887	12.7	23,950
1915	5,584	18.7	104,317	1,403	26.3	36,949	99,300	5,221	518,436	1,820	14.3	26,102
1916	5,745	18.1	103,762	1,398	23.0	32,163	100,392	5,308	532,868	1,846	15.6	28,782
1917	......	......	......	......	......	33,061	......	......	......	......	......	24,203
1918	5,374	15.5	83,531	1,507	20.2	30,474	110,511	4,142	457,782	1,818	16.7	30,445
1919	5,300	14.6	77,468	1,595	20.6	32,915	112,085	5,954	667,318	1,808	12.9	23,296
1920	4,883	16.8	82,275	1,588	23.8	37,772	119,831	5,323	637,878	1,799	15.5	27,830

Year.	Spelt.			Wheat.			Canary seed.			Dry beans.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*Acres.*	*Bush.*	*Bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	59	17.5	1,028	9,706	15.3	148,495	9,059	10.3	93,280	458	16.2	7,398
1912	59	12.6	737	9,625	11.4	109,783	8,920	8.3	73,887	462	12.2	5,630
1913	63	18.0	1,130	9,644	11.7	112,401	9,182	7.7	71,006	464	13.3	6,151
1914	65	17.5	1,172	9,681	12.0	116,089	9,170	9.2	83,929	454	11.9	5,400
1915	66	18.3	1,202	10,037	13.9	139,298	9,348	9.2	86,395	484	13.3	6,444
1916	64	18.6	1,201	10,148	15.0	152,329	9,108	13.1	118,923	496	15.3	7,572
1917	......	......	......	......	......	142,674	......	......	......	......	......	......
1918	70	16.1	1,133	10,228	13.3	135,709	8,055	12.6	101,309	493	15.0	7,371
1919	72	17.1	1,230	10,378	12.6	129,250	8,315	13.4	111,578	485	13.5	6,535
1920	68	15.8	1,078	10,254	13.5	138,605	7,890	14.1	111,523	483	14.0	6,743

Year.	Dry peas and lentils.			Peanuts.			Haricot beans.			Sugar beets.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1911	127	9.3	1,180	19	0.8	15	656	8.6	5,637	91	......	......
1912	118	8.6	1,019	18	1.2	22	657	7.5	4,904	106	11.2	1,189
1913	128	7.1	906	19	1.1	20	675	8.3	5,585	147	7.5	1,093
1914	132	9.7	1,286	19	1.2	22	695	10.3	7,127	79	10.3	814
1915	142	9.4	1,340	12	1.0	13	717	9.5	6,782	......	......	......
1916	165	9.6	1,587	11	1.1	13	729	9.9	7,183	134	6.2	830
1917	......	......	......	......	......	......	......	......	......	146	5.3	769
1918	217	8.7	1,895	20	1.2	24	785	8.5	6,654	163	4.5	742
1919	215	10.0	2,152	20	1.0	20	781	8.0	6,278	......	......	......
1920	233	10.7	2,481	19	1.1	22	760	9.1	6,918	......	......	......

TABLE 80.—*Crops of Spain*—Continued.

Year.	Tares (algarrobes and yeros).		Vetches (alverjons and almortas).		Grapes.		Olives.		Potatoes.	
	Area.	Production.	Area.	Production.	Area.	Production.	Area.	Production.	Area.	Production.
	1,000 acres.	*1,000 tons.*	*1,000 acres.*	*1,000 tons.*	*1,000 acres.*	*1,000 tons.*	*1,000 acres.*	*1,000 tons.*	*1,000 acres.*	*1,000 bush.*
1911	489	155	123	40	3,188	3,303	3,567	2,447		
1912	498	140	120	31	3,113	3,126	3,577	392	632	93,089
1913	512	123	127	34	3,089	3,254	3,590	1,639		
1914	519	142	128	37	3,067	3,086	3,619	1,302	688	76,657
1915	557	139	132	40	3,080	1,841	3,662	1,954		
1916	563	160	135	41	3,173	4,363	3,675	1,264		
1917						4,486		2,434		
1918	609	151	140	43	3,255	4,209	3,853	1,547		
1919	631	174	136	45		3,722				
1920	651	216	134	43						

TABLE 81.—*Number of live stock in Spain.*

[Source: Ministerio de Instruccion Publica y Bellas Artes, Madrid.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
Dec. 31:							
1910	2,369,000	2,424,000	15,117,000	3,216,000	520,000	886,000	868,000
1911	2,541,000	2,472,000	15,726,000	3,370,000	546,000	905,000	837,000
1912	2,562,000	2,571,000	15,830,000	3,116,000	526,000	929,000	829,000
1913 [1]	2,879,000	2,710,000	16,441,000	3,394,000	542,000	948,000	849,000
1914	2,743,000	2,810,000	16,128,000	3,265,000	525,000	984,000	841,000
1915 [1]	2,926,000	2,883,000	15,995,000	3,217,000	512,000	951,000	826,000
1916	3,071,000	2,814,000	16,012,000	3,207,000	489,000	913,000	839,000
1917	3,233,000	3,929,000	17,227,000	4,182,000	558,000	1,043,000	924,000
1918 [1 2]	3,174,000	4,107,000	17,735,000	3,686,000	577,000	1,049,000	916,000

[1] Census.
[2] Preliminary.

TABLE 82.—*Net imports or net exports of leading farm products for Spain.*

[Source: Estadistica General del Comercio Exterior de España.]

Year.	Barley,[1] net exports.	Corn,[2] net imports.	Net exports.		Net imports.			
			Rice.	Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton, unmanufactured.
	1,000 bush.	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*[3]
1911	234	5,654	[4] 921	6	4,890	575	4,874	416
1912	174	6,760	599	141	1,471	733	5,118	427
1913	11	22,308	40,741	12	6,287	817	5,690	406
1914	212	7,927	33,745	5	15,252	846	5,095	385
1915	1,863	8,066	109,038	1	13,364	800	3,109	645
1916	2,091	4,158	70,609	1	11,022	427	1,297	467
1917	490	2,008	75,176	74	725	181	239	446
1918	661	315	66,944	63	5,957	[5] 252	97	277
1919	1,118	2,026	21,773	2	12,426	[5] 392	[5] 149	340

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net imports.
[5] Net exports.

TABLE 82.—*Net imports or net exports of leading farm products, for Spain*—Continued.

Year.	Net imports.		Net exports.		Net imports.		Wool, net exports.
	Hides and skins.	Meat.	Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco.	
	1,000 lbs.	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	3,524	34,024	2,559	1,286	[5] 506	48,931	21,842
1912	2,979	33,138	3,113	1,718	53	60,583	21,518
1913	640	37,161	1,673	2,502	59	60,279	29,408
1914	[5] 318	32,005	921	1,743	[5] 25,259	35,677	26,111
1915	20,005	28,374	1,145	2,101	[5] 19,209	40,789	[4] 1,090
1916	10,617	28,095	584	1,957	34,832	33,492	[4] 2,967
1917	14,490	22,536	3,953	1,185	76,256	41,342	12,517
1918	20,349	9,692	10,347	634	24,938	49,807	[4] 15,964
1919	20,271	....	11,297	275	55,997	70,422	12,356

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[5] Net exports.
[4] Net imports.

TABLE 83.—*Crops of Sweden.*

[Source: Jordbruk och Boskapsskötsel; issued by Kungl. Statistiska Centralbyrån, at Stockholm, Sweden. These statistics begin as early as 1865 for production, and as early as 1890 for area.]

Year.	Barley.			Maslin.			Oats.			Rye.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	......	......	14,923	......	......	11,631	......	......	75,637	......	......	24,283
1912	......	......	14,156	......	......	12,165	......	......	87,766	......	......	23,075
1913	450	37.7	16,933	438	32.6	13,845	1,977	49.63	96,550	917	24.7	23,009
1914	421	29.0	12,172	450	18.8	8,235	1,947	28.72	55,498	968	27.8	26,776
1915	420	32.9	13,780	470	28.6	13,424	1,984	43.49	86,299	958	24.2	23,652
1916	412	33.3	13,699	492	28.9	14,035	1,936	44.61	85,320	912	25.6	21,334
1917	436	26.0	11,369	620	19.1	11,852	1,932	31.8	61,400	818	17.3	13,904
1918	457	25.3	11,552	655	21.8	14,267	1,812	30.9	56,084	948	21.2	19,292
1919 [1]	412	31.2	12,891	644	28.0	18,083	1,760	43.5	76,591	919	25.1	23,073

Year.	Wheat.			Beans.			Clover seed and grass seed.	Hay (cultivated).		
	1,000 acres.	*Bush.*	*1,000 bush.*	*Acres.*	*Bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1911	......	......	8,106	......	......	165	......	......	......	3,858
1912	......	......	7,797	......	......	176	......	......	......	4,978
1913	290	32.8	9,502	6,405	31.8	204	23,927	3,002	1.75	5,247
1914	288	30.9	8,906	6,133	10.9	67	20,587	3,056	1.41	4,313
1915	315	30.7	9,660	5,876	21.3	125	11,229	3,032	1.32	3,994
1916	318	28.4	9,038	5,599	29.9	167	21,273	3,181	1,68	5,356
1917	329	21.1	6,929	4,591	16.7	77	22,071	2,980	.96	2,950
1918	379	23.5	8,888	5,869	18.9	111	21,114	3,077	.85	2,524
1919 [1]	348	27.3	9,509	5,997	25.3	151	....	2,905	1.30	3,860

[1] Preliminary.

TABLE 83.—*Crops of Sweden*—Continued.

Year.	Peas.			Potatoes.			Root crops (fodder).			Sugar beets.		
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*
1911	....	....	1,358	....	....	46,369	....	....	2,443	....	....	1,064
1912	....	....	1,069	....	....	56,202	....	....	2,875	....	....	933
1913	56	22.9	1,262	377	192	72,350	189	19.0	3,587	71	13.34	946
1914	56	12.9	704	375	167	62,596	178	15.7	2,801	80	13.30	1,066
1915	55	19.8	1,085	376	191	71,756	191	16.4	3,119	79	11.68	925
1916	55	22.2	1,189	367	150	55,018	180	15.1	2,721	92	11,18	1,033
1917	60	13.7	819	389	191	74,252	207	15.4	3,183	78	11.9	986
1918	89	21.0	1,854	405	166	67,344	221	14.1	3,110	75	12.0	895
1919[1]	96	22.3	2,127	417	186	77,573	225	14.3	3,224	90	11.4	1,031

[1] Preliminary.

TABLE 84.—*Number of live stock in Sweden.*

[Source: Kungl. Statistiska Centralbyran, Stockholm, Sweden.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.
Dec. 31:					
1910	2,748,000	957,000	1,004,000	69,000	587,000
1913	2,721,000	968,000	988,000	71,000	596,000
1914	2,761,000	1,015,000	993,000	77,000	603,000
June 1:					
1915	2,884,000	891,000	1,146,000	102,000	672,000
1916	2,913,000	1,065,000	1,198,000	132,000	701,000
1917	3,020,000	1,030,000	1,344,000	136,000	715,000
1918	2,584,000	634,000	1,409,000	133,000	715,000
1919	2,551,000	717,000	1,564,000	133,000	716,000

TABLE 85.—*Net imports or net exports of leading farm products, for Sweden.*

[Source: Sveriges Officiella Statistik: Handel.]

Year.	Barley,[1] net exports.	Net imports.					Butter, net exports.	Net imports.		
		Corn.[2]	Oats.[2]	Rice.	Rye.[2]	Wheat.		Cheese.	Cotton, unmanufactured.[3]	Cotton-seed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	147	460	5,096	23,482	2,079	6,658	48,546	737	91	680
1912	119	3,847	6,342	19,673	4,686	6,589	46,545	1,267	99	865
1913	9	2,382	[4] 299	12,134	4,422	7,771	42,898	1,208	98	699
1914	11	2,184	2,611	24,787	2,580	5,321	41,752	696	83	930
1915	[5] 516	8,292	2,086	31,153	1,985	9,932	41,502	520	201	1,602
1916	25	2,022	[4] 466	31,853	1,167	9,859	28,642	285	130	1,503
1917	[5] 351	1,212	1	48	457	3,673	[5] 15,753	1,208	32	[4] 4
1918	[5] 133	1,374	364	7,313	[4] 16	2,356	[5] 11,422	424	33	2
1919	[5] 787	3,199	1,536	22,287	[4] 65	4,016	[5] 13,770	3,559	80	....

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net exports.
[5] Net imports.

TABLE 85.—*Net imports or net exports of leading farm products, for Sweden*—Continued.

Year.	Net imports.			Meat, net exports.	Net imports.				
	Flaxseed.	Hides and skins.	Hops.		Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco.	Wool.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	791	[4] 5,258	841	16,401	357,138	507	3,752	10,053	5,663
1912	805	1,189	1,205	25,430	383,155	694	3,047	9,913	6,569
1913	1,115	3,391	1,018	4,474	346,540	709	4,750	10,319	5,859
1914	951	[4] 5,998	1,426	30,216	283,501	437	5,225	9,369	4,603
1915	1,142	12,531	1,283	43,294	333,316	9	[4] 32,686	7,547	8,725
1916	1,011	240	1,200	22,773	157,241	[4] 17	549	10,021	14,060
1917	9	2,146	1,228	6,465	73,414	112	15,667	10,514	2,951
1918	67	5,351	4,147	[5] 18,378	14,160	1,256	23,588	7,484	754
1919	695	23,393	835	[5] 87,134	151,308	732	20,805	12,892	17,816

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[4] Net exports.
[5] Net imports.

TABLE 86.—*Crops of Switzerland.*

[Sources: Annuaire International de Statistique Agricole, issued by the Institute International d'Agriculture, Rome, Italy. Le Paysan Suisse (Organe officiel de l'Union Suisse des Paysans). These statistics are available as early as 1908.]

Year.	Barley.			Corn.			Oats.			Rye.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*Acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1911	13	34.9	454	3,286	36.8	121	81	59.9	4,850	60	30.5	1,828
1912	12	35.6	427	3,286	32.3	106	82	49.0	4,017	61	28.0	1,705
1913	13	35.0	455	3,212	36.7	118	81	64.0	5,188	60	29.5	1,772
1914	15	35.2	528	2,718	39.0	106	83	62.4	5,181	61	28.3	1,724
1915	16	38.8	620	3,212	43.0	138	92	61.0	5,608	66	31.2	2,059
1916	18	34.4	620	3,707	41.0	152	103	65.5	6,745	71	28.2	2,000
1917	19	37.5	712	4,873	51.7	252	70	65.7	4,602	55	31.9	1,752
1918	22	30.3	666	7,000	51.1	358	86	60.3	5,188	49	37.8	1,850
1919	18	34.7	625	6,000	47.8	287	57	59.3	2,811	54	32.4	1,748
1920	18	34.4	620	6,000	46.7	280	56	55.6	3,114	50	32.2	1,622

Year.	Wheat.			Potatoes.			Wine.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Gals.*	*1,000 gals.*
1911	102	34.5	3,524	115	207.7	23,883	58	341.2	19,787
1912	102	31.2	3,178	115	210.9	24,251	57	305.4	17,406
1913	102	34.8	3,546	115	231.6	26,639	55	87.0	4,787
1914	103	31.8	3,278	115	166.1	19,107	53	183.5	9,724
1915	114	34.7	3,957	121	253.6	30,681	51	345.2	17,603
1916	124	30.8	3,821	135	136.1	18,372	52	218.4	11,359
1917	139	32.8	4,556	140	259.8	36,376	51	....	....
1918	203	38.9	7,905	168	258.1	43,355	49	314.3	15,401
1919	130	27.1	3,524	136	205.3	27,925	46	289.9	13,334
1920	119	30.1	3,586	123	229.7	28,256	46	269.8	12,410

TABLE 87.—*Number of live stock in Switzerland.*

[Source: Le Bureau de Statistique du Departement Suisse des Finances, Berne.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
April—							
1911 [1]	1,433,000	570,000	161,000	341,000	144,000	3,000	2,000
1916 [1]	1,616,000	545,000	173,000	359,000	137,000	3,000	1,000
1918	1,530,000	364,000	225,000	355,000	129,000	3,000	1,000
1919	1,005,000	304,000	209,000	284,000	70,000	3,000	1,000
1920 [2]	960,000	372,000	186,000	273,000	73,000	3,000	1,000

[1] Census.
[2] Excludes cantons of Berne and Waadt

TABLE 88.—*Net imports or net exports of leading farm products for Switzerland.*

[Source: Statistique du Commerce de la Suisse avec l'Etranger.]

Year.	Net imports.							Cheese, net exports.	Cotton, unmanufactured,[3] net imports.
	Barley.[1]	Corn.[2]	Oats.[2]	Rice.	Rye.[2]	Wheat.[2]	Butter.		
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*
1911	4,537	4,058	12,906	25,601	774	18,290	12,058	58,949	113
1912	4,589	4,341	13,088	19,709	750	19,883	11,878	58,440	121
1913	4,492	4,785	12,728	27,306	661	21,206	11,099	70,976	126
1914	3,556	3,068	10,226	35,425	266	17,187	8,766	72,855	101
1915	2,641	4,461	6,835	44,056	15	17,915	5,626	71,365	147
1916	2,268	4,767	7,290	47,294	38	22,156	944	46,788	123
1917	1,479	3,241	3,356	75,864	196	9,948	369	12,648	94
1918	613	652	2,140	84,970	452	7,406	54	2,594	38
1919	1,369	5,274	6,331	27,967	1,632	12,937	13,250	373	115

Year.	Hides and skins, net exports.	Net imports.						
		Hops.	Meat.	Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco.	Wool.
	1,000 lbs.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	15,077	1,256	59,534	87,204	2,895	230,862	18,085	11,350
1912	16,596	1,746	64,837	73,050	3,088	268,289	19,376	11,037
1913	17,319	1,125	46,644	52,716	3,408	258,513	18,449	10,261
1914	20,824	1,420	27,181	37.895	4,860	294,076	22,283	9,059
1915	12,238	964	20,083	38,179	1,116	235,549	17,527	16,992
1916	5,267	779	16,615	58,443	2,856	243,074	21,792	28,968
1917	771	469	12,783	62,476	1,257	235,537	17,551	19,332
1918	[4] 793	300	24,313	24,807	138	160,649	13,866	7,950
1919	2,805	166	40,192	91,791	[5] 681	231,321	27,569	10,098

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net imports.
[5] Net exports.

TABLE 89.—*Crops of the Union of South Africa.*

[Source: Quarterly Abstract of Union Statistics, Union of South Africa. The annual statistics for the Union begin with 1918. Separate reports for the constituent States begin at various earlier dates.]

Year.	Barley.	Corn.	Kafir corn.	Oats.	Wheat.	Potatoes.	Cotton.	Tobacco.	Tea.[1]
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1904	1,011	12,899	3,360	4,085	2,362	....	....	....	....
1911	1,274	30,830	5,528	9,661	6,034	4,182	....	14,961	1,740
1918	2,054	45,143	6,434	10,775	10,150	3,909	797	14,931	1,603
1919[2]	1,029	30,966	1,908	6,389	7,979	3,429	1,419	14,183	1,410

[1] "Manufactured tea."
[2] Excluding "native locations, reserves," etc. In 1918 these "Locations," etc., produced 359,000 bushels of wheat; 30,000 bushels of barley; 300,000 bushels of oats; 4,940,000 bushels of kafir corn, 10,455,000 bushels of corn (maize); 239,000 bushels of potatoes; and 2,420,000 pounds of tobacco.

TABLE 90.—*Number of live stock in the Union of South Africa.*

[Source: Office of Census and Statistics, Pretoria, South Africa.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
1910[1]	....	....	22,198,000	....	....	....	....
May 7, 1911[2]	5,797,000	1,082,000	30,657,000	11,763,000	719,000	94,000	337,000
Dec. 31, 1912	....	....	35,889,000	11,691,000	....	....	....
Dec. 31, 1913	....	....	35,711,000	11,521,000	....	....	....
Dec. 31, 1915	....	....	31,434,000	8,918,000	....	....	....
Dec. 31, 1916	....	....	31,981,000	8,962,000	....	....	....
May 5, 1918[2]	6,852,000	1,043,000	29,914,000	8,019,000	781,000	85,000	554,000
1919[3]	5,575,000	724,000	28,492,000	5,842,000	695,000	81,000	499,000

[1] Cape of Good Hope and Transvaal only.
[2] Census.
[3] Excluding native locations, reserves, etc.

TABLE 91.—*Net imports or net exports of leading farm products, for British South Africa.*

[Source: Trade and Shipping of the Union of South Africa and of Southern and Northern Rhodesia.]

Year.	Barley,[1] net imports.	Corn,[2] net exports.	Net imports.		Rye,[2] net exports.	Net imports.			Cotton, unmanufactured.[3] Net exports.	Cottonseed oil, net imports.
			Oats.[2]	Rice.		Wheat.[2]	Butter.	Cheese.		
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*	*1,000 gals.*
1911	369	3,926	200	82,160	[4] 1	5,618	3,885	5,001	(5)	485
1912	359	3,644	[6] 101	84,225	[4] 1	2,377	4,372	5,174	(5)	414
1913	317	26	241	89,890	[4] 2	8,328	3,629	5,648	1	552
1914	263	4,873	[6] 12	76,813	1	6,630	3,856	5,042	1	426
1915	167	6,590	79	82,287	3	5,120	1,730	3,948	1	482
1916	248	6,616	33	79,285	19	5,689	[6] 1,344	2,078	(5)	380
1917	77	11,088	[6] 930	83,022	39	3,746	[6] 3,215	425	(5)	219
1918	14	13,452	[6] 304	78,109	25	1,653	1,022	[6] 235	(5)	5
1919	[6] 14	13,398	[6] 1,338	42,359	12	1,975	[6] 180	[6] 1,535	1	35
1920	343	4,512	370	49,646	(7)	8,612	30	892	2	39

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net imports.
[5] Less than 500 bales.
[6] Net exports.
[7] Less than 500 bushels.

TABLE 91.—*Net imports or net exports of leading farm products, for British South Africa*—Continued.

Year.	Hides and skins, net exports.	Hops, net imports.	Meat.		Oil cake and oil-cake meal. Net exports.	Potatoes.		Sugar, net imports.	Net exports.	
			Net imports.	Net exports.		Net exports.	Net imports.		Tobacco.	Wool.
	1,000 lbs.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	44,979	13	35,531	....	....	....	17	74,760	[4] 512	153,292
1912	57,879	502	28,363	....	4,708	....	176	39,174	[4] 372	185,473
1913	62,828	484	31,930	....	6,194	....	247	59,855	282	194,357
1914	53,347	443	20,913	....	2,114	....	22	49,677	1,538	152,866
1915	61,290	453	10,414	....	(8)	34	....	14,805	1,145	186,343
1916	57,998	446	....	5,459	15	84	....	3,950	1,184	143,611
1917	47,140	442	....	42,709	....	166	....	24,093	692	121,240
1918	43,326	570	....	11,968	25	139	....	39,558	1,266	135,199
1919	71,301	552	....	40,047	65	62	....	[6] 28,667	1,865	201,150
1920	50,519	476	3,632	....	526	....	5	[6] 28,530	3,422	191,066

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[4] Net imports.
[8] Less than 500 pounds.
[6] Net exports.

TABLE 92.—*Crops of the United Kingdom.*

[Source: Agricultural Statistics; issued by Ministry of Agriculture and Fisheries of Great Britain. These statistics begin with acreage in 1866 and production in 1884.]

Year.	Barley.			Oats.			Rye (Ireland only).			Wheat.		
	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.	Area.	Yield per acre.	Production.
	1,000 acres.	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*[2]	*1,000 bush.*[2]	*1,000 acres.*	*Bush.*[1]	*1,000 bush.*[1]
1911	1,756	34.0	59,625	4,051	41.5	168,068	9	29.0	261	1,951	34.0	66,340
1912	1,814	33.1	60,042	4,075	41.7	169,994	8	30.6	238	1,970	30.0	59,211
1913	1,930	35.1	67,701	3,961	43.0	170,491	7	30.0	202	1,790	32.7	58,483
1914	1,871	35.6	66,559	3,888	44.0	170,518	8	29.4	222	1,905	33.8	64,400
1915	1,523	31.8	48,376	4,159	44.3	184,092	7	29.2	218	2,333	32.7	76,244
1916	1,652	33.0	54,568	4,147	42.5	176,049	7	29.0	....	2,052	30.1	61,659
1917	1,796	33.0	59,290	4,764	45.1	214,728	8	29.2	....	2,103	31.5	66,350
1918	1,838	34.8	64,036	5,603	45.9	257,433	9	27.0	....	2,793	34.4	96,079
1919	1,870	31.8	59,523	5,117	41.1	210,388	....	27.4	....	2,370	30.2	71,505
1920	2,050	32.2	65,999	4,635	41.6	192,724	....	24.4	....	1,981	28.7	56,898

Year.	Beans (dry).			Flax fiber (Ireland only).			Hay (from permanent grass).			Hops (England only).		
	1,000 acres.	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Lbs.*	*1,000 tons.*	*1,000 acres.*	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911	306	26.1	7,986	67	378.0	13	6,575	1.3	8,367	33	1,111	36,739
1912	281	28.6	8,029	55	526.4	15	6,679	1.6	10,796	35	1,201	41,825
1913	266	29.5	7,842	59	477.4	14	6,799	1.7	11,384	36	803	28,632
1914	292	31.7	9,243	49	369.6	9	6,490	1.4	9,176	37	1,550	56,813
1915	264	28.9	7,626	53	407.4	11	6,393	1.4	8,873	35	821	28,516
1916	235	31.3	7,366	91	355.6	16	6,521	1.7	10,876	31	1,100	34,480
1917	211	18.6	3,912	108	319.2	17	6,494	1.5	9,441	17	1,458	27,721
1918	252	30.6	7,685	143	245.0	18	5,950	1.5	8,892	16	930	14,560
1919	294	....	....	96	322.0	15	....	....	....	17	1,266	21,168
1920	....	....	....	127	....	....	....	....	....	21	1,488	31,250

[1] "Winchester" bushels, the legal bushel of capacity of the United States.
[2] Bushel of 56 pounds.

TABLE 92.—*Crops of the United Kingdom*—Continued.

Year.	Mangolds.			Peas (dry).			Potatoes.			Turnips and swedes.		
	1,000 acres.	*Tons.*	*1,000 tons.*	*1,000 acres.*	*Bush.*[1]	*1,000 bush.*[1]	*1,000 acres.*	*Bush.*[3]	*1,000 bush.*[3]	*1,000 acres.*	*Tons.*	*1,000 tons.*
1911	530	19.5	10,321	140	27.2	3,822	1,163	241.5	280,753	1,834	13.2	24,271
1912	570	19.9	11,354	174	23.3	4,048	1,208	177.0	213,783	1,784	15.1	26,949
1913	500	20.8	10,389	128	27.2	3,493	1,173	241.9	283,913	1,758	16.1	28,351
1914	515	20.7	10,666	130	23.8	3,087	1,197	233.3	279,121	1,750	15.5	26,987
1915	498	21.8	10,860	99	25.1	2,478	1,202	234.1	281,502	1,615	17.0	27,363
1916	460	22.0	10,091	86	25.2	2,155	1,144	178.5	204,172	1,610	16.2	26,116
1917	483	24.1	11,613	103	22.2	2,295	1,365	235.2	321,209	1,677	16.6	27,823
1918	500	23.1	11,560	128	28.3	3,636	1,505	227.7	344,325	1,601	16.0	25,575
1919	472	18.5	8,701	135	......	......	1,219	194.1	235,648	1,681	15.2	25,527
1920	......	......	......	......	......	......	1,291	183.9	237,437	......	......	......

[1] "Winchester" bushels, the legal bushel of capacity of the United States.
[3] Bushel of 60 pounds.

TABLE 93.—*Number of live stock in United Kingdom.*

[Source: Ministry of Agriculture and Fisheries, London.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
June—							
1910	11,765,000	3,561,000	31,165,000	......	2,095,000	......	......
1911	11,866,000	4,250,000	30,480,000	......	2,033,000	......	......
1912	11,915,000	3,993,000	28,967,000	......	1,995,000	......	......
1913	11,937,000	3,306,000	27,629,000	......	1,874,000	......	......
1914	12,185,000	3,953,000	27,964,000	242,000	1,851,000	31,000	245,000
1915	12,171,000	3,795,000	28,276,000	243,000	1,712,000	29,000	227,000
1916	12,451,000	3,616,000	28,850,000	293,000	1,834,000	28,000	230,000
1917	12,382,000	3,008,000	27,867,000	269,000	1,880,000	25,000	228,000
1918	12,311,000	2,809,000	27,063,000	277,000	1,916,000	26,000	232,000
1919	12,491,000	2,925,000	25,119,000	......	1,915,000	......	......
1920	11,770,000	3,113,000	23,407,000	......	1,885,000	......	......

TABLE 94.—*Net imports or net exports of leading farm products, for the United Kingdom.*

[Source: Trade and Navigation of the United Kingdom.]

Year.	Net imports.									
	Barley.[1]	Corn.[2]	Oats.[2]	Rice.	Rye.[2]	Wheat.[2]	Butter.	Cheese.	Cotton, unmanufactured.	Cotton-seed oil.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bales.*[3]	*1,000 gals.*
1911	55,699	77,359	61,940	589,830	2,338	203,307	465,384	256,185	4,008	579
1912	45,003	87,996	64,293	751,415	1,962	229,160	433,977	249,866	5,193	1,488
1913	51,683	97,579	62,815	758,209	2,272	226,978	450,516	248,976	4,010	[4] 2,636
1914	35,645	75,379	51,583	671,856	2,064	212,894	434,797	265,786	3,447	[4] 2,020
1915	24,276	92,199	58,448	1,157,934	1,392	186,855	425,177	299,095	4,820	510
1916	35,365	68,748	47,715	931,101	2,054	209,124	239,290	286,129	4,045	2,165
1917	20,984	53,799	57,867	807,580	5,353	205,564	201,341	327,769	3,163	1,915
1918	11,660	32,272	55,488	847,214	5,292	174,979	176,494	263,061	3,114	5,712
1919	38,501	38,987	32,041	80,545	......	178,033	174,078	236,976	3,846	7,105
1920	29,441	71,114	25,488	146,540	......	210,771	189,020	306,048	3,458	[4] 2,220

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Bales of 478 pounds, net weight; equivalent to 500 pounds, gross weight.
[4] Net exports.

TABLE 94.—*Net imports or net exports of leading farm products, for the United Kingdom*—Continued.

Year.	Net imports.								
	Flax-seed.	Hides and skins.	Hops.	Meat.	Oil cake and oil-cake meal.	Pota-toes.	Sugar.	Tobacco.	Wool.
	1,000 bush.	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1000 lbs.*
1911	10,354	55,297	11,443	2,691,088	708,442	1,636	3,654,849	109,882	536,857
1912	10,597	73,762	25,038	2,653,240	794,109	[4] 2,763	3,626,658	128,741	506,607
1913	24,321	72,550	26,299	2,834,810	851,865	16,533	3,819,817	152,318	553,539
1914	18,213	95,343	8,245	2,826,276	657,969	4,291	3,634,837	145,289	459,344
1915	17,011	161,088	21,399	3,198,042	910,851	2,780	3,563,490	182,700	856,983
1916	20,055	99,345	15,163	3,053,089	632,269	1,985	2,974,738	143,889	621,237
1917	7,454	174,602	[4] 498	2,541,590	476,659	2,646	2,410,940	38,049	629,200
1918	9,729	186,688	[4] 775	3,286,967	24,076	[4] 636	2,014,951	166,915	442,340
1919	20,536	142,126	16,971	3,020,178	611,912	1,846	3,430,963	349,322	968,948
1920	15,575	[4] 223,342	50,638	2,802,969	459,574	9,726	2,472,269	222,841	699,217

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[4] Net exports.

TABLE 95.—*Crops of Uruguay.*

[Sources: Anuario de Estadística Agrícola; issued by Ministerio de Industrias, Oficina de Estadística Agrícola, at Montevideo, Uruguay. These statistics begin as early as 1898-99.]

Crop year.	Barley.			Corn.			Oats.		
	Area.	Yield per acre.	Produc-tion.	Area.	Yield per acre.	Produc-tion.	Area.	Yield per acre.	Produc-tion.
	Acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*
1910-11	2,340	11	25	498	7.30	3,639	29	20.38	590
1911-12	6,234	13	84	591	13.48	7,963	86	21.30	1,825
1912-13	3,432	11	38	629	8.48	5,343	50	17.37	872
1913-14	14,049	12	165	692	10.31	7,142	97	18.96	1,850
1914-15	5,221	8	40	787	14.47	11,382	82	11.40	933
1915-16	9,696	12	115	697	6.61	4,604	105	21.72	2,283
1916-17	12,734	9	110	627	10.87	6,815	142	13.61	1,926
1917-18	5,824	18	108	590	12.76	7,526	165	22.36	3,697
1918-19	5,137	14	72	496	5.62	2,784	85	15.20	1,288

Crop year.	Rye.			Wheat.			Canary seed.		
	Acres.	*Bush.*	*Bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*Acres.*	*Bush.*	*Bush.*
1910-11	143	6	846	637	9.38	5,972	294	8.19	2,410
1911-12	164	13	2,173	799	10.96	8,757	469	11.52	5,411
1912-13	54	13	724	816	6.69	5,461	2,298	6.30	14,510
1913-14	453	10	4,641	911	6.45	5,887	5,959	7.91	47,174
1914-15	188	....	....	783	4.59	3,596	3,986	5.19	20,683
1915-16	75	10	720	950	10.39	9,867	5,859	8.37	49,052
1916-17	143	8	1,134	780	6.91	5,390	5,290	4.05	21,443
1917-18	96	10	1,000	976	13.38	13,060	2,976	10.63	31,647
1918-19	119	9	1,090	840	8.21	6,890	1,952	8.56	16,715

TABLE 95.—*Crops of Uruguay*—Continued.

Crop year.	Flaxseed.			Tobacco.			Vineyards.		
							Area.	Production, grapes.	Production, wine.
	1,000 acres.	*Bush.*	*1,000 bush.*	*Acres.*	*Pounds.*	*1,000 pounds (cured).*	*1,000 acres.*	*1,000 tons.*	*1,000 gals.*
1910-11	95	6.98	660	1,480	739	1,094	14	27	3,884
1911-12	143	6.15	879	3,956	748	2,958	15	21	2,789
1912-13	141	9.26	1,302	4,159	736	3,062	15	37	5,133
1913-14	128	7.50	963	2,506	693	1,738	16	30	4,354
1914-15	101	5.82	588	1,181	748	883	15	22	3,009
1915-16	44	8.84	391	941	598	563	15	37	5,436
1916-17	36	3.39	122	1,806	442	799	16	35	5,081
1917-18	36	9.16	333	1,693	561	949	17	46	6,759
1918-19	51	9.69	498	....	....	....	....	....	....

TABLE 96.—*Number of live stock in Uruguay.*

[Source: Direccion General de Estadistica. Montevideo.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
1908 [1]	8,193,000	180,000	26,286,000	20,000	556,000	18,000	....
Apr. 20, 1916 [1]	7,803,000	304,000	11,473,000	12,000	555,000	14,000	3,000

[1] Census.

TABLE 97.—*Net imports or net exports of leading farm products, for Uruguay.*

[Source: Anuario Estadístico de la República Oriental del Uruguay.]

Year.	Net exports.			Rice, net imports.	Net exports.		Cottonseed oil, net imports.	Net exports.	
	Barley.[1]	Corn.[2]	Oats.[2]		Wheat.[2]	Cheese.		Flaxseed.	Hides and skins.
	1,000 bush.	*1,000 bush.*	*1,000 bush.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 gals.*	*1,000 bush.*	*1,000 lbs.*
1911	(3)	7	1	....	650	38	383	520	69,191
1912	1	14	12	....	1,800	54	383	658	63,559
1913	(3)	3	2	....	455	94	....	1,804	52,942
1914	(3)	3	2	....	19	28	....	1,069	34,884
1915	[4] 67	93	[4] 24	10,790	[4] 2,298	[4] 360	514	564	73,429
1916	[4] 34	14	10	13,814	731	[4] 256	349	322	67,256
1917	[4] 7	[4] 35	[4] 121	14,892	43	[4] 94	219	14	69,117
1918	....	....	....	....	....	....	....	105	....

Year.	Hops, net imports.	Net exports.			Net imports.		Wool, net exports.
		Meat.	Oil cake and oil-cake meal.	Potatoes.	Sugar.	Tobacco.	
	1,000 lbs.	*1,000 lbs.*	*1,000 lbs.*	*1,000 bush.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 lbs.*
1911	....	183,723	1,101	1	57,087	....	134,286
1912	....	185,713	946	1	57,087	....	178,441
1913	....	221,296	2,161	1	....	[5] 3	150,883
1914	....	236,772	....	1	....	....	98,298
1915	30	306,139	1,769	[4] 684	57,535	1,792	83,563
1916	64	247,733	787	[4] 1,099	52,394	2,408	67,465
1917	64	321,093	1,342	[4] 704	50,534	3,566	87,330

NOTE.—The figures in this table are the differences between imports and exports. The year covered is the calendar year.

[1] Including malt, in terms of grain.
[2] Including meal or flour, in terms of grain.
[3] Less than 500 bushels.
[4] Net imports.
[5] Net exports.

TABLE 98.—*Crops of Hawaii.*

[Source: United States Census. These statistics begin with 1899.]

Crop.	Unit of production.[1]	1909			1919		
		Area (acres).	Yield per acre.	Production.	Area (acres).	Yield per acre.	Production.
Corn	Bushel	3,190	26	83,780	6,027	19	115,130
Rice (paddy)	do	9,425	99	929,509	5,801	113	657,152
Dry edible beans	do	169	21	3,525	98	39	3,836
Soy beans	do	20	31	626	15	26	389
Dry peas	do	14	11	148	9	14	122
Peanuts	do	20	80	1,594	75	74	5,560
Potatoes	do	353	46	16,220	405	56	22,773
Sweet potatoes	do	270	82	22,007	232	102	23,651
Sugar cane	Ton	186,230	23	4,240,238	123,165	39	4,862,707
Coffee	Pound	3,727	2,639	9,834,026	5,687	3,496	19,883,650
Cotton	do	37	149	5,500	14	827	11,575
Tobacco	do	48	1,677	80,475	...	...	50
Sisal	do	...	...	9,025,000	...	...	1,802,000
Rubber	do	...	...	6	...	...	...
Strawberries	Quart	20	1,598	31,952	23	1,461	33,607
		Number of bearing trees or plants.	Yield per tree or plant.		Number of bearing trees or plants.	Yield per tree or plant.	
Apples	Bushel	372	...	12	165	.8	139
Peaches and nectarines	do	5,416	...	344	392	.1	50
Grapes	Pound	46,992	5	229,643	2,130	51	107,710
Coconuts	Number	32,777	4	136,827	7,197	22	161,123
Avocado	Pounds, 1909; number, 1919.	3,575	18	63,247	1,349	51	68,575
Bananas	Bunch	261,691	1	333,069	190,267	.8	160,953
Bread fruit	Bag, 1909; number, 1919.	4,433	...	820	1,407	72	101,268
Figs	Pound	2,139	6	14,096	1,132	2	2,539
Lemons	Box	575	...	83	...	...	...
Limes	Box, 1909; number, 1919.	6,128	...	956	1,605	104	167,142
Mangoes	Box, 1909; number, 1919.	2,224	1	2,265	1,736	204	353,398
Oranges	Box, 1909; number, 1919.	4,690	.7	3,502	2,372	131	310,296
Papaia	Bag, 1909; number, 1919.	38,045	.6	22,078	21,675	34	739,556
Pineapples	Number, 1909; pound, 1919.	23,267,929	.5	12,361,695	100,222,788	3	299,981,433
Pomeloes	Box	173	.5	93	...	...	...

[1] The original gives the production of grains and seeds, potatoes, and sweet potatoes in pounds. The number of bushels has been here computed by taking the following average weights per bushel: Corn, 56 pounds; rice, 45; peanuts, 22; sweet potatoes, 55; and dry edible beans, soy beans, dry peas, and potatoes, 60 pounds.

TABLE 99.—*Number of live stock in Hawaii.*

[Source: United States Census.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
Apr. 15, 1910	149,000	31,000	77,000	5,000	28,000	9,000	3,000
Jan. 1, 1920	142,000	39,000	44,000	5,000	24,000	11,000	2,000

NOTE.—These figures represent total live stock, on farms and elsewhere.

TABLE 100.—*Crops of the Philippine Islands.*

[Source: Department of Agriculture and Natural Resources of the Philippine Islands. These statistics are available as early as 1902.]

Year.	Corn.			Rice (unhulled).			Abaca (manila hemp).			Cacao.		
	Area cultivated.	Yield per acre.	Production.	Area cultivated.	Yield per acre.	Production.	Area harvested[1]	Yield per acre.	Production.	Bearing trees.	Yield per tree.	Production.
	1,000 acres.	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Bush.*	*1,000 bush.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*Thousands.*	*Lbs.*	*1,000 lbs.*
1911	748	8	5,724	2,579	17	43,249			378,926			......
1912	841	10	8,443	2,666	9	24,483	......	......	351,575	......	......	164
1913	948	11	9,994	2,820	18	51,610	......	......	309,791	......	......	294
1914	1,041	14	14,431	3,076	16	47,898	787	385	303,431	1,005	1.24	1,247
1915	1,095	15	15,910	2,794	13	37,537	818	416	339,933	1,046	1.32	1,379
1916	1,069	14	15,239	2,819	16	43,984	820	410	336,766	1,030	1.20	1,231
1917	1,058	14	14,545	3,029	20	59,568	845	420	354,838	920	1.29	1,185
1918	1,034	12	12,196	3,381	22	75,406	850	433	367,868	999	1.23	1,248
1919	1,064	12	13,095	3,413	21	71,165	842	388	327,032	1,009	1.25	1,263
1920	1,327	13	16,978	3,669	21	76,563	894	407	363,939	([2])	......	1,815

Year.	Coffee.			Maguey.			Tobacco.		
	Bearing trees.	Yield per tree.	Production.	Area harvested.	Yield per acre.	Production.	Area harvested.	Yield per acre.	Production.
	Thousands.	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*	*1,000 acres.*	*Lbs.*	*1,000 lbs.*
1911	......	......	......	......	......	......	171	330	56,257
1912	......	......	189	......	......	10,204	141	463	65,131
1913	......	......	249	......	......	7,981	170	614	101,545
1914	1,131	1.22	1,381	25	658	16,719	150	684	103,024
1915	1,175	1.30	1,532	31	454	13,923	132	641	84,443
1916	1,353	1.23	1,658	58	507	29,519	146	623	90,695
1917	1,023	1.28	1,311	55	695	37,897	153	707	107,868
1918	1,209	1.32	1,591	54	676	36,739	194	700	135,705
1919	1,210	1.31	1,581	44	611	27,157	183	683	121,555
1920	([3])	......	2,707	50	799	40,075	250	573	143,064

Year.	Coconuts.						Sugar.				
	Bearing trees.	Nuts gathered.		Production.			Area cultivated.	Production.			
		Average per tree.	Total.	Copra.	Oil.	Tuba.		Crude sugar.	Panocha.	Molasses.	Basi.
	Thousands.	*Number.*	*Thousands.*	*1,000 lbs.*	*1,000 gals.*	*1,000 gals.*	*1,000 acres.*	*1,000 lbs.*	*1,000 lbs.*	*1,000 gals.*	*1,000 gals.*
1911	[4] 41,695	23.1	965,156	260,855	1,744	......	297	537,756	......	......	......
1912	[4] 46,136	22.6	1,041,182	383,679	1,286	......	406	534,251	......	......	......
1913	[4] 44,642	17.5	781,586	257,276	1,324	11,134	435	642,391	47,762	608	2,374
1914	23,951	24.7	591,266	236,736	950	14,278	419	763,739	52,939	655	2,468
1915	29,146	29.7	865,816	378,252	839	13,571	428	794,045	48,339	618	1,465
1916	30,020	24.5	735,276	312,533	710	14,249	444	772,232	52,317	586	1,784
1917	30,965	28.4	880,589	411,182	693	11,538	459	798,811	51,722	520	1,854
1918	38,023	39.6	1,506,796	764,237	1,203	22,170	508	873,557	75,933	1,343	1,877
1919	42,837	34.0	1,454,951	770,254	1,358	26,500	495	835,824	70,868	539	2,303
1920	43,585	34.6	1,509,504	797,195	761	24,586	488	863,901	69,924	1,082	2,660

[1] Area cultivated, 1911, 999,000 acres; 1912, 1,069,000; 1910, 910,000.
[2] Area, 2,891,000 acres.
[3] Area, 2,940,000 acres.
[4] Total trees.

TABLE 101.—*Number of live stock in Philippine Islands.*

[Source: Department of Commerce and Communications; Bureau of Commerce and Industries, Manila, P. I.]

Date.	Cattle.[1]	Swine.	Sheep.	Goats.	Horses.
Dec. 31—					
1910	1,027,000	1,682,000	94,000	441,000	143,000
1911	1,179,000	1,703,000	93,000	455,000	152,000
1912	1,319,000	1,888,000	99,000	476,000	171,000
1913	1,465,000	2,087,000	104,000	528,000	179,000
1914	1,625,000	2,286,000	118,000	592,000	216,000
1915	1,756,000	2,521,000	129,000	644,000	223,000
1916	1,795,000	2,735,000	130,000	604,000	203,000
1917	1,761,000				198,000

[1] Including caraboas, which in 1910 numbered 757,000; in 1911, 864,000; in 1912, 957,000; in 1913, 1,047,000; in 1914, 1,147,000; in 1915, 1,222,000; in 1916, 1,229,000; in 1917, 1,204,000.

TABLE 102.—*Crops of Porto Rico.*

[Sources: Figures for 1909, from the Thirteenth United States Census; for 1917, Porto Rico Food Commission; for 1918–19, Porto Rico Agricultural Experiment Station (by Henry C. Hendrickson, Farm management specialist).]

Item.	Unit of production.	Census, 1909.		Insular Food Commission's estimate, 1917.		Food crop acreage, 1918–19.
		Acreage.	Production.	Acreage.	Production.[1]	
Total rural land						
Total farm land		2,085,162				
Total improved farm land		1,570,304				
Sugar cane	Tons	145,433	3,180,750			
Coffee	Pounds	186,875	52,717,727			
Tobacco	do	22,142	10,827,755			
Corn	Bushels	56,640	548,236	34,497	308,009	80,000
Rice, rough	do	16,138	154,717	10,959	109,589	22,000
Edible beans, dry	do	20,652	125,553			
Red beans, dry	do			6,885	40,162	
White beans, dry	do			11,627	66,045	
Peas, dry	do	6,859	44,101			118,000
Cow peas, dry	do			5,474	45,617	
Pigeon peas (gandules)	do			13,151	109,592	23,000
Peanuts	do	202	4,584			
Milo maize	do	329	1,956			
Achiote	Pounds	167	46,467			
Cotton	do	1,425	630,400			
Hediondo	do	253	80,000			
Majaguas	Dozen	113	2,693			
Matojo		1,371				
Palmas de yagua		90				
Sweet potatoes	Bushels			26,584	1,208,364	55,000
Yams	do			3,378	122,836	7,000
Yautias	Pounds			9,119	182,380	22,000
Yuca (cassava)	do			5,512	111,440	14,000
All "vegetables"		68,158				
Hay and forage	Bundles	15,826	8,323,819			
		Trees or plants.				
Citrus fruits:						
Chinas (oranges)	Boxes	520,266	690,716			
Lemons, cultivated	do	9,874	3,598			
Toronjas (citrons)	do	117,557	47,013			
Mangoes, cultivated	do	88,785	232,123			
Pineapples	do	15,795,121	437,018			
Plantains	Number	5,261,073	49,843,475			
Bananas	Bunches	22,425,201	16,992,258			
Cacoa	Pounds	61,325	117,253			
Grapes	do	3,597	2,610			
Unclassified fruits		31,881				
Coconuts	Number	298,316	15,567,914			

[1] Production for 1917 was reported in hundredweight, by the Food Commission. Bushels were computed for this table by assuming 1 bushel equivalent to 56 pounds of corn, 45 pounds of rough rice, 60 pounds of peas and beans, and 55 pounds of sweet potatoes and yams. This estimate refers to the "Acres planted and approximate production on September 1, 1917."

TABLE 103.—*Area of principal crops in Porto Rico.*

[Source: Annual Reports of the Governor of Porto Rico.]

(In thousands of acres.)

Year ending June 30—	Cane.	Coffee.	Tobacco.	Pine-apples.	Oranges.	Coco-nuts.	Minor fruits.
1913	209	168	17	4	5	7	102
1914	210	165	18	4	4	6	102
1915	211	165	18	4	5	6	102
1916	203	167	16	3	5	6	102
1917	205	168	13	3	5	7	103
1918	256	148	24	3	6	9	95
1919	239	159	23	3	6	9	102
1920	240	160	22	3	6	10	103

TABLE 104.—*Number of live stock in Porto Rico.*

[Source: United States Census.]

Date.	Cattle.	Swine.	Sheep.	Goats.	Horses.	Mules.	Asses.
Apr. 15, 1910	316,000	106,000	6,000	49,000	58,000	5,000	1,000
Jan. 1, 1920	264,000	99,000	4,000	33,000	47,000	7,000	1,000

UNITED STATES EQUIVALENTS OF THE PRINCIPAL WEIGHTS AND MEASURES USED IN FOREIGN AGRICULTURAL STATISTICS.

1 ardeb=1.98 hectoliters=5.6186 Winchester bushels........................Egypt.
1 batman=6.5477 pounds avoirdupois..Persia.
1 bouw=7096.5 square meters=1. 754 acres.......................Dutch East Indies.
1 cantar=44.928 kilograms=99.048 pounds avoirdupois........................Egypt.
1 cantar=123.7123 pounds avoirdupois......................................Rumania.
1 catty (kati)=1⅓ pounds avoirdupois.......................................China.
1 cental=100 pounds...................................United States, Australia.
1 centner=110.23 pounds avoirdupois.......................................Denmark.
1 chetvert=5.9568 Winchester bushels.......................................Russia.
1 cho=2.4507 acres..Japan.
1 dessiatine=2.6997 acres..Russia.
1 donum=0.27702 of 1 acre..Turkey.
1 feddan=1.038 acres..Egypt.
1 hectare=2.471 acres...Metric system.
1 hectoliter=2.8377 Winchester bushels..............................Metric system.
1 hectoliter=26.417 United States gallons (liquid)..................Metric system.
1 hundredweight (long)=112 pounds avoirdupois..........United Kingdom, Australia.
1 hundredweight (or cental)=100 pounds....................United States, Canada.
1 imperial bushel=1.031515 Winchester bushels.....................British Empire,
1 imperial gallon=1.2003 United States gallons (liquid)...........British Empire.
1 joch (cadastral hold, or cadastral arpent)=1. 422 acres.................Hungary.
1 kile=1.07 Winchester bushels...Greece and Turkey.
1 kilogram=2.2046 pounds avoirdupois................................Metric system.
1 kin=1.3228 pounds avoirdupois...Japan.
1 ko=2.3968 acres...Formosa.
1 koku=4.9629141 imperial bushels=5.119 Winchester bushels...................Japan.
1 koku=47.654 United States standard gallons (liquid).......................Japan.
1 kwan=8.2673 pounds avoirdupois..Japan.
1 libra (pound)=1.014 pounds avoirdupois....................................Chile,
Cuba, Peru, Santo Domingo, Uruguay.
1 liter (dry)=0.028377 Winchester bushels...........................Metric system.
1 liter (liquid)=0.26417 United States gallons......................Metric system.
1 maund=82.28571429 pounds..British India.
1 mow=0.151818 of 1 acre..China.
1 muid=3.094545 Winchester bushels...........................British South Africa.
1 quintal (double zentner, or metric centner)=220.46 pounds avoirdupois.
Metric system.
1 quintal=123.4576 pounds avoirdupois......................................Greece.
1 oke=1.248 kilograms=2.751 pounds avoirdupois..............................Egypt.
1 oke=2.822 pounds avoirdupois...Greece.
1 picul=133⅓ pounds avoirdupois...China.
1 picul=61.76 kilograms=136. 156 pounds avoirdupois............Dutch East Indies.
1 pood=36.1128 pounds avoirdupois..Russia.
1 pound, Great Venetian=1.0582 pounds avoirdupois..........................Greece.
1 Russian pound=$\frac{1}{40}$ pood=0.90282 pound..........................Russia.

1 pund=1.1023 pounds avoirdupois....Denmark.
1 square meter=0.0002471 acre....Metric system.
1 stater=124.168 pounds avoirdupois....Greece.
1 stremma=0.2471 acre....Greece.
1 ton (metric)=2204.6 pounds avoirdupois....Metric system.
1 ton (long)=2,240 pounds avoirdupois.
United States (foreign trade) and United Kingdom.
1 ton (short)=2,000 pounds avoirdupois.
United States (internal trade) and Canada (foreign trade).
1 tonde=3.9479 Winchester bushels....Denmark.
1 tonde land=1.3631 acres....Denmark.
1 tunna=4.6789 Winchester bushels....Finland.

EQUIVALENTS (FOR UNITED STATES PRODUCTS).

COTTON:
1 pound of lint=the product of about 3 pounds of seed (unginned) cotton.

COTTONSEED OIL (also linseed oil, lard oil and corn oil):
1 gallon=7.5 pounds avoirdupois.

FLOUR AND MEAL:
1 barrel of wheat flour (196 pounds)=the product of 4½ bushels of wheat.
1 barrel of rye flour (196 pounds)=the product of 6 bushels of rye.
1 barrel of corn meal (196 pounds)=the product of 4 bushels of corn.
1 barrel of buckwheat flour=the product of 7 bushels of buckwheat.
18 pounds of oatmeal=the product of 1 bushel of oats.

MALT:
1.1 bushels of malt=the product of 1 bushel of barley.

RICE:
100 pounds of cleaned rice=the product of 162 pounds of rough rice or paddy. (Knapp.)

SPIRITS OF TURPENTINE:
1 gallon=7.2 pounds avoirdupois.

AVERAGE WEIGHTS OF 1 BUSHEL.

[See Crop Reporter, November, 1911, p. 86.]

	Pounds.		Pounds.		Pounds.
Apples	48	Malt	34	Rye	56
Barley	48	Oats	32	Spelt	40
Beans (dry)	60	Onions	57	Sweet potatoes	55
Buckwheat	48	Peaches	48	Timothy seed	45
Corn (shelled)	56	Peanuts	22	Tomatoes	56
Corn (on cob)	70	Potatoes	60	Wheat	60
Corn meal	48	Hemp seed	44		
Flaxseed	56	Rice, rough (unhulled)	45		

For values of foreign monetary units, see the *latest* quarterly circular of the United States Treasury Department, entitled "Values of Foreign Coins." (These circulars are issued January 1, April 1, July 1, and October 1, each year.)

For value in gold of $1 in currency, also value in currency of $1 in gold, each month, 1862 to 1878, see Monthly Summary of Commerce and Finance, October, 1895, p. 518.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 988

Contribution from the States Relations Service
A. C. TRUE, Director.

Washington, D. C. PROFESSIONAL PAPER December 5, 1921

HEAT PRODUCTION OF HONEYBEES IN WINTER.

By R. D. Milner, *formerly Assistant Chief of the Office of Home Economics, States Relations Service,* and Geo. S. Demuth, *formerly Apicultural Assistant, Bureau of Entomology.*

CONTENTS.

Studies of the behavior of honeybees in winter[1] show that these insects do not hibernate, but throughout the entire winter they consume their stores of honey and generate heat. The results of these studies further show that after the winter cluster is formed, at 14° C., there is an inverse relationship between the temperature inside and outside the cluster, and that the generation of heat to warm the winter cluster is solely by muscular activity, such as fanning of the wings and other movements. These results do not agree with the conclusions of Parhon[2] that the honeybee is in part heterothermic. The work on behavior of the bees during winter, from which the practical conclusions as to the needs of bees in winter were drawn, was chiefly on temperature responses, and no data were available as to the actual heat production of the bees during this season. The work herein recorded was begun in order that the missing data might be in part obtained.

From many observations it has long been known that the duration of life of the individual worker bees is determined by the work which

[1] U. S. Dept. Agr. Bul. 93 (1914), The Temperature of the Honeybee Cluster in Winter. By Phillips and Demuth. See also Farmers' Buls. 695, 1012, and 1014.

[2] Parhon, Marie, 1909. Les échanges nutritifs chez les abeilles pendant les quatre saisons. Paris: Masson et Cie. 57 pp.

55663°—21——1

they are called upon to do. When there is a heavy honey flow and the bees are at their greatest activity their lives are limited to about 6 weeks, while during the winter season, if every condition is favorable, they may live 6 months. On the other hand, it is clear from the experience of beekeepers and from the investigations previously mentioned that if the conditions in wintering are unfavorable the bees are aroused to great activity. Under these conditions they are greatly reduced in strength, and even though they may live through the actual period of winter, they are so depleted in vitality that they are unable to do the heavy work incident to building up the colony to full summer strength, and they die off faster than their places are taken by the emerging bees of the brood reared in the spring. In the honeybee organism either the power of constructive metabolism is entirely lacking or it is far less effective than that of destructive metabolism, and the rate of the latter is apparently accelerated by the activity of the bees, thus bringing on more rapidly the impairment of functional capacity which ends in death. The physiological changes which occur in worker bees during this process of aging are not well understood, but certain facts have been observed which are significant. Mr. Goodrich-Pixell [3] has found that the nerve cells in bees dying of exhaustion are highly vacuolated and the cytoplasm greatly depleted, thus substantiating the work of Hodge [4] and of Smallwood and Phillips.[5]

Chief among the factors that influence the activity and consequent welfare of a colony of bees in winter are the condition of the colony at the beginning of winter (physiological age of the individuals), external temperature, quality of the food used during confinement, ventilation, humidity, and various causes of irritation. The experiment here recorded was undertaken to study the responses of bees to some of these stimuli, as measured by heat production, being a continuation of the work of Phillips and Demuth (loc. cit.) on the behavior of bees in winter, in which work the temperature responses were of greater significance. It was carried out in December, 1915, and the intention was to continue with similar experiments in other seasons under a wider variety of conditions than was maintained in this instance. Such investigations can be conducted only after brood rearing has normally stopped, and they must be concluded before the bees are filled with feces, in order that the data may not be complicated by activity due to this disturbing factor. It is therefore

[3] Quart. Jour. Micros. Sci. [London], n. ser., 64 (1920), No. 254, Pt. 2, pp. 191–206. ill. Determination of age in honeybees.

[4] Jour. Physiol, 17 (1894) Changes in ganglion cells from birth to senile death; observations on man and honeybees.

[5] Jour. Comp. Neur., 27 (1916). Nuclear size in the nerve-cells of the bee during the life-cycle.

possible to carry out but one experiment a year with a given colony. Circumstances incident to the war prevented continuation of this work, but the results obtained in this experiment are of such economic importance, as well as scientific interest, that it seems desirable to publish them without further delay.

SOURCE OF HEAT IN THE WINTER CLUSTER.

The effect of external temperature on the activity of a colony of bees is conspicuous. The bee is similar to other cold-blooded animals in that it lacks the means for internal regulation of body temperature that are found in birds and mammals, and hence the temperature of its body is affected by that of the surrounding air. As the temperature of the air in the hive falls in winter the bees become less active until a certain critical temperature (14° C.) is reached, at which they undertake by muscular activity, not unlike that of shivering, to produce heat in order to keep warm. Between the combs and sometimes extending above or below them they form an approximately spherical and fairly compact cluster, with the bees on the outside comprising a sort of shell with their heads turned toward the center. This shell may be several layers thick, the number of layers and the compactness of the cluster depending upon the size and condition of the colony and the temperature of the air in the hive. The bees in this shell remain quiet, except for an occasional shifting of position, but those in the space inside the shell become very active, moving about, shaking their bodies, and fanning vigorously with their wings, thus producing heat to warm the cluster.

By means of many thermocouples fastened in different parts of the hive Phillips and Demuth (loc. cit.) were able to measure the temperatures at various points within and around the winter cluster. They found that when the temperature of the air within the hive and surrounding the bees was between 14° and 20° C. the bees remain quietly on the combs but not clustered, their body temperatures being, of course, approximately that of the surrounding air. While the upper temperature limit of this quiescent condition is not definitely fixed, varying with the condition of the bees and the weather outside the hive, the lower limit is quite accurately determined by the needs of the bees. When the air temperature falls to 14° C. the bees come together to form the winter cluster. If the temperature falls still lower, they begin to generate heat within the cluster, and frequently the inner temperature rises considerably above those temperatures at which the bees were able to exist without activity. Temperatures as high as 30° to 35° C. are not uncommon, and, indeed, were observed even when the air outside the cluster was as low as

0° C. In locations where the outer temperatures fall much below this the bees are still able to maintain high temperatures, more bees taking part in heat production. That such high temperatures can be maintained in these circumstances indicates that the shell of bees is effective as a heat insulator, but there is obviously a serious drain on the vital capacity of the bees employed in producing heat. This is shown by the rapid slowing down of the fanning of the wings as it continues.

OUTLINE OF THE EXPERIMENT.

To obtain information regarding the actual amount of work done by a colony of bees while in the winter cluster, a small colony on four combs having natural honey stores was placed in the chamber of a small respiration calorimeter and their carbon-dioxid production and oxygen consumption were measured for 10 days, while the temperature of the air surrounding the bees was kept just low enough so that the bees at all times would remain clustered. Throughout the experiment the temperature of the air surrounding the bees and at several points within the cluster was taken in order that this work might be made comparable with the work on the behavior of bees in winter as indicated by temperature responses. The bees were located in a box within the calorimeter so constructed that while they could not escape from it there was opportunity for abundant ventilation. There were 14 thermocouples distributed in the hive in the calorimeter in such manner that the temperatures in different places inside and outside the cluster could be ascertained, the leads from the thermocouples being extended through the outlet in the wall of the chamber to a potentiometer on the outside. The temperatures were read every half hour, day and night, for nearly 12 days.

The thermocouples were so placed in the hive as to make it impossible for the clustered bees ever to occupy space in which some of the thermocouples were not located, thus insuring that the temperatures of the cluster might be obtained wherever the cluster might move in the hive. The temperatures of all parts of the hive outside the cluster could also be obtained by the arrangement of these thermocouples. One of the thermocouples (No. 15) was located outside the hive and 2 inches from it, thus giving the temperature of the air of the chamber at this point. The readings obtained with this thermometer are plotted in the charts on pages 15 to 18. A resistance thermometer was also placed in the chamber, but at some distance from the thermocouple. Measurements made with this thermometer are shown in the table on page 8. The two records did not always exactly agree because the thermometers were not together.

DISCUSSION OF THE TEMPERATURE RESPONSES IN THIS EXPERIMENT.

The colony used in the experiment here reported was taken to Washington from the suburbs some time prior to the beginning of the experiment. The bees were placed in the calorimeter and then it was found that the apparatus was defective and it was necessary to remove them. During the interval before the experiment here recorded was begun, they were placed outside where they were free to fly when the weather permitted, and they had several flights and carried out the dead bees. They were therefore in good condition at the beginning of the experiment.

For several hours after the hive was again placed in the respiration chamber, the temperatures of the hive and bees were high, chiefly as a result of the disturbance arising from the handling necessary at this time. They were put in place at 3 p. m. on December 11, and during the night the temperature of the bees on one occasion, and in one point only, rose to 35° C. During the night the temperature of both the chamber and the bees drifted down, until shortly after noon on the 12th, when they may be considered as having reached normal quiescence. Just when the bees definitely formed a winter cluster is not clear from the data, but certainly when they had reached quiescence they were clustered.

In the graphic charts of temperatures of this colony, records are included for thermocouples 6, 7, and 12, these being the ones which were in the center of the cluster, which was located near the top and slightly to one side of the hive. For comparison with these the record for thermocouple 15 giving the temperature of the air of the chamber at one point outside the hive is also included.

It will be observed that on several occasions the temperature of the center of the cluster (which shifted between thermocouples 12 and 7, according to the movement of the cluster during the experiment) rose somewhat abruptly but temporarily, not, however, reaching the temperatures observed at the time that the bees were placed in the chamber. While some of the rises may be attributed to mechanical disturbances, it was not always possible to determine the exciting cause. This is in accordance with numerous observations made in the work on the behavior of bees in confinement to which reference has already been made. Throughout the experiment, of course, heat production never ceased, and with the bees in this condition of activity it took but a small disturbance to induce them to generate slightly more heat. This is comparable with the periods of activity that have long been observed in bees wintered in cellars.

It is more important to note that during the 12 days that the bees were in the respiration chamber the temperature of the center of the cluster gradually rose from an average of 16° C. on December 13 to an average of 30° C. on the 22d, though the air outside the hive kept in the range of temperature from 6° C. to 9° C. This is in agreement with results obtained by Phillips and Demuth (loc. cit.) with bees wintered in a cellar which were interpreted as indicating that such an upward drift of temperature of the colony during confinement is the result of irritation because of an accumulation of feces. In the case of the colonies recorded in an earlier publication,[6] one colony showed a slower rise than was found in this colony, while another, wintered on honeydew stores, showed a more rapid rise. Since it has been shown that disturbance of any sort causes a rise in cluster temperatures, it is not entirely clear to which disturbance the rise of this colony should be attributed. Of course, as this colony was located in a respiration chamber in a busy laboratory, it was exposed to greater disturbance than would have been the case in some other experiments or in the average bee cellar, although all practicable precautions were taken to avoid jar and the apparatus was cushioned. It is not improbable that the sudden and temporary increases in temperature may have been due to physical disturbance and that the cause of the continued rise was physiological disturbance.

It will be noted that beginning at 6.30 p. m. on December 22 the temperatures of the cluster began to drop. At this time the carbon-dioxid content of the air in the chamber was high and the oxygen deficient, as will be explained later. Under these conditions the bees were more quiet (generated less heat) than when under conditions which would usually be considered more favorable. The temperature of the center of the cluster dropped until it reached 23° C. The reason for the decrease in activity at this time has not been discovered. It was thought that the bees were dying because of unfavorable atmospheric conditions, but at 5 a. m. on the 23d the temperature again began to rise and continued until it again reached 34° C. Whether this increase in activity was a reaction in response to physical disturbance or to change in atmospheric conditions made at this time (see p. 13) is not clear.

METHOD OF MEASURING THE WORK DONE BY THE CLUSTER.

At noon, December 12, measurement of the metabolic activity of the bees was begun. The respiration calorimeter used for this experiment has been described in a publication of the department,[7] but to aid in explaining the conditions of the experiment the principles of

[6] U. S. Dept. Agr. Bul. 93. The Temperature of the Honeybee Cluster in Winter.
[7] Jour. Agr. Research [U. S.], 6 (1916), No. 18, pp. 703–720.

the apparatus may be briefly summarized. The respiration chamber in which the hive was inclosed was ventilated by withdrawing air from the lower portion, passing it through sulphuric acid to remove water vapor and through soda lime to remove carbon dioxid, and returning it to the upper part of the chamber. The increase in the weights of the sulphuric acid and the soda lime during a given period indicates respectively the quantities of water vapor and carbon dioxid removed from the chamber. These represent the quantities produced during the period when due allowance is made for change in the water vapor and carbon-dioxid content of the air as ascertained from analyses made at the beginning and end of the period. Oxygen to replace that removed by the bees was supplied to the chamber from a cylinder, the gas being introduced at a rate sufficient to maintain a certain volume in the system, as indicated by a tension equalizing device which served to keep the air in the chamber at the same barometric pressure as that of the laboratory. The quantity of gas admitted was ascertained from the loss in weight of the cylinder or by reading a meter through which the gas was passed. This showed the quantity of oxygen consumed by the bees when correction was made for change in the residual oxygen content of the air of the chamber. In making these corrections for variations in residual gases, changes in temperature and barometric pressure of the air of the system were also taken into account. By proper attention to these means of ventilation, any desired conditions with respect to water vapor, carbon dioxid, or oxygen content of the air could be maintained.

The temperature of the air surrounding the hive could also be controlled to a certain extent. In a space adjacent to the metal walls of the respiration chamber, and protected by a thick heat-insulating cover, were means for heating and cooling the walls; also within the chamber was a coil of copper tubing through which cold water could be circulated to take heat from the air about the hive. By weighing the water flowing through this coil and measuring its increase in temperature, the quantity of heat carried out could be ascertained, which, with necessary corrections for heat from other sources, would be that imparted to the air by the bees.

RESULTS OBTAINED IN THE EXPERIMENT.

Data indicating the physiological activity of the bees are summarized in the following table with others showing the experimental conditions.

Summary of experimental data.

Date.	Temperature of air in the chamber.	Humidity of air in chamber.	CO_2 in air in chamber.	Oxygen in air in chamber.	Water vapor taken from the air.	Carbon dioxid produced.	Oxygen consumed.	Heat generated.
	° *C.*	*Per cent.*	*Per cent.*	*Per cent.*	*Grams.*	*Liters.*	*Liters.*	*Calories.*
Dec. 13	7.3 to 8.8	....	0.53	15.2	17.1	9.6	....	....
Dec. 14	6.4 to 8.0	75 to 90	1.42	16.8	3.4	10.4	....	....
Dec. 15	6.1 to 8.2	77 to 90	.87	17.1	5.0	11.7	....	....
Dec. 16	6.3 to 7.0	77 to 95	.81	21.1	8.1	13.3	....	....
Dec. 17	6.3 to 7.6	72 to 93	1.08	22.6	8.3	12.8	....	....
Dec. 18	7.8 to 9.2	76 to 95	.52	24.5	6.9	12.1	....	....
Dec. 19	7.1 to 7.8	50 to 86	.63	26.4	26.5	12.9	....	....
Dec. 20	6.9 to 7.9	49 to 66	.23	28.9	25.9	14.5	....	....
Dec. 21	6.8 to 8.3	47 to 66	1.40	24.5	22.2	11.0	....	....
Dec. 22	7.4 to 7.7	45 to 65	.51	18.2	23.2	16.3	....	....
Dec. 23	7.6 to 8.8	50 to 55	.29	7.3	15.9	14.9	....	....
Total, omitting first day						129.9	138.4	683

With the warm conditions prevailing in the laboratory, the cooling capacity of the apparatus, which had been constructed for work at higher temperatures, was not sufficient to chill the hive as much as had been desired when this experiment was planned, consequently the bees were not subjected to very low temperatures. Those shown in the table were measured with an electrical resistance thermometer suspended in the air above the hive, which was as warm as that in any part of the apparatus, but the readings on two thermometers in other parts of the chamber did not differ materially from these. The figures shown are the lowest and highest temperatures observed each day, but there was no uniformity in the time at which these occurred. The fluctuations in temperature are shown in the curve for thermocouple No. 15 on pages 15 to 18. The maximum range, from 6.1° to 9.2° C., was in the vicinity of the temperature which beekeepers usually consider favorable for bees wintering in cellars.

The daily production of carbon dioxid shown in the table is an index of the amount of work performed by the bees. This quantity was derived, in the manner previously explained, from the weight of the carbon-dioxid absorber, which was taken every 24 hours. Any error in these figures, with the possible exception of those for December 21 and 22, which are explained later, is believed to be of small magnitude. The most significant error that could occur would be due to the fact that the circulation of air was not directly through the hive, but through the chamber in which the hive was inclosed. In some cases there might be an accumulation of carbon dioxid in the hive in one period which would escape in a later period, with a corresponding error in the measurements of the quantities for the two periods; but as there was free space in the small experimental hive for only a few liters of air, a relatively large change in the carbon-dioxid content of the air in the hive would introduce only a very small error in the quantity measured in any period.

The determination of the carbon-dioxid production for the experiment as a whole is accurate. In footing the total the quantity for the first day is omitted, because the oxygen consumed was not measured that day. In the 10 days the bees produced 130 liters of carbon dioxid and consumed 138 liters of oxygen. The corresponding respiratory quotient is 0.94, which indicates that their metabolism was almost entirely that of carbohydrate. Their heat production, calculated from these data, was 688 calories. The quantity of heat measured by the calorimeter was larger than this, but it involved an error due to leakage of heat through the walls, owing to the wide difference between the temperature of the air in the chamber and that in the laboratory, which the apparatus as used could not overcome. Making such allowance for this error as was indicated by subsequent test of the apparatus under somewhat similar conditions, the corrected amount of heat measured was but slightly different from this computed value.

The number of bees in this colony, by actual count, was 9,635. The average weight of empty worker bees is about 0.075 gram; their total weight, in round numbers, would be 720 grams. The heat output of this colony, 688 calories, was therefore equivalent to 0.97 calorie per gram for the 10 days, or virtually 0.1 calorie per gram per day. This is equivalent to a heat output of 7,000 calories per day by a man weighing 70 kilograms (154 pounds), which is found only in unusual circumstances. The average individual of this size actively engaged in hard work at least 8 hours a day would give off about 4,000 calories in 24 hours. The heat output of lumbermen working hard in the northern woods in a cold winter was found to be about 7,000 calories per man per day, as indicated by their food consumption. During the period that they were working hardest their hourly expenditure of energy may have been double the average for the rest of the day, possibly as high as 600 calories per hour, although this seems doubtful. In certain experimental conditions a well-trained man engaged in muscular activity sufficient to cause a heat output of 650 calories per hour, which was measured in the same manner as the heat output of the bees was measured in this experiment, but this was considered to be severe, exhausting work, almost at the limit of human endurance, and was continued only for short periods. This output, per unit of weight, would be larger than that of the colony of bees taken as a whole, but it will be recalled that the bees actually

55663°—21——2

engaged in the excessive activity of heat production at any one time are only a small part of the total colony, the rest of them being crowded together in the shell of the cluster or in empty cells of the honey comb or standing quietly. The amount of work done by the bees that are really active is comparable with that done by the man in unusual conditions, and is therefore relatively enormous; and this is maintained not only for short periods but through the whole day and the whole winter.

Moreover, it will also be observed that the temperature conditions during this experiment were those in which bees are the least active. In fact, as mentioned previously, the temperature in the respiration chamber during the experiment was about the same as that which beekeepers usually maintain in cellars for wintering bees. Colonies wintered outdoors, especially if unprotected, must endure in many cases much more severe temperature conditions. Furthermore, this experiment was conducted at a time of the year when bees are naturally more nearly quiescent. Bees are usually more active during the latter part of winter than during late fall and early winter. The figures obtained in this experiment, therefore, represent about as low an expenditure of energy as is ever found in a colony of bees, except for short intervals. In a preliminary test with this colony the quantities of carbon dioxid measured were decidedly larger than these, owing to less favorable conditions.

A hygrometer suspended in the chamber was read at frequent intervals. The maximum and minimum readings for each day are shown in the table. During the first five days the humidity was allowed to remain at a high level. This was accomplished by keeping the air of the system in circulation only part of the time, virtually every other hour. During the other five days the humidity was kept much lower by maintaining a constant circulation of air through the sulphuric acid. There was a very noticeable difference in the quantities of water vapor removed from the chamber in the several days of the two periods, owing to the fact that the relative dryness of the air in the later period was causing a loss of water from the wood of the hive. No difference in the activity of the bees that could be ascribed to the difference in water-vapor content of the air was noticeable in the temperature curves or in the carbon-dioxid output of the various days.

The barometer was read at noon each day. There were no significant changes in barometric pressure during the course of the experiment. The reading on the 13th was 755 millimeters, which rose each succeeding day to 769 on the 16th, then fell to 750 on the 18th. It was 767 on the 19th and for the rest of the experiment remained within 4 millimeters of this pressure.

There was no apparent effect on the activity of the bees from variations in the carbon-dioxid content of the air in the hive, at least within very wide limits. One column in the table shows the percentage of carbon dioxid in the air at the time the residual analysis was made each day. These figures tell little of the condition of the air at any other period during the day; they merely show what it was after the air of the chamber had been passing through the soda lime for at least an hour; but unless the bees had been actually more active at the time the residual analysis was made (which, according to the thermocouples, did not occur in any instance) there must have been at least as much and probably more carbon dioxid in the air previous to the time of the analysis than is indicated by these figures. It would appear, then, that throughout the whole of the experiment the carbon-dioxid content of the air in the hive was appreciably greater than that of normal air, which is probably the usual condition in a hive; also there were outside variations in the proportion of this gas in the air, as shown by the data in the table. On December 21 and 22 arrangements were made to insure a considerable excess of carbon dioxid in the air. During most of the time on these days the soda lime was removed from the train for purifying the circulating air and the carbon dioxid was allowed to accumulate within the respiration chamber while the water vapor was removed. Starting with the content of nearly one-quarter of 1 per cent on the 20th, or almost eight times that in normal air, the increase continued until in the whole air system of the apparatus, which was about 170 liters, there was included over 10 liters of carbon dioxid before the period ended on December 21, a proportion more than 200 times that in normal air. There is no significant change in the curves on page 18 showing the behavior of the bees, to indicate that they were materially affected by these abnormal conditions. The curve for thermocouple No. 7 continued at the same level for nearly 12 hours, then began to rise slowly; those for Nos. 12 and 6 fell somewhat for about 12 hours and then maintained a level for the remainder of the period. There would appear to be on the whole a quieting of the bees for this day, but this could be hardly attributed to the quantity of CO_2 present, for on the following day, when there was a still greater concentration, the activity of the bees increased.

From the character of the curves in these two days it would be expected that the carbon-dioxid production on the 22d would exceed that of the 21st, but not necessarily by nearly 50 per cent as shown in the values in the table. It is not unlikely that some of the carbon dioxid measured on the 22d was produced on the 21st. Unintentionally, replacement of the soda lime in the air circulating system was delayed until one hour before the close of the first period, and this was not sufficient time to remove all the carbon dioxid from the system, as was shown by the high percentage of the gas found in the residual air. It is possible that in this circumstance the air in the hive had a larger percentage of carbon dioxid than that of the sample analyzed. On the 22d the air was passed through the soda lime for nearly three hours prior to the end of the period, in which case the air in the hive had greater opportunity to become like that of the system. Even with a carbon-dioxid content of at least 6 per cent, which was the case on the 21st, the quantity of the gas carried over in the hive to the next period would be much less than 1 liter, which would still leave a wide difference between the figures for carbon-dioxid production in these two days. There is nothing in the data at hand to suggest a reason for this difference. It is interesting to observe that the total of carbon dioxid produced for these two days was almost identical with that of the two days preceding them, when the carbon-dioxid concentration of the air was low.

The proportion of oxygen in the air at the end of each period is also shown in the table. These figures simply show the condition at a given time each day, but they give no definite idea of the proportion of oxygen in the air during the whole day. This would vary hour by hour with the admission of oxygen, the absorption of water vapor and carbon dioxid, and with changes in the temperature of the air, but on the whole would be somewhere in the range between the proportion at the end of one period and that at the corresponding time in the period preceding or following. The figures therefore show that there was a continual increase in the proportion of oxygen from the 13th to the 20th, then a decrease to the 23d.

The low proportion of oxygen in the air at the beginning of the experiment was due to the fact that air rather than oxygen was supplied to the system to replace the carbon dioxid and water vapor removed during the preliminary period and to maintain a sufficient quantity of air in the system while the apparatus was being chilled before the experimental conditions were established. After the experiment began, replacement was made by oxygen until the 20th, when the requisite volume was again maintained by admitting air, in order to reduce the proportion of oxygen in the air of the system. No effect that could be ascribed to changes in the oxygen content of the air was observed until the last day of the experiment. On that day not only water vapor and carbon dioxid, but oxygen also was removed from the system by passing the circulating air through a solution of potassium pyrogallate before returning it to the chamber. This was continued until the proportion of oxygen in the air, which was only 18 per cent at the beginning of the period, was very greatly reduced. After a few hours the circulation of air was stopped and the water vapor and carbon dioxid allowed to accumulate in the air of the system in which there was a deficiency of oxygen. The effect on the activity of the bees was soon apparent; the temperature curves, which for some reason had begun to rise, very shortly turned in the opposite direction and continued to fall for about 12 hours. The proportion of oxygen was then 12 per cent and it was thought that the bees had probably been suffocated. Eight hours before the time at which the period would regularly end the air of the system was again put in circulation and water vapor and carbon dioxid removed, oxygen being also removed at the same time. This was continued until the close of the period (which was also the end of the experiment) in order that the air of the system might be quite thoroughly freed of carbon dioxid. After the circulation of air was resumed the bees again indicated that they were living, and during the time that the air-purifying system was operating their activity increased until by the end of the experiment the temperature curve had reached as high a point as at any time during the course of the experiment, even though the proportion of oxygen in the air was low. Analysis of the sample taken at the end of the period showed only 7.3 per cent of oxygen.

If the decrease in the activity of the bees in this instance was due to atmospheric conditions in the hive, the cause was probably excess of carbon dioxid and water vapor rather than deficiency of oxygen. Though the proportion of oxygen in the air was decreased from 18 to 12 per cent in 16 hours, it is doubtful if this alone would have an appreciable effect upon the physiological activity of the bees. In experiments with men in atmospheres about as deficient in oxygen as this, there was no noticeable effect upon their metabolism. In these experiments, however, there was no such excess of carbon dioxid and water vapor as in the experiment with the bees.

It is possible, as intimated on page 6, that the reason for the increase in activity of the bees after the circulation of air was resumed may have been physical disturbance. Since it was thought that the bees were dying, movement about the laboratory was somewhat less restricted when the air-circulating device was started, although care was still taken to avoid jarring the calorimeter. The circulation of air through the calorimeter could hardly have caused any disturbance of the bees, because the low rate, while sufficient to keep the air in motion, could not produce any current that would stir the hive. It is also possible that, since the removal of oxygen from the air was continued during this period, the proportion of oxygen in the air eventually became so low that the bees had to respire more rapidly to obtain a sufficient quantity of this gas. It would be expected, however, that this effect would be manifested somewhat later in the period than the time at which activity was renewed.

In considering the circumstances on this last day of the experiment with bees it is interesting to recall observations made in the study of the effect of ventilation on men, that the sensations produced by "bad" air are not experienced when the air is stirred. If this indicates an actual difference in physiological conditions in the different circumstances, then it is not inconceivable that something analogous to this was true of the bees on this day. The stirring of the air when the circulation was resumed may have served to remove some cause of depression that was effective when the circulation was stopped.

SUMMARY.

In the colony of bees under observation in the respiration chamber the expenditure of energy was reduced to the lowest limit by the maintenance of favorable temperature and by the avoidance of all disturbing factors, so far as possible. Under these circumstances, rarely found in the apiary, the energy produced by the bees, as measured by the carbon dioxid and water produced and the oxygen consumed, was greater, according to body weight, than that produced by a man when working at hard manual labor, when we take into consideration the fact that the work was done by only a relatively few of the bees in the cluster. Even assuming that the work of the period were equally divided among the bees, their energy output per unit of body weight is higher than that of the average laborer. When we take into consideration the fact that usually the bees do not have such favorable conditions in winter as these bees had, it is clear that the energy output is enormous in the average apiary.

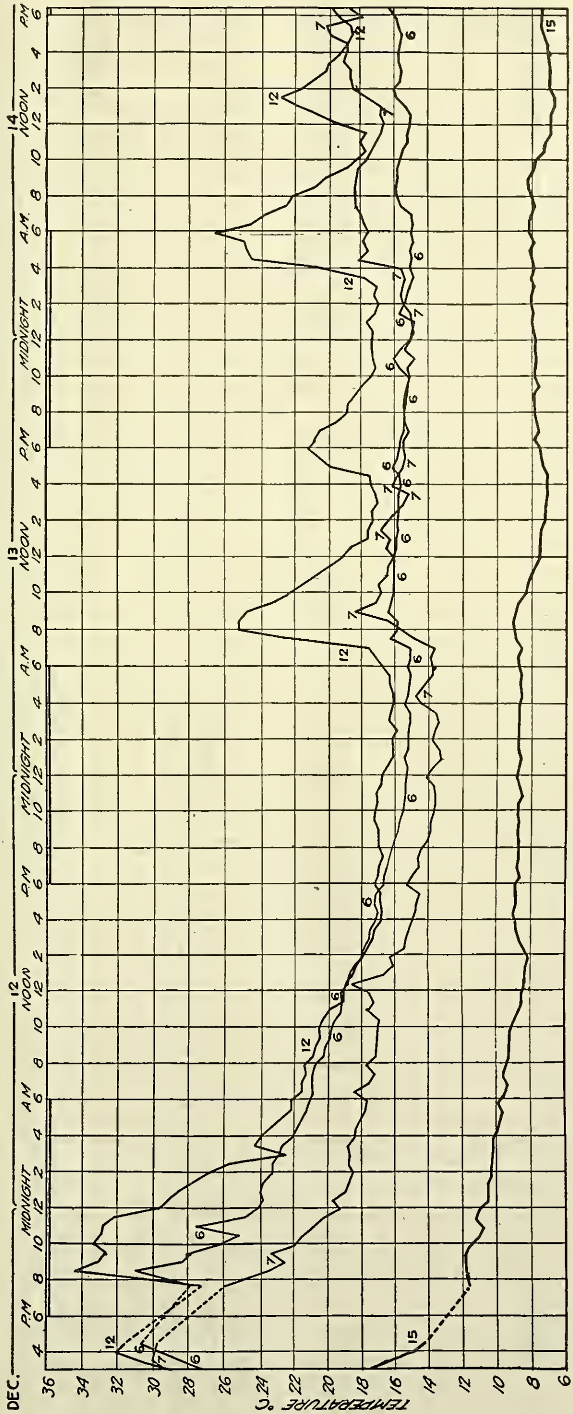

CHART I.—Temperatures shown by thermocouples 6, 7, 12, and 15, from 3 p. m., December 11, to 6.30 p. m., December 14.

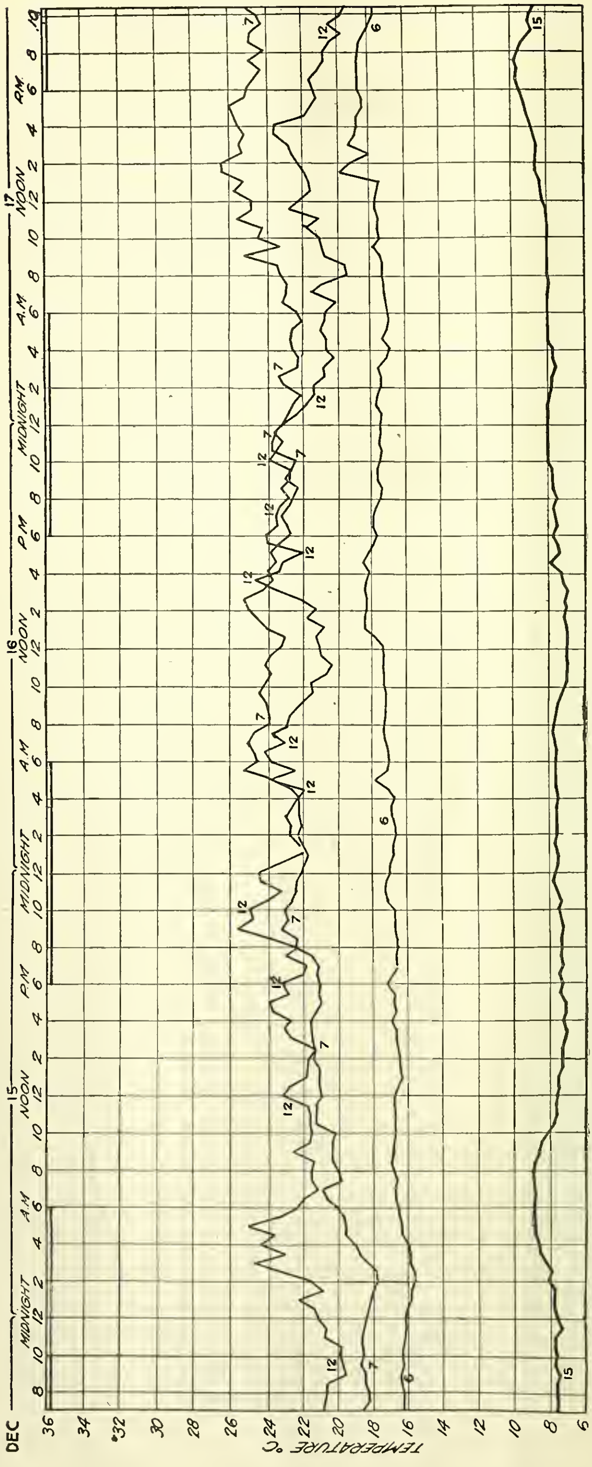

CHART II.—Temperatures shown by thermocouples 6, 7, 12, and 15, from 6.30 p. m., December 14, to 10.30 p. m., December 17.

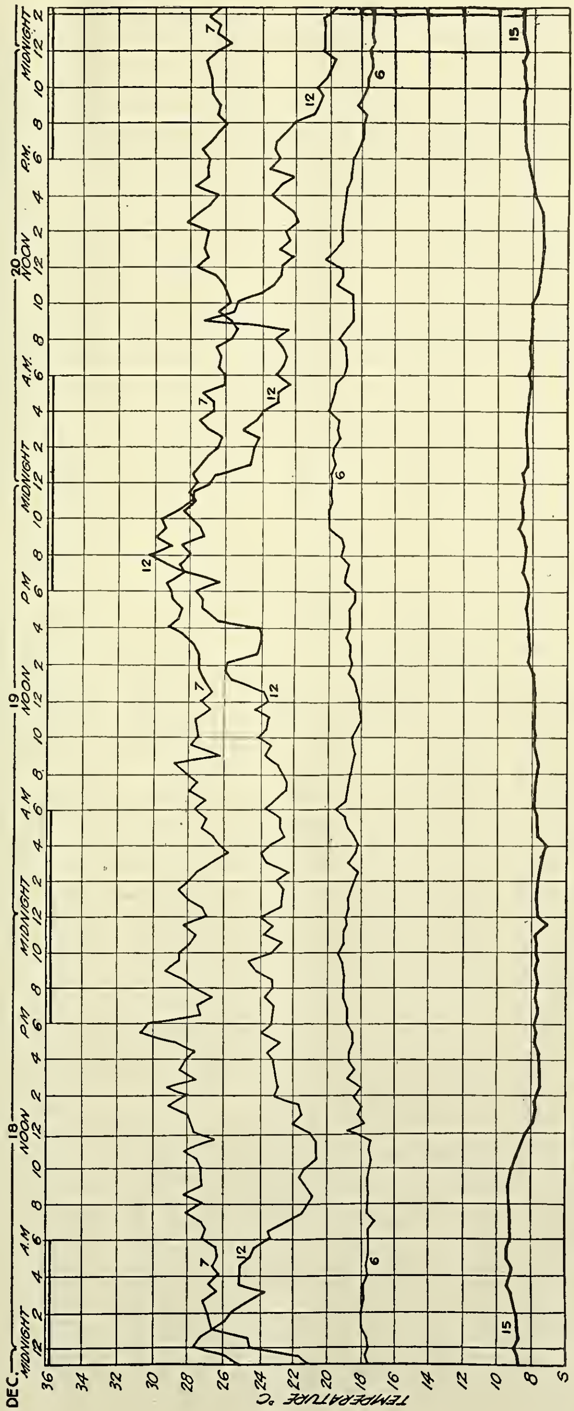

CHART III.—Temperatures shown by thermocouples 6, 7, 12, and 15, from 10.30 p. m., December 17, to 2.30 a. m., December 21.

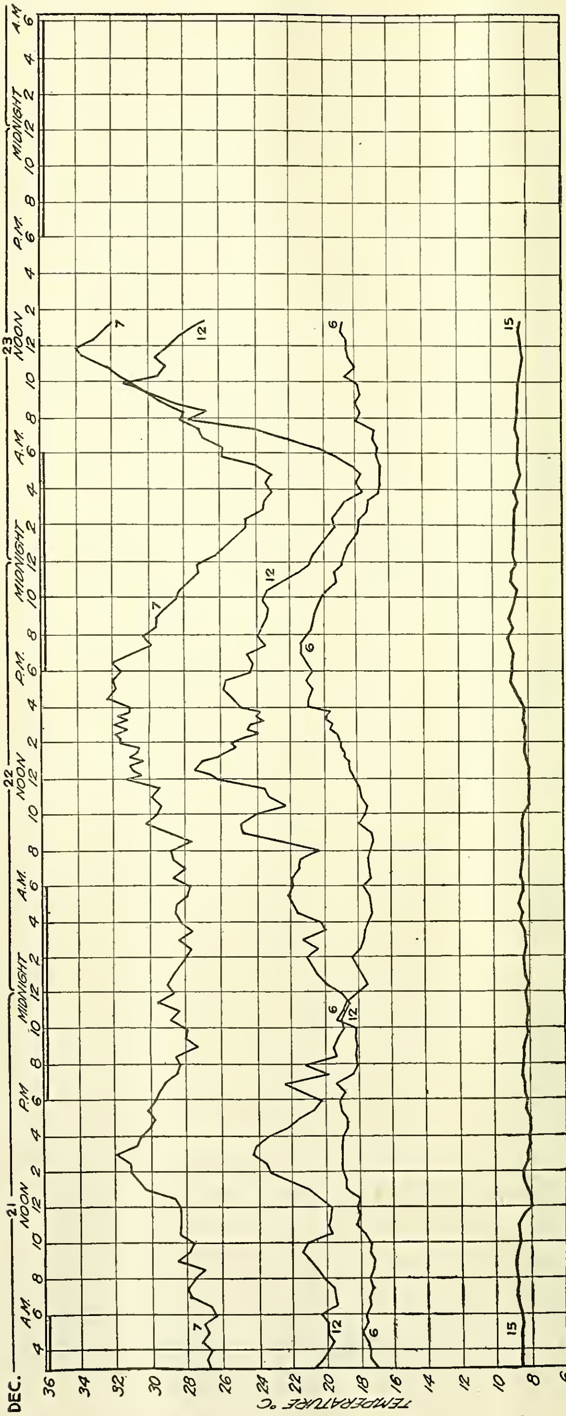

CHART IV.—Temperatures shown by thermocouples 6, 7, 12 and 15, from 2.30 a. m., December 21, to 12.30 p. m., December 23.

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 989

Contribution from the Bureau of Chemistry, W. G. CAMPBELL, Acting Chief, and Insecticide and Fungicide Board, J. K. HAYWOOD, Chairman.

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PINE-OIL AND PINE-DISTILLATE PRODUCT EMULSIONS: METHOD OF PRODUCTION, CHEMICAL PROPERTIES, AND DISINFECTANT ACTION.

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CONTENTS.

PURPOSE OF INVESTIGATION.

The use of a pine-oil emulsion made from "steam" or "steam-and-solvent" process pine oil was advocated by Stevenson (18),[1] of the Hygienic Laboratory of the United States Public Health Service, in 1915, for general disinfecting purposes. He stated that such a product has a Hygienic Laboratory phenol coefficient of 4 to 6, which "remains practically constant for about two months. After that a noticeable deterioration occurs. Samples four months old show a phenol coefficient of about 3.5." According to McCoy, Stimson, and Hasseltine (13), "Hygienic Laboratory pine-oil disinfectant * * * is well adapted to the disinfection of intestinal discharges, but appears to be deficient against pyogenic organisms," and "in the present state of our knowledge the use of this preparation should be confined to bacillary infections such as typhoid fever, cholera, and bacillary dysentery." In October, 1917, Walters (31) pointed out the fact that pine oil is very much less active than phenol against the *Staphylococcus aureus*.

[1] The figures in parentheses refer to the bibliography at the end of this bulletin.

Pine-oil products of the composition recommended by the Hygienic Laboratory and of similar composition have been put on the market by a number of manufacturers. Many of the commercial so-called pine-oil disinfectants are adulterated with kerosene and other mineral oils, and their phenol coefficients fall far below that found by Stevenson (18) for the Hygienic Laboratory pine-oil disinfectant.

The work reported in this bulletin was undertaken for the purpose of determining the physical, chemical, and disinfectant properties of pine-oil and other pine-distillation products in order to secure data to assist in the detection of the adulteration of commercial products, as well as to check up the statements concerning the deterioration of pine-oil disinfectant and its peculiar behavior against certain pathogenic organisms.

PRODUCTION OF PINE OIL.

Pine oil is obtained by the distillation of pine wood in closed retorts. It is an essential oil the odor of which varies from a pleasant pine to a disagreeable empyreumatic, depending on the method of its manufacture and the refining processes used. There are two general processes for making it—destructive distillation and the so-called steam or steam-and-solvent method. The wood used is the same in either case.

In the early days what was considered to be a vast, inexhaustible pine forest, beginning in North Carolina, extended down the coast through Florida and the Gulf States to eastern Texas. Soon the turpentine and lumber industries took most of the standing timber, and they have moved steadily south and westward from North Carolina, where they started, until they have almost reached the end of the forest in Louisiana and Texas. These industries left in their wake a large amount of waste in the form of stumps and dead and down timber. In the course of time, the outer layer rots away from this timber, and the resinous heart material remains, forming what is termed throughout the South "lightwood," so called because it is used to make fires and for lights, not on account of its density. As a matter of fact, it is heavy, some samples having a density as high as 1.075 (30). This is the wood which is used for distillation. Most of it comes from the longleaf southern pine (*Pinus palustris*), although commercially any wood that is "fat" enough, or contains enough resinous material, is used. This includes small amounts of slash pine (*Pinus heterophylla*) and shortleaf pine (*Pinus echinata*) (8) (19). Much of the wood is obtained in the course of clearing land for agricultural purposes.

DESTRUCTIVE DISTILLATION.

The crude beginnings of destructive distillation are to be found in charcoal burning (27), which was carried out in open trenches, the combustion being controlled by partially covering the wood with earth. Tar and charcoal were the only products recovered. Then came the beehive oven, operated in much the same way, which recovered the more volatile parts of the distillate.

The first retort plant, started about 1872 (14) (19), was not very successful for a time. It consisted of a series of retorts heated by fires underneath, and all the distillate was run together. This product was used mainly for the preservation of wood. Many people were experimenting with the idea, however, so that by 1888, according to Clark (5), the process of destructive distillation as applied to wood (longleaf pine) was an established and growing industry in the Southern States.

During this period many patents were taken out and many variations in the method of distillation were tried. The products marketed were charcoal, tar, pitch, creosote oils, and light oils. The light oils, which contained turpentine and pine oil, were not refined. In fact, it was not until about 1900 (7) that wood turpentine came into commercial notice, and even then the samples contained so many impurities that they could be used only for certain purposes and could be sold only at a decided reduction on the price for gum turpentine. Since the market for these oils was limited, the makers turned to the specialty market and sold them for secret uses, so that very often it was the maker who had the best selling agency, not the best plant, that succeeded. French and Withrow (7) cite the case of one firm having 100,000 gallons of a certain oil which they could not sell at 5 cents a gallon, while another firm could not supply its customers at 18 cents a gallon with the same product, but would not buy from the first for fear of future competition. The oils were used for paints, varnishes, stains, insecticides, disinfectants, medicinal products, and numerous other things.

After 1902 (23), when the steam-distilled wood turpentine came on the market, the destructive wood turpentine was also more thoroughly refined. Indeed, so much of the unpleasant odor was eliminated that in many instances it could be made to take the place of gum turpentine. About the same time the pine oil was also refined to a higher degree, and came to be commercially known as such, although it is still marketed also under various trade names.

At present the products of distillation are more or less standardized, but the plants vary in minor details. The capacity of the retorts varies from 1 to 11 cords. The retorts may be cylindrical or rectangular in cross-section and either horizontal or vertical. Some of them are heated by fires directly underneath and some by hot gases drawn through flues in the retort. The retorts also are heated to a higher temperature during the distillation in some plants than in others. The details depend to a large extent on the ideas of the man in charge and on what he considers to be his most important product. If it is charcoal, he will heat longer and at a higher temperature; if it is wood turpentine, he will heat carefully at first; and so on.

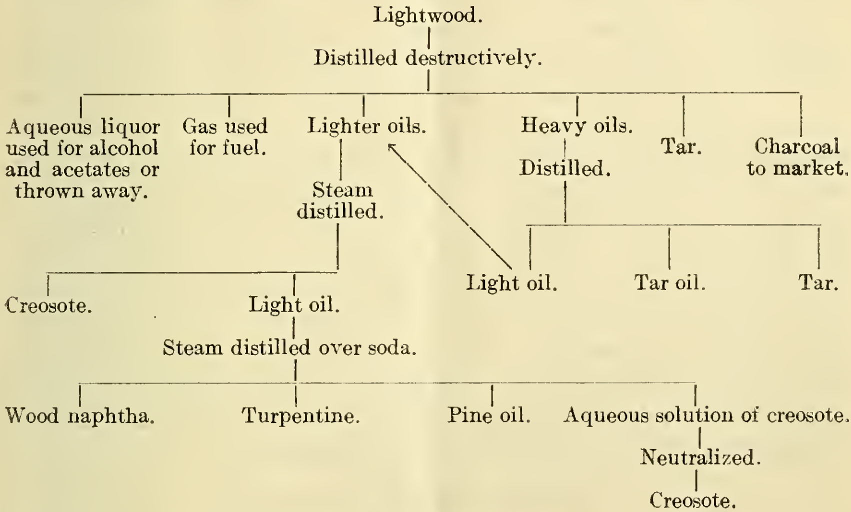
The methods in use in the spring of 1919 were in general as follows: The lightwood is brought to the plant in cordwood lengths, or shorter, and split to about the size of ordinary cordwood. The stumpwood, of course, is very crooked and does not pack well, but is usually richer in resinous material than the upper timber. This wood may be packed in the retort by hand as received, or after being cut into two-foot lengths, or it may be loaded on cars which are run into the retorts. The retorts are then sealed, steam run in to displace the air, and firing is begun. At first a mixture of aqueous distillate and light oils comes over. This contains most of the turpentine and pine oil, and the heat is kept low until it is over. Then the receiver is changed and the heat increased for the destructive part of the distillation. A fairly large amount of gas is formed in this part of the operation and is usually employed for firing. The heavy oils, which contain most of the tar oils, are gathered in a tank. This material may or may not be separated into two fractions. The tar may be distilled from the retort or it may be allowed to run out from the bottom of the retort through a water seal. When the distillation, which takes from 18 to 48 hours, is finished, the retort is permitted to cool down so that the charcoal will not take fire when it comes into contact with the air. Some plants provide covers about the size of the retort into which the cars containing the charcoal are drawn, and any fire is smothered by shutting off the air. Thus, less time between charges is lost, and the retorts are heated to some extent for the next distillation. In other plants it is necessary to cool the retorts sufficiently to permit the removal of the charcoal by hand, or even to allow a man to go inside to repack the retort. This usually causes a decided loss of time in the distillation cycle.

The oils are refined by fractional distillation in steam stills, repeated once or more according to the purity of the product desired, and distilled once, at least, from over soda solution to remove the creosote oils. The products are a wood naphtha, apparently quite similar to rosin spirits, wood turpentine, pine oil, tar oil, tar, pitch, and creosote. Owing to the heavy demand for flotation oils in the past few years, however, a very large amount of the oil has been sold unrefined for this purpose.

The yields of oils vary with the amount of resinous material in the wood and the methods employed in the distillation. Another factor in the reported variations of yields is that results are usually reported as so much a cord, while the wood charge is weighed rather than measured, the weight called a cord varying from about 3,500 to 5,000 pounds. Yields of total crude oils claimed vary from 40 to

120 gallons a cord, and the yield of pure pine oil was given as 1 to 4 gallons a cord. Veitch and Donk (28) give, for a cord of 4,000 pounds, a yield of from 36 to 120 gallons of crude oils and from 2 to 5 gallons of pine oil. At present the lower value may be partially due to the fact that the distillers must use poorer grades of lightwood than was necessary heretofore.

The following diagrammatic scheme shows the products of the destructive distillation of lightwood.



STEAM DISTILLATION.

Steam distillation of wood for turpentine and pine oil came later than the destructive distillation. Patents for this process were issued as early as 1864, but, according to Teeple (23), its rapid development did not begin until 1902, probably because of the fact that the price of turpentine, the main product, did not reach paying levels until that time.

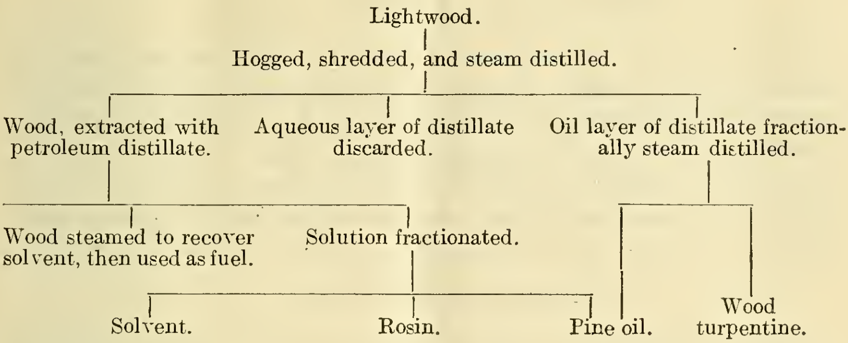
Many variations of the steam process, including the use of superheated and saturated steam, various pressures, various shapes of retorts, and different methods of steam circulation were patented; but finally practically the same method of operation was universally adopted (23). The wood is "hogged" (chipped), sometimes shredded, put in retorts, and subjected to a saturated-steam extraction. At the outset little or no pressure is used on the steam. When the volatile products decrease, the pressure is raised 10 or 15 pounds and subsequently reduced, when the steam and volatile products come out from the chips together. This increase and reduction of pressure is repeated several times. A yield of from 10 to 17 gallons a cord is obtained.

Probably the first wood turpentine sufficiently refined to compete with gum turpentine was put out by these plants. They are also to be credited with early refining of pine oil. By 1908 they were selling it in tank-car lots (20). Most of the steam distillation plants, however, were unable to exist on the low turpentine market of 1911–12, so that by 1913 no plants were operating, except one or two on sawmill waste. In the spring of 1919 none were known to be in operation other than in connection with sawmills.

The methods used on sawmill waste are somewhat different from those used on lightwood. The wood is "hogged" and run into the extractors. Steam is turned on and extraction begun. The period of steaming is much shorter than in the case of lightwood, because there is usually a large amount of waste wood to work on, and since the distilling plant is never large enough to treat all of the waste by complete extraction, it pays better to distill the part of the oil that comes off easily and then discard the chips than completely to extract a smaller amount of wood. As a rule, the sawmill refuse is partly selected so that the distillation plant gets the most resinous part of the waste, including box facings and rich butts. Still, the yields are very low. The oils are separated from the aqueous distillate and fractionally steam distilled in steam-heated stills to give wood turpentine and pine oil, which are the only products obtained by this method of manufacture.

STEAM-AND-SOLVENT PROCESS.

As the rosin is left in the waste wood by the steam process the problem of recovering it arises. The wood, being already shredded, is in good condition for extraction, and so the process of extraction with a volatile solvent is added to the steam process. As carried out at present, the lightwood is first "hogged," then shredded, and put into large extractors. Steam is turned on and steam distillation continued as long as an appreciable amount of oils comes over. Then the steam is turned off, a light petroleum distillate turned in, and extraction with this continued for some time with heating. When practically all the rosin is extracted the solvent-rosin mixture is run into a storage tank, and the chips are steamed to recover residual solvent, after which they are used for fuel. The oil from the aqueous layer is fractionally distilled into wood turpentine and pine oil. The solvent-rosin mixture is fractionated into solvent, pine oil, and rosin. The pine oil obtained from this process contains small amounts of the solvent, and for most commercial purposes it is sold mixed with the pine oil obtained from the steam part of the process. A diagrammatic scheme of the process is as follows:



CHEMICAL COMPOSITION OF PINE OILS.

Steam-distilled and steam-and-solvent process pine oils are pleasant-smelling oils, having the characteristic pine odor. Teeple (20) says that the specific gravity ranges from 0.935 to 0.947, depending on the content of lower boiling terpenes, that a good commercial product will begin to distill at from about 206° C. to 210° C., and that 75 per cent of it will distill between the limits 211° and 218° C. On an oil of density 0.945 at 15.5° C. he found an index of refraction, for the D line, of 1.4830. Schimmel & Co. (17), working on a sample with a density at 15° C. of 0.9536, found an index of refraction at 20° C., for the D line, of 1.48537. The bulk of the sample distilled between 190° and 220° C. and 5 per cent between 160° and 190° C.

The first recorded work on the chemical composition of pine oil is that of Walker, Wiggins, and Smith (30), who concluded that this oil is a terpineol. Teeple (20) showed that the essential constituent of pine oil is a terpineol, probably alpha terpineol. Schimmel & Co. (17) report the following constituents: Camphene, alpha pinene, beta pinene, l-limonene, dipentene, cineol, gamma terpinene, alpha terpineol in large proportions, borneol, methyl chavicol, fenchyl alcohol, and camphor. The first seven of these, all of which boil at 180° C. or lower, doubtless are normal constituents of wood turpentine, and are found in pine oil because of incomplete separation. The last five have boiling points higher than 200° C. and are, therefore, probably normal constituents of pine oil.

The pine oil from destructive distillation varies much more than that from these processes. Chemically it is presumably a mixture of the oil described in the preceding paragraphs with oils formed by the destructive distillation of rosin and wood. The relative proportions of the two parts will vary with the process of distillation. In general, the distillation takes place over a somewhat wider range than in the case of the steam-distilled product.

EXAMINATION OF KNOWN SAMPLES.

In the spring of 1919 samples of pine oil were obtained from all the manufacturers using the steam and steam-and-solvent processes known to the Bureau of Chemistry, as well as from most of those known to be doing destructive distillation. Some of those employing the destructive distillation method were working at the time on crude oils only. From these makers samples of the crude fraction from which the pine oil would be obtained were secured.

METHODS OF EXAMINATION.

Specific gravity.—The specific gravity was taken with a Westphal balance at 20° C.

Distillation.—Distillation was conducted in an ordinary 250 cc. distilling flask, using 50 cc. samples, and was at the rate of about one drop a second. The temperatures are uncorrected.

Resinous material.—In the case of the pine oil the content of resinous material was very small, and it was determined by shaking out the sample with two portions of 25 per cent sodium hydroxid solution, washing the solution twice with ether, acidifying the alkaline extract with dilute sulphuric acid, extracting the resinous material with ether, taking down on the water bath, and weighing. In the case of the wood naphtha and the crude distillates it was determined as directed under "Phenols."

Phenols.—The total alkali-soluble material, extracted as described under "Resinous material," was steam distilled after acidifying with dilute sulphuric acid, and the distillate saturated with salt and extracted with ether. The ether solution was taken down on the water bath and weighed as phenols. The residue in the distillation flask was shaken out with ether, the ether evaporated off, and the residue weighed as resinous material. With ferric-chlorid solution, all the phenols gave a blue coloration, changing to brown on standing. With solid potassium hydroxid and chloroform, they gave a reddish-purple color, indicating the presence of guaiacol.

Unpolymerized residue.—Twenty cubic centimeters of exactly 38 N sulphuric acid, in a graduated narrow-neck Babcock bottle, were cooled in ice water; 5 cc. of the oil to be examined were slowly added and mixed, care being taken that the temperature was kept below 60° C. When the mixture no longer warmed on shaking, it was thoroughly agitated, the bottle was placed in a water bath heated to from 60° to 65° C. for 10 minutes, and the contents were thoroughly mixed by vigorous shaking six times, for one-half minute each time, during the period. The bottles were then cooled to room temperature and filled with concentrated sulphuric acid until the contents came up to the graduations in the necks of the bottles. They were then centrifuged at 1,200 revolutions per minute, for 5 minutes, and the volume of unpolymerized material read off.

Refractive index.—The refractive index was determined on an Abbé type refractometer, the temperature being kept at 20° C.

RESULTS OF EXAMINATION.

The results on the steam and steam-and-solvent process pine oils are given in Table 1.

TABLE 1.—*Composition of steam and steam-and-solvent process pine oils.*

Laboratory No.	Method of manufacture.	Density at 20° C.	Refractive index at 20° C.	Water.	Oil distilled below 190° C.	Distillate, 190°-220° C.	Unpolymerized.	Resinous material.
				Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
31704	Steam	0.932	1.4870	Trace.	3.0	87.6	2.0	0.09
31859	do	.942	1.4848	0.6	1.8	94.6	1.2	.37
31860	do	.945	1.4833	.8	1.2	92.0	1.2	.05
31705	Steam-and-solvent	.930	1.4820	1.0	3.6	92.0	1.2	.17
31706	do	.927	1.4820	.6	7.0	89.0	2.0	.27
31707	do	.932	1.4835	.4	4.0	92.4	3.2	.20

These oils, although obtained from widely separated points, are quite similar according to these analyses. The densities vary from 0.927 to 0.945, and the refractive indices from 1.4820 to 1.4870. In no case did the water exceed 1 per cent or the resinous material 0.5 per cent. The distillate between 190° and 220° C. was from 87.6 to 94.6 per cent.

The destructive-distillation pine oils vary much more in their properties, as will be seen from the results in Table 2.

TABLE 2.—*Composition of destructive-distillation pine oils.*

Laboratory No.	Density at 20° C.	Refractive index at 20° C.	Water.	Oil distilled below 190° C.	Distillate 190°-220° C.	Unpolymerized.	Resinous material.
			Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
31708	0.893	1.4868	Trace.	47.0	50.2	0.8	0.02
31709	.903	1.4920	Trace.	14.8	82.0	.8	.38
31711	.929	1.5000	None.	None.	98.0	.8	.10
31712	.949	1.4995	0.4	Trace.	91.4	.8	.10
31713	.944	1.5035	Trace.	11.0	65.4	.8	[1] 12.50
31714	.886	1.4945	Trace.	65.2	32.4	.8	[1] 1.70

[1] Contained appreciable amounts of wood-tar phenols or creosote.

The densities vary from 0.886 to 0.949; the refractive indices from 1.4868 to 1.5035; the distillate below 190° C., from none to 65.2 per cent; and the alkali-soluble material from 0.02 to 12.5 per cent. In color the oils vary from a light yellow, similar to that of steam-process pine oil, to a dark reddish brown. Certain of them are almost free from the smoky odor characteristic of destructive wood distillates, while others are heavy with it.

Since it was desired to determine whether other oils from the destructive distillation of wood are active germicides, commercial samples of these also were collected and the samples analyzed (Table 3).

TABLE 3.—*Composition of commercial samples of destructive-distillation pine oils.*

Laboratory No.	Description of sample.	Density at 20°C.	Refractive index at 20°C.	Resinous material.	Phenols.	Water.	Oil distilled.			Unpolymerized.
							Below 160° C.	160° C. to 180° C.	180° C. to 220° C.	
				Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
31710	Wood naphtha	0.869	1.4780	[1] 2.59	....	None.	34.0	56.0	6.0	0.8
31715	do	.869	1.4625	2.07	0.54	None.	83.0	12.6	....	.8
31716	do	.868	1.4700	.74	2.43	None.	79.0	16.0	....	.4
31717	Crude light oil	.919	1.4965	11.90	3.85	None.	12.0	39.6	21.0	Trace.
31720	do	.909	1.4840	2.96	5.30	None.	25.0	39.6	28.4	.8
31723	do	.946	1.5105	19.70	4.40	None.	4.0	31.0	27.0	.4
31719	Heavy crude oil	1.028	1.5450	37.40	6.20	0.6	4.0	8.0	16.0	None.
31718	Entire crude oil	.975	1.5255	20.10	5.80	None.	19.4	14.6	12.8	0.8
31721	do	1.020	1.5460	37.90	4.80	1.0	6.0	8.0	15.0	Trace.
31722	do	1.003	1.5355	26.80	6.40	.8	6.4	10.0	20.0	Trace.
31725	Tar oil	1.049	1.5450	31.30	9.70	1.0	1.6	1.0	8.0	None.
31726	do	1.015	1.5500	22.60	6.00	.4	2.0	6.0	18.0	Trace.

[1] Contained wood-tar phenols which were not separated.

It will be noted that there is a rough relation between the boiling points, densities, and indices of refraction of the crude oils, those with the lower boiling points having the lower densities and lower refractive indices. The unpolymerized residue is in all cases less than 1 per cent. The resinous material and phenols are high in the crude distillate, in some cases as much as 40 per cent.

Pine oil obtained by the steam or steam-and-solvent process is a very uniform product. That obtained from destructive distillation is much less uniform. It consists of the same compounds as the steam-distilled product, together with the distillation products of rosin and wood in various proportions, depending upon the particular manner in which the distillation was conducted.

The crude distillation products also vary greatly in their composition, depending on the practice at the plant where they were made.

The unpolymerized residue in the case of all the products of pine distillation is low, 2 per cent or less, except in one case in which the oil had been in contact with petroleum distillate in the course of manufacture and probably still contained a small amount of it. Since petroleum oils, of course, give high polymerization residues, this provides a method for detecting the adulteration of pine oil with kerosene or other mineral oil fractions.

PREPARATION OF PINE-OIL EMULSIONS.

All of the samples collected, which were fairly representative of the products of destructive distillation of the longleaf pine as carried out commercially, were made into emulsifiable liquids by the method given for the Hygienic Laboratory pine-oil disinfectant (18), with certain modifications in some cases.

The oil, rosin, and alkali solutions were mixed in the following proportions and according to the following directions:

	Grams.
Oil	1,000
Rosin	400
25 per cent sodium hydroxid solution	200

The oil and rosin were heated together in a covered porcelain vessel until all the rosin dissolved. The mixture was cooled to 80° C., the sodium hydroxid solution added, and the liquid violently stirred for at least 10 minutes. Sufficient water was added to make the mixture to the original weight, and the preparation cooled. It will be noted, of course, that only the steam or steam-solvent oils are used in the Hygienic Laboratory pine-oil disinfectant. Oils Nos. 31717, 31718, 31719, 31725, and 31726 already contained so much resinous material that they did not emulsify well when the full amount of rosin called for by the Hygienic Laboratory formula had been added to them. Consequently, less rosin was used in these cases, one-half the specified amount in the case of Nos. 31717 and 31718, and no additional rosin in the others. The usual amount of sodium hydroxid solution was added in these mixtures. In mixing with water all gave fair emulsions.

These products were then used for determining the bactericidal efficiency, the results of which are given in the following pages.

DISINFECTANT ACTION OF EMULSIONS OF PINE-OIL AND OTHER PINE-DISTILLATION PRODUCTS.

STEAM-DISTILLED AND STEAM-AND-SOLVENT PROCESS PINE-OIL EMULSIONS.

Stevenson (18) claimed for a pine-oil emulsion made from steam or steam-and-solvent process pine oil, advocated by him in 1915 as a general disinfectant, a phenol coefficient of from 4 to 6, and stated that it could be used in any dilution up to $\frac{1}{500}$, according to the time it was allowed to act. The dilution recommended for practical use seems to have been based solely on the Hygienic Laboratory phenol coefficient. Stevenson also stated that the preparation deteriorates with age. Later McCoy, Stimson, and Hasseltine (13), and Walters (31) called attention to the fact that this pine-oil disinfectant, although showing a high disinfectant value against organisms of the typhoid group and certain others, is much less efficient than phenol or cresol against other common pathogenic organisms, notably *Micrococcus aureus*.

In order to check these various statements, six samples of pine oil were prepared according to the directions given on page 11 of this bulletin, and their Hygienic Laboratory phenol coefficients determined immediately after making, at the end of a month, and in from 12 to 13 months. In these tests Armour's peptone was substituted for Witte peptone, which was difficult to obtain and not of uniform quality. The same lot of peptone was used throughout, but the meat extract used in the broth was from two different batches, the one employed at the end of the experiments being much darker than the other. The tests were made by two operators using the same materials.

When freshly made, these six samples gave coefficients varying from 3.42 to 4.34. At the end of a month the same samples gave coefficients ranging from 3.31 to 4.19, and at the end of 12 months they gave coefficients ranging from 3.14 to 4.23. The greatest single variation obtained was a drop from 3.85 when freshly made to 3.14 at the end of a year. The average of the coefficients obtained on these six freshly made preparations was 3.88. At the end of the month the average was 3.74, and at the end of 12 months the average was 3.66. This would seem to indicate a deterioration of less than 10 per cent in one year. Taking into consideration the limitations of the test, however, it is evident that this apparent deterioration is practically negligible.

With respect to dilutions, none of the samples examined were uniform in killing *B. typhosus* in $\frac{1}{500}$ dilution in 15 minutes, and two failed to kill in $\frac{1}{400}$ dilution in this length of time. While it is probably true that a $\frac{1}{500}$ dilution would have killed if allowed to remain in contact with the organism for an indefinite time, yet, considering the difficulties of practical disinfection as compared to the artificial test, it is evident that a $\frac{1}{500}$ dilution is too high to recommend even for *B. typhosus*. Under the circumstances it would be much safer to recommend a dilution of not over 1 in 100 when used in cases of typhoid fever.

In testing the efficiency of the product against *Micrococcus aureus*, several strains of this organism were employed, as it varies markedly in its resistance to pine-oil preparations. In all, four strains were tested. These were given laboratory numbers 200, 202, 203, and 204. No. 200, a stock strain over five years old, formerly used for class demonstrations, at that time gave typical lesions in the rabbit. At present it is practically nonpathogenic. Nos. 202 and 203 were freshly isolated by the writer from infections in the finger and neck. No. 202 caused abscess formation in the rabbit. No. 203 was nonpathogenic for this animal. No. 204 was a freshly isolated strain obtained from the United States Navy medical school through the courtesy of Dr. Pryor. It killed the rabbit, when injected intravenously in dosage of 2 cc. broth culture, in from one to two days. The lesions produced were those of septicæmia. All the strains produced pigment on potato, and microscopically and culturally seemed typical. They could be differentiated one from the other only by animal inoculation and by the difference in resistance shown by one of them to pine oil.

In testing the pine-oil emulsions against these strains the Rideal-Walker technique was used, and, in order to guard against possible error through contamination, the pathogenic strains were, in at least one test, passed through a rabbit after recovery from the pine oil.

No. 200, the old stock strain, was found to be the most variable in its power of resistance. It was tested against all six samples of the Hygienic Laboratory pine-oil disinfectant, and gave R. W. coefficients ranging from none to 1. In no case, however, was it killed in 15 minutes by a dilution of $\frac{1}{100}$. The variability of this strain made it obviously unsuited for experimentation, for which reason the other three strains were obtained.

Nos. 202, 203, and 204 acted alike, and were found to resist 5 and 10 per cent emulsions for 15 minutes. Since 10 per cent is too strong to make a satisfactory emulsion, it was evident that the product is, for all practical purposes, useless against these strains in any strength.

In order to test the efficiency of pine oil against the spore-bearing group of bacteria, a number of experiments were made in which *B. anthracis* was employed as the test organism. Old neutral-agar cultures were used. To these sterile distilled water was added, after which small pieces of sterile filter paper were saturated in the resulting mixture. These pieces of paper were transferred to test tubes containing 5 and 10 per cent dilutions of the pine-oil emulsion. After various intervals of time they were again transferred to tubes of broth, in order to free them from the pine oil, and finally transferred to neutral agar. The tubes were kept at a room temperature of from 20° to 25° C. Two samples were tested in 10 per cent emulsion and one in 5 per cent emulsion. Under these conditions pine oil failed to kill the spores of *B. anthracis* in 3 days.

EMULSIONS OF DESTRUCTIVE-DISTILLED PINE OIL AND OTHER PRODUCTS OF DISTILLATION.

In addition to the sample of Hygienic Laboratory pine-oil disinfectant prepared by the method described by Stevenson, there are on the market a number of preparations made from inferior oils. These (page 9) are known as destructive-distilled pine oil, wood naphtha, crude light oil, entire crude oil, and tar oil. Experiments on these preparations were carried out in the same way as those on the Hygienic Laboratory pine-oil disinfectant.

Five samples of the destructive-distilled pine-oil emulsions gave coefficients ranging from 1.71 to 3.42 when freshly prepared. At the end of a month the range was from 1.68 to 3.40, and at the end of the year from 1.45 to 3.23. The greatest individual drop in one year was from 1.71 when freshly made to 1.45 at the end of the year. The average was 2.47 when freshly prepared, 2.52 at the end of the month, and 2.46 at the end of the year. No deterioration could be demonstrated. It should be noted that these samples varied one from the other more markedly than did the Hygienic Laboratory pine-oil disinfectants, one showing a coefficient of 1.71, another a coefficient of 3.42.

Two samples of the wood naphtha oil emulsion were examined. One gave a coefficient of 0.70 when freshly prepared, 0.60 at the end of a month, and 0.60 at the end of a year. The other gave a coefficient of between 0.54 and 0.60 when fresh, 0.44 at the end of a month, and 0.45 at the end of a year. The slight decrease in the coefficient noted at the end of the first month is too small to indicate any definite deterioration.

A sample of "light" crude-oil emulsion gave a coefficient of 0.85 when fresh, 0.75 at the end of a month, and 0.90 at the end of the year. A second sample, examined within a month of its manufacture, showed a coefficient of 0.84. At the end of the year the coefficient was 1.03.

A sample of the "heavy" crude-oil emulsion had a coefficient of 0.74 when examined in the first month. At the end of a year it was 0.78.

A sample of emulsion made from the entire crude oil gave a coefficient of 0.60 when fresh, 0.64 at the end of the month, and 0.64 at the end of the year. A second sample gave a coefficient of 0.74 at the end of a month, and 0.85 at the end of the year.

Two samples of tar-oil emulsions showed coefficients of 0.82 and 0.70 in the first month, and 0.84 and 0.83, respectively, at the end of a year.

The action of these samples on *M. aureus* and *B. anthracis* was similar to that of the Hygienic Laboratory pine-oil disinfectant. That is to say, when tested against *M. aureus* strain 200, they gave Rideal-Walker coefficients ranging from none to 0.7, but when tested against strains 202 and 203, they failed to kill in any dilution. Likewise they failed to kill *B. anthracis* in 5 and 10 per cent emulsions.

CONCLUSIONS.

Pine-oil emulsions made from steam-distilled pine oils, when freshly prepared, gave Hygienic Laboratory coefficients varying from 3.42 to 4.34, the average being 3.88. At the end of 12 months the average was 3.66.

A disinfectant prepared from destructive-distilled pine oil is weaker as well as more variable in its germicidal power against *B. typhosus* than is the Hygienic Laboratory pine-oil disinfectant. The samples examined gave Hygienic Laboratory coefficients of from 1.71 to 3.42.

Emulsions made from the other oils tested gave coefficients under 1. These preparations failed to emulsify completely in 10 per cent concentration.

Pine-oil emulsions made from various grades of pine oils failed to kill *M. aureus* and *B. anthracis* in any dilution capable of emulsification.

In view of the results obtained these products should not be used for general disinfecting purposes.

When using pine-oil emulsions against *B. typhosus*, it is safer, for practical purposes, to employ a solution of five times the strength capable of killing the organism in five minutes. Thus a product showing by the Hygienic Laboratory method a killing power of $\frac{1}{500}$ should be used in a $\frac{1}{100}$, or 1 per cent, dilution. If a product will not give a dilution having a concentration five times that of the weakest concentration capable of killing *B. typhosus* in 15 minutes, and remain completely emulsified, it should not be used as a disinfectant.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 990

Contribution from the Bureau of Markets and Crop Estimates
H. C. TAYLOR, Chief

Washington, D. C. PROFESSIONAL PAPER October 20, 1921

PRELIMINARY MANUFACTURING TESTS OF THE OFFICIAL COTTON STANDARDS OF THE UNITED STATES FOR COLOR FOR UPLAND TINGED AND STAINED COTTON.

By W. R. MEADOWS, *Cotton Technologist*, and W. G. BLAIR, *Specialist in Cotton Testing.*

CONTENTS.

GRADES OF COTTON TESTED.

The spinning tests[1] herein described were conducted to determine the relative values of the following grades of cotton:

Low Middling	L.M.
Good Middling Yellow Tinged	G.M.Y.T.
Middling Yellow Tinged	M.Y.T.
Low Middling Yellow Tinged	L.M.Y.T.
Good Middling Yellow Stained	G.M.Y.S.
Middling Yellow Stained	M.Y.S.
Good Middling Blue Stained	G.M.B.S.
Middling Blue Stained	M.B.S.

ORIGIN OF COTTON USED.

The cotton for these tests was purchased by expert cotton classers of the Bureau of Markets for use in the preparation of the Official Cotton Standards of the United States for color for Upland tinged and stained cotton.

[1] This cotton was classed by members of the committee authorized to hear disputes under the provisions of the United States cotton futures act. The spinning tests were conducted in the textile department of the North Carolina State College of Agriculture and Engineering, under the general direction of W. R. Meadows, cotton technologist, and were made by W. G. Blair, specialist in cotton testing, assisted by C. E. Folk, E. S. Cummings, and H. B. Richardson, assistants in cotton testing, and E. F. Upton, formerly assistant in cotton testing.

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Upon receipt of this cotton in Washington it was again classed and stapled and only typical bales of each grade were included in the final selection. By using this selection, the bulk of the off-colored cottons from the various districts of the cotton belt were included.

Table 1 shows the grade, weight, number of bales, length, and character of staple, point of origin, and the year in which the cotton was grown.

TABLE 1.—*Stock selected for spinning test on colored cotton.*

Grade.	Weight.	Staple length.	Character of staple.	Origin.	Crop.	Remarks.
	Pounds.	*Inch.*			*Year.*	
L.M.	126	15/16	Medium	Little Rock, Ark	1919–20	Full on grade.
	100	15/16	Medium	Bay City, Tex	1919–20	Shy because of pin leaf.
	115	15/16	Medium	New York, N.Y	1917–18	
	140	15/16	Medium	Atlanta, Ga	1919–20	
	481					
G.M.Y.T.	60	15/16	Medium	Atlanta, Ga	1917–18	
	60	15/16	Medium	Atlanta, Ga	1917–18	
	60	15/16	Medium	Atlanta, Ga	1917–18	
	60	15/16	Medium	Atlanta, Ga	1917–18	
	60	15/16	Medium	Little Rock	1917–18	
	300					
M.Y.T.	40	7/8	Medium	Unknown	1917–18	
	60	15/16	Medium	Augusta, Ga	1917–18	
	60	15/16	Medium	Atlanta, Ga	1917–18	
	60	15/16	Medium	Savannah, Ga	1917–18	
	60	15/16	Medium	Memphis, Tenn	1917–18	
	280					
L.M.Y.T.	87	15/16	Medium	Memphis, Tenn	1918–19	Full 15/16 inch.
	105	15/16	Medium	Chattanooga, Tenn	1916–17	
	80	15/16	Medium	Oklahoma City	1918–19	
	40	15/16	Medium	Savannah, Ga	1918–19	
	312					
G.M.Y.S.	100	1	Medium	Memphis, Tenn	1918–19	
	106	1	Medium	Atlanta, Ga	1918–19	15/16 to 1 inch full.
	60	15/16	Medium	Memphis, Tenn	1917–18	
	266					
M.Y.S.	133	15/16	Medium	Memphis, Tenn	1918–19	
	84	1	Medium	Memphis, Tenn	1918–19	Full inch.
	30	15/16	Medium	Atlanta, Ga	1918–19	Somewhat gin-cut.
	247					
G.M.B.S.	110	15/16	Medium	Macon, Ga	1918–19	
	95	15/16	Medium	Greensboro, N.C	1918–19	
	52	7/8	Medium	Augusta, Ga	1918–19	
	257					
M.B.S.	105	15/16	Medium	Greensboro, N.C	1918–19	
	100	7/8	Medium	Augusta, Ga	1917–18	
	107	1	Medium to hard.	Memphis, Tenn	1915–16	
	312					

MECHANICAL CONDITIONS.

The different bales of each grade of cotton were arranged around the hopper bale breaker in a semicircle. A layer from each bale was taken in rotation and placed in the hopper.

Each grade was opened during the afternoon, the opened cotton being placed in a bin and allowed to age overnight. It was not considered necessary to allow the cotton to age for a longer period because all the ties except two had been removed upon receipt of the cotton two months previously.

Preliminary tests were made on the cleaning machines, Low Middling cotton being used until the visible waste was approximately equal to that removed during the previous tests.[2] This was done in order that the merits of the several grades of white and colored cottons might be put as nearly as possible on a comparative basis.

The same mechanical conditions were maintained for all grades throughout the test.

The relative humidity in the carding and spinning rooms was maintained as nearly as possible between 60 and 65 per cent during the entire test.

PERCENTAGES OF WASTE.

Accurate records were kept of the net amount of cotton fed to each cleaning machine, the amount of each kind of waste discarded, and the weight of the finished product.

The waste percentages calculated from the above items are shown in Table 2.

TABLE 2.—*Percentages of waste from the different grades of cotton tested.*

Character of waste.	White.	Yellow Tinged.			Yellow Stained.		Blue Stained.	
	L.M.	G.M.Y.T.	M.Y.T.	L.M.Y.T.	G.M.Y.S.	M.Y.S.	G.M.B.S.	M.B.S.
PICKER WASTE.[a]	*Per ct.*	*Per cent.*	*Per ct.*	*Per cent.*	*Per cent.*	*Per ct.*	*Per cent.*	*Per ct.*
Opener-breaker motes and fly	1.63	1.00	1.20	1.87	0.81	0.86	1.36	2.08
Finisher motes and fly	.83	.50	.64	1.17	.50	.97	.68	1.30
Total visible	2.46	1.50	1.84	3.04	1.31	1.83	2.04	3.38
Invisible	2.93	.99	1.17	1.12	.25	1.50	.25	1.70
Total visible and invisible	5.39	2.49	3.01	4.16	1.56	3.33	2.29	5.08
CARD WASTE.[b]								
Flat strippings	2.57	2.88	3.32	3.53	2.64	3.93	2.57	2.98
Cylinder and doffer strippings	.62	.97	1.12	1.16	1.13	1.56	.75	.96
Motes and fly	2.81	1.65	2.02	4.34	1.68	3.57	1.82	3.25
Sweepings	.11	.17	.11	.31	.18	.17	.18	.14
Total visible	6.11	5.67	6.57	9.34	5.63	9.23	5.32	7.33
Invisible	.28	[c] 1.24	[c] .79	.22	.82	.89	1.78	.66
Total visible and invisible	6.39	4.43	5.78	9.56	6.45	10.12	7.10	7.99
THROUGH CARDS.[a]								
Total visible	8.23	7.04	8.21	11.99	6.85	10.75	7.24	10.24
Total invisible	3.20	[c] .22	.40	1.33	1.06	2.36	1.99	2.33
Total visible and invisible	11.43	6.82	8.61	13.32	7.91	13.11	9.23	12.57

[a] Based upon net weight fed to bale breaker. [b] Based upon net weight fed to cards. [c] Gain.

[2] See U. S. Department of Agriculture Bulletin 591: Manufacturing Tests of the Official Cotton Standards for Grade, by William S. Dean and Fred Taylor. 1917.

The visible waste discarded by a cleaning machine can be governed by the settings used on that machine.

The invisible waste can not be governed with any degree of accuracy, since it depends upon the grade and character of the cotton and the relative humidity at the time the cotton is run. Table 2 shows that there was a large invisible loss on the grade of Low Middling on the pickers. This loss is partly accounted for by the low relative humidity and high temperature existing while this grade was being run. (See Table 3.)

TABLE 3.—*Average temperature and relative humidity in picker and card room.*

Room.	L.M.	G.M.Y.T.	M.Y.T.	L.M.Y.T.	G.M.Y.S.	M.Y.S.	G.M.B.S.	M.B.S.
Pickers:	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*
Average temperature	81	85	86	90	85	79	77	88
Average relative humidity	45	69	70	60	65	62	65	61
Cards:								
Average temperature	81	81	81	84	79	81	80	91
Average relative humidity	63	73	75	69	68	64	71	63

All grades except G.M.Y.S., M.Y.S., and M.B.S. stood overnight between the pickers and the cards.

If the total percentages of waste are used as a basis of value the following order is obtained:

(1) Good Middling Yellow Tinged; (2) Good Middling Yellow Stained; (3) Middling Yellow Tinged; (4) Good Middling Blue Stained; (5) Low Middling; (6) Middling Blue Stained; (7) Middling Yellow Stained; (8) Low Middling Yellow Tinged.

MOISTURE DETERMINATIONS.

Samples of each grade of cotton were taken at each machine or process, weighed on a sensitive equal-arm balance, placed in air-tight cans, and shipped to Washington, dried to absolute dryness, and reweighed on equally sensitive balances. The moisture content of each sample was then calculated. The results are shown in Table 4.

The low humidity conditions noted on the pickers while the Low Middling grade was being run are checked by the moisture content of the samples taken at this process.

TABLE 4.—*Percentages of moisture*[1] *in the cotton of the different grades at various points in the cotton-manufacturing processes.*

Sample.	L.M.	G.M.Y.T.	M.Y.T.	L.M.Y.T.	G.M.Y.S.	M.Y.S.	G.M.B.S.	M.B.S.
	Per ct.	*Per cent.*	*Per ct.*	*Per cent.*	*Per cent.*	*Per ct.*	*Per cent.*	*Per ct.*
Raw cotton from bale breaker	5.59	7.47	6.55	6.78	7.18	7.75	6.44	6.72
Lap from opener-breaker lapper	4.17	8.28	7.58	6.72	7.47	6.95	6.67	6.67
Lap from finisher picker	4.17	8.64	7.70	6.61	7.53	7.41	6.49	5.88
Sliver from cards	5.04	8.17	6.89	6.44	6.95	6.49	6.38	5.71
Sliver from finisher drawing	6.21	7.64	7.47	6.21	7.24	7.18	6.61	5.93
Roving from fine frame	8.51	6.78	6.83	6.78	7.00	6.38	5.26	5.76
22's yarn	6.67	6.49	5.99	7.24	6.04	6.38	5.54	5.76

[1] Percentages expressed as "regain."

STRENGTH OF YARNS.

Each grade of cotton was spun into 22's yarn. The turns per inch inserted were 19.9, 21.1, and 22.3, using twist multipliers of 4.25, 4.50, and 4.75, respectively.

In the cotton-testing laboratory at Washington each grade and twist was reeled into skeins of 120 yards and broken under constant relative humidity conditions of 65 per cent at 70° F.

TABLE 5.—*Comparing the breaking strength of 22's yarn with different twists.*

Twist multiplier.	Turns per inch.	L.M.	G.M.Y.T.	M.Y.T.	L.M.Y.T.	G.M.Y.S.	M.Y.S.	G.M.B.S.	M.B.S.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
4.25	19.9	79.9	84.2	89.0	79.1	83.4	82.1	76.1	75.8
4.50	21.1	81.3	85.7	88.5	81.2	87.2	82.9	76.6	79.5
4.75	22.3	77.3	81.9	82.6	77.2	82.6	77.1	73.2	77.5

Table 5 shows that the yarn of each grade spun with the twist multiplier of 4.50 was the strongest. This fact is very important because the twist multiplier of 4.75 is usually used as a standard for warp yarns where strength is required. There is one exception to the above fact; in the case of the Middling Yellow Tinged the strongest break per skein was obtained with a twist multiplier of 4.25. This difference, however, is so small that it is scarcely to be considered.

The yarn with 21.1 turns per inch, or the 4.50 twist multiplier, broke on an average 2.05 per cent stronger than that with 19.9 turns per inch, or 4.25 twist multiplier, and 5.32 per cent stronger than that with 22.3 turns per inch, or the 4.75 twist multiplier.

Comparing the breaking strengths of the yarns with the same twist, there appears to be no definite relationship between the strength of the yarn and the grade of the cotton from which it is spun.

Arranging the grades in the order of their strength values, a slightly different order is observed than when they are arranged in the order of their waste values, the order of strength values being Middling Yellow Tinged, Good Middling Yellow Stained, Good Middling Yellow Tinged, Middling Yellow Stained, Low Middling, Low Middling Yellow Tinged, Middling Blue Stained, and Good Middling Blue Stained.

The breaking strength of the yarn was also tested by the single-strand method. The results of these tests are shown in Table 6 and indicate a slight difference in the relationship between the strength of the different grades from that found in the skein tests.

TABLE 6.—*Average breaking strength in ounces of single strands from 22's yarn. (Twist multipliers 4.25, 4.50, and 4.75.)*

Twist multiplier.	L.M.	G.M.Y.T.	M.Y.T.	L.M.Y.T.	G.M.Y.S.	M.Y.S.	G.M.B.S.	M.B.S.
	Ounces.	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*
4.25	10.4	11.0	11.2	11.1	11.8	11.0	10.0	10.2
4.50	10.4	11.1	11.9	11.0	11.1	10.4	10.5	10.9
4.75	10.6	11.4	11.2	10.7	11.8	10.5	9.9	10.7

MANUFACTURING PROPERTIES.

On opening the several grades the Middling Yellow Stained and Low Middling Yellow Tinged gave off a considerable amount of dust. No noticeable feature was encountered in running the other grades through the pickers.

On the cards the Middling Yellow Stained and Low Middling Yellow Tinged gave off considerable fly at stripping time. These grades were followed in order by Good Middling Yellow Stained, Middling Blue Stained, and Middling Yellow Tinged. The remaining grades had the usual amount of fly. During a 10-hour day on a commercial basis the cards would have to be stripped four times for the Middling Yellow Stained and Low Middling Yellow Tinged; three times on the Good Middling Yellow Stained, Middling Blue Stained, and Middling Yellow Tinged; and twice a day on the Good Middling Blue Stained, Low Middling, and Good Middling Yellow Tinged.

A large amount of trash and fly collected on the roller beams of the roving frames and spinning frame. The largest amount was noticed on the Middling Yellow Stained and Low Middling Yellow Tinged, followed in order by Good Middling Yellow Stained, Middling Blue Stained, Middling Yellow Tinged, Good Middling Blue Stained, Low Middling, and Good Middling Yellow Tinged.

On the spinning frame the only grade that gave any trouble was the Good Middling Blue Stained. The other grades would go a full doff without more than one or two ends breaking down, whereas the Good Middling Blue Stained had about twice as many down in the same time.

The Middling Yellow Stained yarn contained a considerable amount of leafy trash.

BLEACHING PROPERTIES.

Bleaching and dyeing tests were made in the textile department of the North Carolina State College of Agriculture and Engineering and under commercial conditions in a bleachery at Providence, R. I.

The three different twists of 22's yarn made from each grade were tested.

TEXTILE SCHOOL TESTS.

Bleaching:

Scouring.—The yarn was washed in cold water for 15 minutes, after which it was boiled in a 2-degree Twaddle solution of caustic soda for 7 hours. It was then washed twice in cold water and hydroextracted.

Chemicking.—The yarn was bleached in a 1¾-degree Twaddle chlorine solution for 2 hours. It was then washed for 30 minutes in cold water and hydroextracted.

Souring.—The yarn was soured for 1½ hours in a 1½-degree Twaddle solution of sulphuric acid and then washed in cold water until free from chlorine.

Soaping.—The yarn was soaped in a solution of 5 per cent Solvay soda and 0.012 per cent methylene blue, which was heated to 160° F. It was then washed in hot water at 120° F., then in cold water, hydroextracted and dried.

The best bleach was obtained on Good Middling Yellow Tinged, followed in order by Good Middling Yellow Stained, Low Middling, and Middling Yellow Stained, each of which gave a good commercial white. The other four grades did not give a satisfactory white. The Middling Yellow Tinged and Low Middling Yellow Tinged had a bluish appearance, while the Good Middling Blue Stained and Middling Blue Stained had a decided slaty or bluish cast. The Middling Blue Stained came out the poorest white of all the grades tested, the bleaching process having practically no effect upon the blue color of this grade. The greatest improvement was noticed in the case of Middling Yellow Stained, this grade having a deep yellow color and considerable trash before bleaching. After processing, this grade had the fourth best white and in addition had lost most of its trash. A trial test was made on the blue stains by putting them through the bleaching solution and acid a second time. Their whiteness was not improved by this double bleach.

Dyeing:

Tests were made on the eight grades by dyeing them with direct colors—pink and blue.

Pink.—The bleached yarn was dyed with the following formula: 0.5 per cent amidine fast pink, 6 per cent Glauber's salt, and 2 per cent Solvay soda. The yarn was treated in this bath for 30 minutes at 140° F., washed in warm water (120° F.), rinsed in cold water, and dried.

The best pinks were obtained on the grades that gave the best bleach. The best pink was obtained on the Good Middling Yellow Tinged, followed in order by Good Middling Yellow Stained, Low Middling, Middling Yellow Stained, Middling Yellow Tinged, Low

Middling Yellow Tinged, Good Middling Blue Stained, and Middling Blue Stained.

Blue.—The bleached yarn was dyed with the following formula: 2 per cent brilliant fast blue 2G, 0.5 per cent Pluto Black 5 P. S. Extra, 10 per cent Glauber's salt, and 2 per cent Solvay soda. The yarn was treated in this bath for 1 hour at 180° F., washed in warm water (120° F.), and then in cold water and dried.

Good blues were obtained on all the grades, with very little difference in depth of color.

Breaking strength of bleached and dyed yarns:

Single-strand tests were made of the gray, bleached, and dyed yarns to determine the effect of bleaching and dyeing on the strength of the yarns. The results of these tests are shown in Table 7. To put the results on a commercial basis, different skeins were used in the gray, bleached, and dyed tests.

TABLE 7.—*Average breaking strength in ounces of single strands from gray bleached, and dyed yarn spun from the different grades of cotton. (Textile School Test.)*

Yarn.	L.M.	G.M. Y.T.	M.Y.T.	L.M. Y.T.	G.M. Y.S.	M.Y.S.	G.M. B.S.	M.B.S.	Average.
4.25√22:	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*
Gray	10.4	11.0	11.2	11.1	11.8	11.0	10.0	10.2	10.84
Bleached	9.4	12.0	10.5	11.3	12.2	11.9	10.9	9.4	10.95
Dyed pink	10.3	10.5	11.1	10.1	11.6	12.2	11.3	10.0	10.89
Dyed blue	9.4	11.4	10.6	8.7	11.0	10.4	9.6	10.0	10.14
4.50√22:									
Gray	10.4	11.1	11.9	11.0	11.1	10.4	10.5	10.9	10.91
Bleached	10.4	12.0	10.9	10.2	11.7	9.8	9.0	10.4	10.55
Dyed pink	10.0	11.9	10.0	10.1	11.0	12.0	9.7	9.6	10.48
Dyed blue	10.1	11.9	10.8	9.6	10.7	11.5	10.1	9.2	10.49
4.75√22:									
Gray	10.6	11.4	11.2	10.7	11.8	10.5	9.9	10.7	10.85
Bleached	9.7	8.7	11.6	11.4	11.8	12.0	9.2	9.5	10.49
Dyed pink	10.1	11.2	10.4	9.6	10.7	10.5	9.3	9.5	10.16
Dyed blue	9.3	10.7	11.0	9.9	10.7	10.9	10.2	9.4	10.26

MILL TEST.[3]

Tests were made at a bleaching and dyeing plant to give results under commercial conditions. Both the chlorine and peroxide bleaches were tried on all the different grades.

Chlorine bleach:

Scouring.—The yarn was first washed in cold water and boiled for 2 hours in a solution of 2 per cent caustic soda and 1 per cent Turkey Red Oil.[4] It was then washed in cold water.

Souring.—The yarn was soured in 1 per cent hydrochloric acid for one-half hour and then washed in cold water.

[3] These tests were made in a mill at Providence, R. I. The tests were conducted by Chris. E. Folk, assistant in cotton testing. Valuable assistance was rendered by E. S. Graves, general manager, and W. A. Traver, superintendent of the mills.

[4] All percentages are based on weight of the goods being bleached.

Chemicking.—The yarn was bleached in a $1\frac{1}{2}$-degree Twaddle chlorine solution for 2 hours and washed in cold water.

Wash.—The yarn was washed in 2 per cent bisulphite of soda for one-half hour—cold. It was then washed in warm water (160° F.) for 10 minutes and then in cold water and dried.

Fair whites were obtained on two grades only, when using this bleach, namely Good Middling Yellow Tinged and Low Middling.

Double-boil chlorine bleach:

The time of boiling with the caustic soda was doubled over the time used in first chlorine bleach to see if the length of time in the boil affected the whites obtained. The yarn was boiled for 2 hours in a solution of 2 per cent caustic soda and 1 per cent Turkey Red Oil, after which it was drawn off and a new solution of the same strength was put into the machine and the boiling continued 2 hours longer. The yarn was then soured and bleached in the same manner as in the first chlorine bleach.

A good commercial white was obtained on Good Middling Yellow Tinged, Low Middling, and Good Middling Yellow Stained under these conditions.

Peroxide bleach:

Scouring.—The yarn was first washed in cold water and then boiled one-half hour in a solution of 2 per cent Turkey Red Oil, then washed in cold water.

Bleaching.—The yarn was bleached in the solution shown below:

$7\frac{1}{2}$ gallons of water.
$5\frac{3}{4}$ ounces sulphuric acid.
$4\frac{3}{4}$ ounces sodium peroxide.
$4\frac{3}{4}$ ounces sodium silicate.

This solution was kept at 180° F. and run until exhausted. It was tested every 10 minutes and found to be exhausted in $1\frac{1}{2}$ hours. The yarn was then rinsed in cold water.

Wash.—The yarn was washed in three different warm waters—the first at 120° F., the second at 100° F., and the third at 90° F. It was then washed in cold water and dried.

Good Middling Yellow Tinged and the Low Middling were the only grades that gave fair whites.

Double peroxide bleach:

The yarn was treated in the same manner as the first peroxide bleach except that the time was doubled in the bleaching, a fresh solution being made up when the first was exhausted.

Good commercial whites were obtained on Good Middling Yellow Tinged, Low Middling, and Good Middling Yellow Stained.

Dyeing:

Tests were made on the eight grades by dyeing the yarns with vat colors—pink and blue.

Pink.—The bleached yarn was dyed with the following formula: 2 per cent penetrol, 2½ per cent caustic soda, 2¾ per cent hydrosulphite, and 4 per cent indanthrene Red B. N. It was dyed at 120° F., and run for 45 minutes, then washed in hot water and dried. The best pinks were obtained on the grades giving the best bleach. The best pink was obtained on Good Middling Yellow Tinged, followed in order by Low Middling, Good Middling Yellow Stained, Middling Yellow Stained, Middling Yellow Tinged, Low Middling Yellow Tinged, Good Middling Blue Stained, and Middling Blue Stained.

Blue.—The bleached yarn was dyed with the following formula: 2 per cent penetrol, 8½ per cent caustic soda, 8½ per cent hydrosulphite and 12 per cent indanthrene G. C. D. blue. The yarn was dyed at 120° F. for 45 minutes, then washed for 10 minutes in hot water (160° F.), then in cold water and dried. Good blues were obtained on all the grades, there being very little difference in depth of color.

Breaking strength of bleached and dyed yarns:

Single-strand strength tests were made of the gray, bleached, and dyed yarns to determine the effect of the bleaching and dyeing processes. The results of these tests are shown in Table 8. In order to put the results on a commercial basis, different skeins were used on the gray, bleached, and dyed tests.

TABLE 8.—*Breaking strength in ounces of single strands from gray, bleached, and dyed yarn spun from the different grades of cotton. (Mill test.)*

Yarn.	L.M.	G.M. Y.T.	M.Y.T.	L.M. Y.T.	G.M. Y.S.	M.Y.S.	G.M. B.S.	M.B.S.	Average.
	Double boil chlorine.				Double peroxide.				
4.25 √22:	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*
Gray	10.4	11.0	11.2	11.1	11.8	11.0	10.0	10.2	10.84
Bleached	10.4	11.5	12.1	10.7	13.0	12.6	11.0	11.4	11.59
Pink	10.4	11.1	11.1	11.0	12.4	11.7	11.1	10.9	11.21
Blue	10.4	11.9	11.1	10.8	11.3	12.0	10.0	9.8	10.91
	Single peroxide.								
4.50 √22:									
Gray	10.4	11.1	11.9	11.0	11.1	10.4	10.5	10.9	10.91
Bleached	9.7	12.4	11.8	10.7	13.3	12.4	10.0	9.7	11.25
Pink	10.0	12.9	11.5	11.2	11.1	12.4	10.8	10.9	11.35
Blue	10.2	11.6	12.0	11.7	11.4	11.8	9.9	11.0	11.20
	Single chlorine.								
4.75 √22:									
Gray	10.6	11.4	11.2	10.7	11.8	10.5	9.9	10.7	10.85
Bleached	11.6	11.8	12.6	11.9	11.4	11.4	10.0	11.0	11.46
Pink	10.7	11.4	10.9	10.6	11.9	10.5	10.5	10.5	10.88
Blue	10.9	11.7	11.4	10.3	10.1	10.8	9.5	10.2	10.62

SUMMARY.

Low Middling, Good Middling Yellow Tinged, Middling Yellow Tinged, Low Middling Yellow Tinged, Good Middling Yellow Stained, Middling Yellow Stained, Good Middling Blue Stained, and Middling Blue Stained cotton selected throughout the cotton belt were tested to determine their relative spinning values.

All the grades were subjected to the same mechanical conditions. These conditions were the same as those used on earlier tests of the Official Cotton Standards of the United States for Upland white cotton.

The percentages of visible waste made by the different grades were as follows:

Grade.	White.	Yellow Tinged.	Yellow Stained.	Blue. Stained.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Good Middling	.....	7.04	6.85	7.24
Middling	.....	8.21	10.75	10.24
Low Middling	8.23	11.99	.....	.....

From the percentages of visible waste it appears that the waste follows the grade of the cotton.

The Middling Yellow Stained and Low Middling Yellow Tinged gave off considerable fly. These grades were followed in order by Good Middling Yellow Stained, Middling Blue Stained, and Middling Yellow Tinged. The remaining three grades gave off the usual amount of fly.

The breaking strengths in pounds per skein of 120 yards of 22's yarn $(4.50 \times \sqrt{22})$ spun from the different grades were as follows:

Grade.	White.	Yellow Tinged.	Yellow Stained.	Blue Stained.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Good Middling	.....	85.7	87.2	76.6
Middling	.....	88.5	82.9	79.5
Low Middling	81.3	81.2	.....	.....

These results show that the highest grade did not always give the strongest yarn.

The bleaching and dyeing tests show that Low Middling, Good Middling Yellow Tinged, Good Middling Yellow Stained, and Middling Yellow Stained can be bleached satisfactorily for white yarns. The Middling Yellow Tinged and Low Middling Yellow Tinged when bleached can be used for dyeing both light and dark shades.

The Good Middling Blue Stained and Middling Blue Stained can be bleached satisfactorily for dyeing dark shades only.

The single-strand tests show that the bleaching and dyeing processes do not materially affect the strength of the yarn, as shown by the average of all tests: Gray, 10.73 ounces; bleached, 11.05 ounces; pink, 10.83 ounces; blue, 10.60 ounces.

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WM. A. TAYLOR Chief

Washington, D. C. ▲ **October 17, 1921**

CROP ROTATION AND CULTURAL METHODS AT EDGELEY, N. DAK.

By JOHN S. COLE, *Agriculturist, Office of Dry-Land Agriculture Investigations.*[1]

CONTENTS.

HISTORY OF THE INVESTIGATIONS.

The Edgeley substation of the North Dakota Agricultural Experiment Station is one unit in a group of 24 field stations at which the Office of Dry-Land Agriculture Investigations has established coordinated cooperative experiments in crop rotations and cultivation methods on the Great Plains.

The station at Edgeley is farther east than any of the other stations on the northern Great Plains. The rainfall is somewhat heavier and there is greater liability to damage from rust than at stations

[1] The Office of Dry-Land Agriculture was organized in 1905, with E. C. Chilcott as agriculturist in charge, who planned, outlined, and instituted these investigations and still has general supervision of them. This bulletin has been prepared under his direction. These investigations have had the active cooperation and support of the officials of the North Dakota Agricultural Experiment Station for the entire fifteen years. O. A. Thompson has been superintendent of the Edgeley substation since its establishment in 1903, and since 1918 he has had immediate charge of the cooperative investigations. The following assistants in Dry-Land Agriculture Investigations have been detailed by the United States Department of Agriculture to the station, in immediate charge of the cooperative work, during the years indicated: E. F. Chilcott, 1906 to 1908; C. H. Plath, 1909 to 1912; and R. S. Towle, 1913 to 1918.

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in more typical dry-farming territory farther west. Though the results at Edgeley are in general agreement with those of the other stations, they differ from them in some respects in that they are expressive of conditions in a transition zone between the dry and the humid areas.

The first crops in these cooperative investigations at the Edgeley substation were planted in 1906. As more land became available the work was increased in 1907 and again in 1908. To check on deeper soil the results obtained at the station farm a 40-acre tract about 1 mile distant was leased and experimental work started on it in 1916. In the following pages this tract is referred to as section 9 and the plats on the station farm as the main field.

In interpreting the results of these investigations the writer has been greatly aided by his knowledge of the results obtained from the closely coordinated investigations conducted by the Office of Dry-Land Agriculture Investigations at 23 other stations on the Great Plains and by the reports, comments, and suggestions of the men in charge of such investigations at their respective stations. The following discussions and conclusions are therefore submitted with a higher degree of confidence than they would be were they based entirely upon investigations conducted at a single isolated station by an individual investigator.

SOIL.

The soil on which the main field is located is derived from the decomposition of shale. Shale in undecomposed particles is found very near the surface. In the third foot the shale, while broken and offering fairly free passage to water, is not broken down into soil. The depth of feeding of crops is practically limited to the first 2 feet. The first foot carries an exceptionally large proportion of water available to the crop and retains about 31 per cent of its dry weight of water, but about 14 per cent is nonavailable to the crop. The second foot retains about 28 per cent of its weight of water, but 18 per cent is nonavailable. The third foot retains about 32 per cent of water, but about 28 per cent is nonavailable. Thus it is possible to store in the first foot about 17 per cent of available water, in the second foot 10 per cent, and in the third foot about 4 per cent. Translated into inches of water, this amounts to a total of 4.76 inches, basing the calculation on an estimated soil weight of 80 pounds per cubic foot. While the amount of available water that can be stored in the first foot is exceptionally high, the shallowness of the soil reduces its total storage capacity to about one-half that of deeper soils.

The soil of section 9 (the tract used as a check in these investigations) is a deep clay loam of greater water-storage capacity.

PRECIPITATION.

The average annual precipitation at Edgeley for the 19 years from 1901 to 1919, inclusive, was 18.02 inches. The highest was 28.61 inches, in 1902, and the lowest 10.85 inches, in 1917. The highest precipitation recorded in any one year since the experiments began was 22.20 inches, in 1915.

The average precipitation by months is: January, 0.28; February, 0.33; March, 0.87; April, 1.92; May, 2.71; June, 3.38; July, 2.80; August, 2.27; September, 1.70; October, 1.01; November, 0.34; and December, 0.41.

The average seasonal precipitation for the five months of April, May, June, July, and August is 13.08 inches, or 72.5 per cent of the total annual precipitation.

EXTENT OF WORK AND CHARACTER OF THE SEASONS.[2]

In the 14 years from 1906 to 1919, inclusive, the following number of plat records have become available: Wheat, 485; oats, 415; barley, 123; corn, 505; flax, 14; alfalfa, 39; brome-grass, 52; red clover, 26; green manure, 98; fallow, 230; total, 1,987. Of this total number, 1,559 have been crop plats and 328 green-manure and fallow plats.

The average yields each year from all plats in the main field are shown in Table I. For wheat, oats, barley, and corn these averages are from a considerable number of plats, embracing a wide range of methods. They therefore give a fairly good indication of the effect of the season on yields and of the yields that may be expected with a wide range of methods, such as are likely to be practiced by farmers. The vital question, of course, is how much these averages may be increased or the poor years overcome by the choice of methods. This will be considered in its proper place.

The flax yield specified is not a fair showing for the flax crop, as it is from a single plat on brome-grass sod. The brome-grass yield is the average of two 1-year-old plats and two 2-year-old plats. The alfalfa yield is the average of one 1-year-old and one 2-year-old plat. The red-clover yield is from one plat in the second year after seeding.

The year 1906 was a good one, with some lodging and some rust.

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[2] Since this manuscript was prepared the 1920 crop results have become available. In the main field the average yields were: Wheat, 9.6 bushels; oats, 47.3 bushels; barley, 25.4 bushels; brome-grass, 2,075 pounds of hay; corn, 2,383 pounds of fodder; and the flax, alfalfa, and red clover were failures. The wheat crop was damaged by rust, lodging, and weeds. The damage was generally greatest and yields the lowest on those plats that had the greatest growth of straw and at one stage of growth the highest potential yield. Drought and hot weather after early grain harvest prevented the corn from earing. Flax was destroyed by wilt and dry weather. With all grain crops, disked corn ground produced the heaviest or one of the heaviest yields. Yields on fallow were especially poor for wheat and below the average for oats and barley. The data make no decisive contribution to the knowledge of the effect of manures.

TABLE I.—*Average annual yields from all plats in the main field at Edgeley, N. Dak., during the 14-year period from 1906 to 1919, inclusive.*

Year.	Wheat.	Oats.	Barley.	Corn (grain).	Corn stover.	Flax.	Brome-grass.	Alfalfa.	Red clover.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Pounds.*	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*
1906	30.9	61.4	31.2	39.6	2,140	12.5	....	....	....
1907	9.1	24.9	12.9	0	2,420	4.4	3,000	....	....
1908	15.9	17.3	26.3	0	2,010	0	2,313	425	550
1909	27.6	56.0	29.2	30.4	5,042	13.2	4,288	1,000	....
1910	5.7	9.1	1.9	0	1,610	0	1,125	1,000	850
1911	1.9	4.4	0	0	4,630	0	1,238	975	....
1912	33.9	61.9	29.4	0	6,350	1.6	3,950	3,775	....
1913	22.8	40.7	24.2	20.9	4,268	0	2,588	1,650	500
1914	16.2	46.0	31.1	14.8	4,049	4.5	3,538	3,305	2,480
1915	36.0	79.7	41.5	0	5,900	4.1	2,800	4,760	2,300
1916	8.8	22.5	21.5	17.5	3,300	8.9	4,750	5,650	5,940
1917	14.0	16.4	10.3	0	1,840	1.4	1,713	1,575	1,300
1918	15.4	19.6	11.3	0	2,879	0	1,775	500	00
1919	2.2	16.2	13.8	0	4,382	0	2,663	0	
Average	17.2	34.0	20.3	8.8	3,623	3.6	2,749	2,051	1,160

General conditions for crops were not favorable in 1907. The spring was late and cold. During the growing season there was little rain. Just previous to ripening time, hot dry winds dried up the grain. A hailstorm on July 13 did some damage to small grains and hurt the corn very appreciably. No ears were matured on the corn.

Yields in 1908 were about the average. The spring was cold, and stands, especially of oats, were rather poor and spotted. Corn was replanted in June. The growth in June was good, but high hot winds with little rainfall from heading until harvest time reduced the yield and flattened the differences between methods. Corn did not mature ears, and the yield of fodder was reduced by a hailstorm in August, which stripped the leaves and checked growth.

General conditions for crop production were very favorable in 1909. The prospective yield of small grains was decreased somewhat by hot dry winds at about the time they were in the milk stage. Corn was mature September 9.

The year 1910 was very unfavorable. Cold weather and heavy frosts after coming up checked and injured the crop. May, June, and July were very dry. The precipitation for April, May, June, and July was only 5.08 inches.

The poor crops of 1911 were due to drought with high temperatures and winds. The rainfall was poorly distributed, with particularly marked deficiency in June and July. The heavy rainfall of August made a fairly good crop of corn fodder.

An exceptionally good year, with high yields, was 1912. At no time did the crops suffer from a lack of water. Temperatures and evaporation were low. The season was too cool to mature corn.

On the whole, 1913 was fairly favorable to crop production. Small grain suffered from a lack of moisture in the first half of June and again preceding harvest. Corn matured on all the plats.

The growing season of 1914 was generally favorable for crops, but yields were reduced by drought, rust, and hail in the period immediately preceding harvest.

The year 1915 was exceptionally favorable. The spring was dry, but at no time after the 1st of May was there any suffering from lack of moisture. There was some lodging and rust in wheat and oats, but yields were higher than in any other year in the record. Corn eared well but did not mature.

Low yields of poor quality of small grains characterized 1916, but the yields of all forage crops were exceptionally high. At no time was there a lack of water. The prospects for all crops were of the best until July, when rust developed with warm humid weather. Many fields in the vicinity were not harvested.

The driest year yet recorded at Edgeley was 1917. As a consequence, the yields of all crops were comparatively low. The hay crop was especially short.

The comparatively low yields of 1918 were due to drought. There was a decided response on fallow and corn ground, but the yields were low where small grain followed small grain.

In 1919 there was some damage from drought, but rust was chiefly responsible for the low yields recorded.

The 14-year average yield of wheat with all methods in use was 17.2 bushels per acre. Maximum yields of over 34 bushels per acre have been recorded with all rotations and methods used except continuous cropping with fall plowing, which has attained a maximum of 29.5 bushels. The highest yield of wheat recorded in the 14 years was 41.9 bushels in 1915 from wheat on rye turned under for green manure.

The average yield of oats was 34 bushels per acre. With all rotations and methods maximum yields of 60 bushels or more have been produced. Three yields of over 100 bushels were obtained on fallow in 1915. The highest yield recorded was 106.9 bushels on fallow in rotation No. 19.

The average yield of barley was 20.3 bushels. With all rotations and methods maximums of over 32 bushels per acre have been reached. The highest yield of barley recorded was 50.8 bushels, in 1915, on spring-plowed oat ground in rotation No. 7.

The highest yields in every rotation were made in 1906, 1912, or 1915, with by far the most of them in 1915.

Expressed in pounds per acre, the average yield of wheat has been 1,032, oats 1,088, and barley 974. The absolute maximum yields recorded are: Wheat, 2,514 pounds; oats, 3,420 pounds; and barley, 2,438 pounds. In 1915, when the greater number of the rotations made their highest yields, the averages were: Wheat, 2,160 pounds; oats, 2,550 pounds; and barley, 1,992 pounds.

These figures are given to show the average production and maximum possibilities of these grain crops. Pound for pound they average practically the same, with the maximum possibilities rather in favor of oats. They suggest that the choice between these crops is determined by the price, and that the one commanding the highest price per pound is entitled to have the highest acreage. It may be stated as a result of similar work at other stations that this relation between spring wheat and oats has been found to hold true for the Great Plains as a whole.

In comparing the results of different methods in the following pages attention is called several times to the apparently greater response of oats than wheat to certain methods, such as fallow. This is probably due to the fact that wheat has on the average suffered more than oats from rust. The proportional damage from rust is nearly always greatest with those methods that have the heaviest and most luxuriant growth and previous to attack the greatest potential yield.

RESULTS OF FALL AND SPRING PLOWING COMPARED.

The work offers a number of comparisons of the relative merits of fall and spring plowing for the several crops. Fall plowing as a rule has been done comparatively early. It has been the endeavor, however, not to advance its date beyond practical limits. The average date of plowing grain stubble is September 12. In 9 of the 14 years the date has fallen between September 2 and September 13. In 2 years the plowing has been done in August and in 2 years it has been delayed until October.

When corn stubble is plowed in the fall it is generally necessary to delay it until a late date, as it can not be done until after the corn is removed. The average date of plowing corn stubble is October 1. Plowing has been done to a good depth, the maximum being 8 inches. The depth of spring plowing has been the same as that of fall plowing, with the exception of one plat, plat A, with each crop, which is continuously cropped and shallow spring plowed. When all the evidence on the subject is studied there is found in the average of a series of years little or no difference between fall and spring plowing for small grains in rotations of corn, wheat, and oats when the depth of the plowing has been the same. In continuous cropping to small grains shallow spring plowing has averaged from 1½ to 2½ bushels higher than deep fall plowing. This comparison at Edgeley is open to question on account of the fact that from time to time there has been an accumulation of blown soil in the stubble of the continuously spring-plowed plats, which has built them up several inches above their original level. Similar results, though, have been obtained since 1916 on section 9, where such building up has not taken place, and they are not out of keeping with results at other stations.

On the continuously cropped plats the years favoring fall plowing and those favoring spring plowing have been about equal in number. In rotations where spring plowing is deep the greater number of years have favored fall plowing. Some years have markedly favored fall plowing, and others have as markedly favored spring plowing. Measured in bushels per acre the greatest difference shown in any one year was in favor of spring plowing in 1915. This was the year of the heaviest yields in the history of the experiments. The winter and spring were dry until after the crop was up, and there was better germination on the spring-plowed than on the fall-plowed plats. The rains that made the crop did not begin until after the crop was started.

For corn the evidence is also contradictory, with little or no average difference where corn follows wheat or corn, but appearing to average in favor of spring plowing where corn follows oats. The evidence of section 9 shows an advantage of spring plowing for corn following wheat, oats, and corn.

The work in hand is not designed to study the question of time of fall plowing. As noted above, there has been during the experiments considerable range in the time of fall plowing. It is not possible, however, to identify in the results any relation between the time the fall plowing has been done and the yield as compared with that from spring plowing.

In these experiments fall plowing and spring plowing are both seeded at the same time. Seeding is usually done comparatively early, the date depending upon the season. But when a large acreage is to be handled plowing in the spring necessarily delays seeding. It has been abundantly proved and is well recognized that delay in seeding in this section decreases yields. This is a section of large acreages. It is, therefore, highly desirable that as much as possible of the land to be seeded to small grains be plowed in the fall, so that seeding may not be delayed. There is, however, no disadvantage and there may even be some gain from spring plowing, provided it does not delay seeding beyond the critical date. The possibility of doing much spring plowing without incurring loss from late seeding depends very much upon the character of the spring.

The distribution of labor indicates spring plowing for corn, although little disadvantage in yield is experienced if the corn be planted on fall plowing.

All the evidence indicates that for the best results spring plowing should be shallow.

DISKING COMPARED WITH PLOWING CORN GROUND IN PREPARATION FOR WHEAT AND OATS.

When corn ground is to be sown to small grains it may be plowed in the fall or spring or it may be prepared for seeding without plowing. In the latter case it is generally disked. The work at Edgeley offers opportunity for several direct comparisons of the results of these methods.

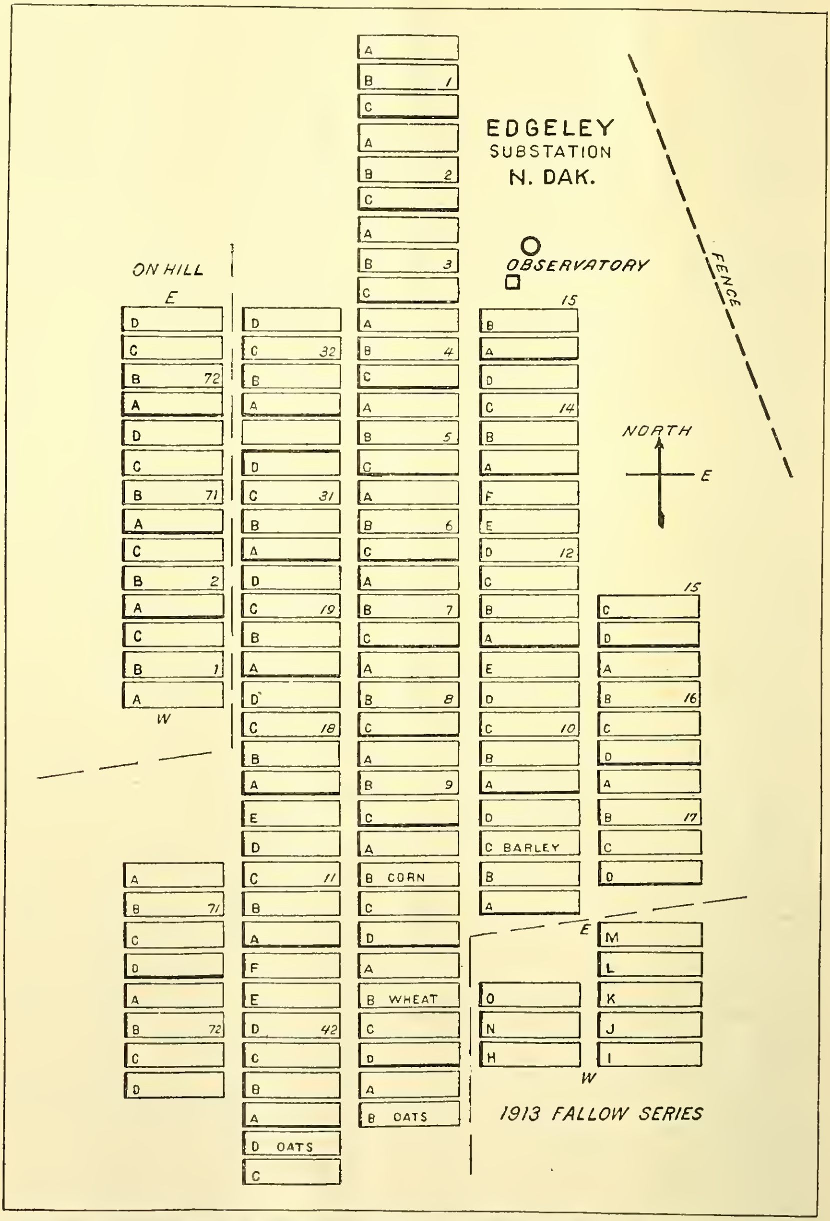

FIG. 1.—Diagram of the experimental plats in the main field at Edgeley, N. Dak., showing the location of the crop rotations with reference to each other.

The location of the rotations with reference to each other is shown in figure 1, which is a plat sheet of the main field. Each rotation is designated by a number and each plat in the rotation by a letter. The crop that is on plat C one year is on plat B the next, and so on until from A it moves to the letter marking the end of the rotation. The plats are 2 by 8 rods and are separated by 4-foot alleys and 20-foot roadways. In the diagram the separation of rotations is indicated by heavy lines. The four unnumbered blocks of four plats each are the continuous and alternate cropping plats devoted to the four crops designated.

Rotations Nos. 1, 2, 71, and 72, set off by a broken line and designated "on hill," are duplications described in the text as being on deeper soil. They do not occupy the position indicated on the diagram, but are detached. The eight plats, also set off by a broken line and designated "1913 fallow series," are also detached. They have been devoted to a study of four methods of fallow.

The circle and square designated "observatory" indicate the location of the instrument yard, in which the meteorological instruments are exposed.

Rotations Nos. 1 and 3 are exactly the same 3-year rotations of oats on fall-plowed wheat stubble, corn on fall-plowed oat stubble, and wheat on corn ground. In rotation No. 1 the corn ground is disked and in rotation No. 3 it is fall plowed in preparation for the wheat. The wheat on the disked corn ground has yielded more than on the fall-plowed corn ground in 11 out of 13 years, and for the 13 years it has averaged 2½ bushels per acre more. The average yields of oats from the two rotations agree within a fraction of a bushel, but the corn has averaged slightly more in rotation No. 1. In 1906, when the treatment was the same, the yield was about the same, indicating no considerable natural advantage of rotation No. 1 over rotation No. 3.

Rotation No. 2 has the same crops, but the ground is spring plowed for each of them. The yield of wheat on disked corn ground in rotation No. 1 has exceeded that on spring-plowed corn ground in rotation No. 2 in 10 out of 13 years, and for the 13 years it has averaged 2.4 bushels more per acre.

The same rotations have been duplicated on deeper soil since 1908. In this duplication the disked corn ground has shown less advantage over the plowed land than in the original plat field, but its average increase for the 11-year period from 1909 to 1919, inclusive, has been three-tenths of a bushel per acre.

Rotation No. 4 is wheat on fall plowing, corn on fall plowing, and oats on disked corn ground. Rotation No. 9 has the same crops in the same order, but all on spring plowing. The oats on disked corn ground in rotation No. 4 has yielded more than the oats on spring plowing in rotation No. 9 in 10 out of 13 years. The average increase on disked corn for the 13 years is 1.1 bushels per acre.

Rotation No. 7 is barley, corn, and oats all on spring plowing. The oats on disked corn ground in rotation No. 4 have outyielded the oats on the plowed corn ground in this rotation in 6 out of 13 years, the average increase for the 13 years being 1.4 bushels per acre.

In all the comparisons of disked and plowed corn ground results in the year 1912 stand out as markedly unfavorable to the disking. In all but one of the comparisons the experience of 1915 is also unfavorable to the practice. These were both years of abundant rainfall and heavy production.

In the tests on section 9 the disked corn ground outyielded the plowed land in 1918 and 1919, but in 1917 the reverse was true.

The evidence seems quite conclusive that while individual years may favor either plowing or not plowing the corn ground, the average of a series of years is in favor of seeding without plowing. This means in practice a strong recommendation against plowing corn ground before seeding, on account of the cost and the time consumed in plowing.

The effect on the crops that follow is not considered in detail, as it appears to be negligible.

CORN GROUND COMPARED WITH SMALL-GRAIN STUBBLE FOR WHEAT AND OATS.

Three 3-year rotations, Nos. 1, 2, and 3, have wheat on corn ground and oats following wheat, while the 3-year rotations, Nos. 4 and 9, have the same crops, but with the oats on corn ground and the wheat following oats.

The average yield in these rotations of wheat following corn is 18.4 bushels, and following oats 14.5 bushels per acre, an advantage of 3.9 bushels per acre in favor of the corn ground. The yield on corn ground has exceeded that on oat stubble every year since the experiments were started.

The oats following corn in rotations, Nos. 4 and 9, show an average increase over the oats following wheat in rotations Nos. 1, 2, and 3 of only 1 bushel per acre. In six years the higher yield has been following corn, and in seven years it has been following wheat. On section 9 for the 3-year period, from 1917 to 1919, inclusive, the same rotations have shown an increase of 1.2 bushels for wheat on corn ground, and 5.3 bushels for oats on corn ground.

These results show a rather decided advantage of corn over small grain as a crop to precede small grain. They indicate very clearly that in a combination of wheat, oats, and corn the wheat should follow the corn and the oats follow the wheat.

GRAIN STUBBLE COMPARED WITH FALLOW.

Several closely and directly comparable experiments afford data for a study of the relative merits of fallow and cropped land as a preparation for a crop.

Rotation No. 5 is fallow, wheat, and oats. Rotation No. 8 is fallow, oats, and wheat. The wheat on fallow in rotation No. 5 in 1910

Fig. 2.—The fallow plat and wheat on fallowed land in rotation No. 5 at Edgeley, N. Dak., on July 26, 1910, showing an ideal condition of the fallow surface. The corn plat and wheat on disked corn ground in rotation No. 14 are in the immediate background.

is shown in figure 2. The fallow plat is shown in ideal condition, a coarse granular mulch free from weeds. The oat crop on fallow in rotation No. 8 on the same date is shown in figure 3.

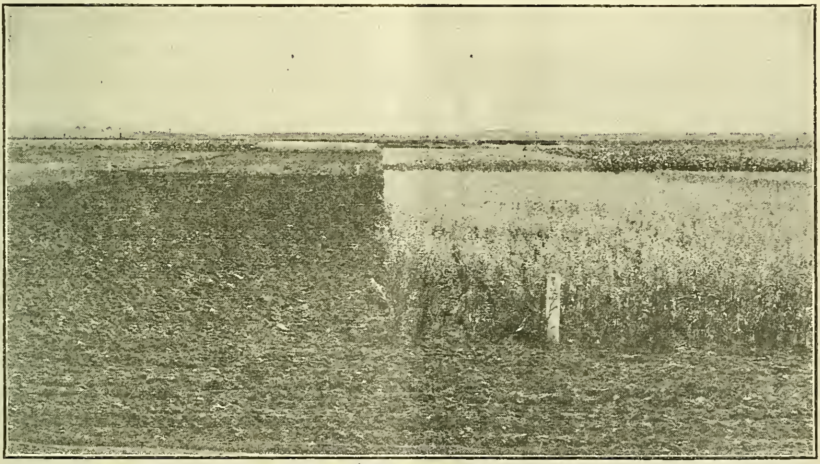

Fig. 3.—General view of the plats at Edgeley, N. Dak., on July 26, 1910. The fallow plat and oats on fallow in rotation No. 8 are in the foreground, rotation No. 10 in the first series of plats in the background, and rotation No. 16 in the second one.

In 10 of the 13 years under study the wheat on fallow in rotation No. 5 has yielded more than the wheat in rotation No. 8, but in only four of these years has the yield been markedly better. In these four years the wheat on fallow averaged 26.1 bushels, and the wheat following oats 15.7 bushels per acre. In the other nine years the fallow averaged 14.2 bushels, and the oat stubble 13.4 bushels. The 13-year average is 17.8 bushels on fallow and 14.1 bushels following oats, a difference of 3.7 bushels in favor of the fallow.

The average yield of oats on fallow in rotation No. 8 has been 36 bushels, and on fall-plowed wheat stubble in rotation No. 5, 35.2 bushels per acre. The higher yield has been on fallow seven years and on the wheat land six years.

Other opportunities for comparisons are offered in the continuous cropping series. In this series each crop—wheat, oats, barley, and corn—occupies four plats. Plat A bears the same crop continuously, the preparation being shallow spring plowing. Plat B is continuously cropped under a system of deep (8-inch) fall plowing. Plats C and D are alternately cropped and fallowed, plat C being in crop in the even years and plat D in the odd years.

The wheat on fallow has averaged 1.4 bushels more than on spring plowing and 3 bushels more than on fall plowing. In 9 of the 13 years under study the yield on fallow has been higher than on either of the other plats. In the duplication of these plats on section 9 for the three years 1917 to 1919, inclusive, the yield on fallow has been 6.1 bushels more than on spring plowing and 8.1 bushels more than on fall plowing.

Oats in this series show a stronger response to fallow than wheat, or than oats did in rotation No. 8 as compared with rotation No. 5. Not only is the yield on fallow a little higher, but the yields of oats in continuous cropping with which it is compared are much lower than those in rotations. The yield on fallow in this series is 40.3 bushels; on spring-plowed oat stubble, 25.2 bushels; and on fall-plowed oat stubble, 23.7 bushels. The increase in favor of fallow in this case is 15.8 bushels over the average of the two other methods.

In the same series barley on fallow has yielded 19.8 bushels; on spring-plowed barley stubble, 17.8 bushels; and on fall-plowed barley stubble, 15.4 bushels. The increase due to fallow is 2 bushels over spring plowing, and 4.4 bushels over fall plowing, or 3.1 bushels over the average of the two.

With corn, there is practically no difference in the average yields of the different plats in this series, although there have been some years strongly in favor of and some as strongly against fallow. The corn plats are duplicated on section 9, and there also no difference in yield is observed.

CORN GROUND COMPARED WITH FALLOW AS A PREPARATION FOR SMALL GRAINS.

The experiments offer a number of direct comparisons of fallow and corn ground as preparations for wheat and oats. Rotation No. 5 is fallow, wheat, and oats, and rotation No. 3 is corn, wheat, and oats. The heavier yield of wheat has been on the corn ground seven years and on the fallow six years. The fallow has had somewhat the heavier yield of straw, but the grain has averaged only three-tenths of a bushel more than on the corn ground. There is some evidence of a carry-over effect of the fallow, as the oats following wheat in the fallow rotation have outyielded the oats in the corn rotation in 8 of the 13 years. The average increase for the 13 years is 5 bushels per acre of grain and nearly 200 pounds of straw. The average yield of corn, which occupies in rotation No. 3 the place of the bare fallow in rotation No. 8, has been 6.4 bushels of grain and 3,432 pounds of stover per acre.

Rotation No. 8 is fallow, oats, and wheat, and rotation No. 4 is corn, oats, and wheat. The heavier yield of oats has been on fallow eight years, and on corn five years. The 13-year average increase on fallow has been 4.2 bushels of grain, but less than 100 pounds of straw per acre. There apparently has been in this case no carry-over effect of the fallow, as the yield of wheat in these rotations differs only by one-tenth of a bushel.

The yield of corn has averaged 6.3 bushels of grain and 3,344 pounds of stover, being practically the same as in rotation No. 3.

In the same four rotations on section 9 for the three years, 1917 to 1919, inclusive, the wheat on fallow has outyielded that on corn ground each year, the average increase being 1.9 bushels. No carry-over effect has been apparent, however, as the average yield of the oats following wheat is a fraction of a bushel less in the fallow than it is in the corn rotation. The oats on fallow have outyielded the oats on corn ground each year, the average increase being 14.3 bushels. The wheat following the oats on fallow yielded 1.1 bushels more than the wheat on oats following corn.

Summing up the evidence from the four rotations on both the main field and section 9, it appears that in a comparison of fallow and corn ground there has been a small advantage in favor of the fallow. The response of oats to the fallow is apparently somewhat greater than that of wheat. Whatever advantage there may be from the fallow is practically exhausted by the first crop. There is some tendency to show a small carry-over effect of fallow on the second crop, but it is so small that the evidence is not very clear. It would appear from the direct comparison of these rotations that the difference in yielding power between fallow and corn ground is so small that a choice between them is really to be determined by the choice between either conducting a bare fallow or raising a crop of corn averaging for 13 years about 6½ bushels of grain and more than 1½ tons of stover per acre.

Two other rotations in the main field for the period from 1908 to 1919 and in section 9 from 1917 to 1919 bear evidence on this subject and lead to the same conclusions. Rotation No. 18 is corn on spring plowing, oats on disked corn ground, fallow, and wheat on fallow. Rotation No. 19 is the same, but with the wheat on disked corn ground and the oats on fallow.

In the main field the average yield for 12 years of oats on fallow has been 6.1 bushels more than on disked corn ground, but the yield of wheat has been four-tenths of a bushel less on fallow than on disked corn ground. The yield of corn in rotation No. 19, which shows the greater yield of both oats and wheat, is also slightly higher than in rotation No. 18.

In section 9 the oats on fallow have averaged 2.7 bushels more than on corn ground, and the wheat 3.4 bushels more.

MANURED COMPARED WITH UNMANURED FALLOW.

Nos. 18, 19, 71, and 72 are 4-year rotations. The first two were started in 1907 and the others in 1908. Nos. 18 and 72 are fallow, wheat, corn, and oats. Nos. 19 and 71 are fallow, oats, corn, and wheat. The fallow in Nos. 71 and 72 receives 10 tons of rotted barnyard manure per acre before plowing. In the 11 years from 1909 to 1919 each crop in the manured rotations has averaged higher yields of both grain and straw than the corresponding crop in the unmanured rotations. The average increases, however, have been small, the highest being 1½ bushels for wheat on fallow.

What appears to be the true significance of the value of manure in a rotation is shown when the results are studied in another way.

The crops are now being grown on land that has been manured the third time. When the results are studied in detail from year to year or grouped and studied in periods of no manure in the first years, manured once, manured twice, and manured three times, it is shown rather clearly that the use of manure on fallow once in four years not only increases the yields of the three crops in the rotation but has a cumulative effect, the increase becoming greater with each round of the rotation. Before the corn came on the manured land in rotations Nos. 71 and 72 the total weight of corn from these rotations averaged only 151 pounds per acre more than in rotations Nos. 18 and 19. When the land had been manured once the increase was 750 pounds; manured twice, 983 pounds; and manured three times, 1,438 pounds per acre.

The yields of wheat and oats are affected by the fact that in very favorable seasons the manure increases the tendency to lodge and to rust, but in the second and third rounds of manuring these crops show decided increases on the manured land.

It is a difficult question to study, but all evidence points to the belief that the observed differences are due to an increase in the manured rotations rather than to any deterioration or reduction in the original yielding power of the unmanured rotations.

These rotations are duplicated on section 9, but the rotations have only been one round in this location. The differences in any exhibition of yields are not as yet great enough to be distinguished from or among the natural differences due to soil variation.

GREEN MANURE COMPARED WITH BARE FALLOW.

At the time these experiments began it was thought that green manures might possibly offer a means of increasing or maintaining the humus content of dry-land soils, thus increasing the yields. It was argued that they could be used in extensive or exclusive grain farming where barnyard manure was not available in adequate quantity.

Experiments were instituted to determine the effect of using winter rye, field peas, and sweet clover for green manures. At the Edgeley station this group of experiments was confined to 4-year rotations in which the land is green manured once every four years. The crops in the other three years are wheat, oats, and corn. Each green manure is used in two rotations. In one rotation oats follow the green manure and the wheat is after corn, which follows the oats. In the other the wheat follows the green manure and the oats are on corn ground.

Rotation No. 14 is rye for green manure, oats, corn, and wheat; rotation No. 15 is rye for green manure, wheat, corn, and oats; rotation No. 16 is peas for green manure, oats, corn, and wheat; rotation No. 17 is peas for green manure, wheat, corn, and oats; rotation No. 32 is sweet clover for green manure, oats, corn, and wheat; and rotation No. 31, is sweet clover for green manure, wheat, corn, and oats. The sweet clover in these rotations is sown with the preceding wheat or oats and plowed under when in blossom in its second year.

For comparison with these green-manure rotations are two similar ones having bare fallow in place of the green manure. These are rotations Nos. 18 and 19, already described. In rotation No. 18 the wheat is on fallow and the oats on corn ground, and in rotation No. 19 the oats are on fallow and the wheat on corn ground.

The green-manure rotations are fairly comparable with the fallow rotations in that each of them involves the loss of the use of the land for one year in four. After the green-manure crop is turned under the plats are treated as fallow for the remainder of the season. They are essentially modified fallows, requiring the extra expense of seed and seeding.

Rotations Nos. 14, 15, 16, and 17 were started in 1906 and the other four in 1907.

The results are difficult to determine in all their relations, on account of the natural variations in plat yields. The study at the present time is further complicated by the fact that the last period of four years has been one of low yields and two of the four have been bad rust years. With all their discrepancies and apparent contradictions, however, they point to a general conclusion: The 12-year averages from 1908 to 1919, inclusive, afford no basis of hope to increase yields by the use of green manures. One possible exception to this will be considered farther on. The expense of the green manures precludes all possibility of their profitable employment. Further, when a crop is grown there is no basis of justification for plowing it under in the hope of increasing the yield of succeeding crops.

Possible differences in soil condition and natural yielding power may be largely eliminated by comparing the relative yielding power of the crops in the several rotations in succeeding periods. The 12-year period can be divided into three periods of four years each, corresponding to the length of the rotations. When so studied it is found that the yields of all crops in rotations Nos. 14, 15, 16, and 17 have been decreasing instead of increasing, as compared with the yields of the same crops in the corresponding fallow rotations, Nos. 18 and 19. The possibility that the later seasons may have been relatively more favorable to bare fallow than the earlier ones might be advanced in explanation of the behavior of the first crop following fallow or green manure; but such an explanation could hardly account for the behavior of the corn following this crop, and certainly not for the crop of wheat or oats which follows the corn and has two crops intervening between it and the fallow.

An exception has been mentioned above. This is noted in the sweet-clover rotations, Nos. 31 and 32. In these rotations the total yield of corn, which is the second crop after the sweet clover is plowed under, has been increasing in comparison with the yield of corn in the other rotations of this series.

Unfortunately, there is no rotation to determine what the effect would have been had the sweet clover been harvested for hay or seed instead of being plowed under. Rotations to test this have been incorporated in the newer work on section 9, but are not yet advanced enough to furnish the desired data.

As to the relative values of rye and peas for green manure, the evidence is somewhat contradictory. Rotation No. 14 with rye has yielded heavier than No. 16 with peas. In these rotations wheat follows the green manure. The corn in rotation No. 15 with rye has outyielded the corn in No. 17 with peas, but the other crops have yielded more in No. 17. In these two rotations the green manure is followed by oats. The differences are small and probably well within the limits of experimental error.

In view of the fact that in more humid sections increases are usually expected from the use of legumes as green manure, it might be fair to state that one of the most interesting results of these experiments is the failure of peas as green manure to increase yields in comparison with those obtained on either fallow or nonleguminous green manures.

A result from these experiments more important than the differences between green manures or fallow is that on disked corn ground the wheat has averaged 1.3 bushels per acre more and the oats 4 bushels per acre more than the same crops on green manures and fallows. The corn following wheat in four rotations has averaged 6.8 bushels of grain and 3,065 pounds of stover per acre, and following oats in four similar rotations it has averaged 6.9 bushels of grain and 3,407 pounds of stover per acre.

SOD CROPS.

In humid sections sod-forming crops occupy an important place in crop rotations. Three such crops were incorporated in the experiments at Edgeley. These are brome-grass, alfalfa, and red clover. Brome-grass is included in two rotations and alfalfa and red clover in one each. The several rotations are all similar in that the other crops are oats on sod, corn on fall-plowed oat stubble, and wheat on disked corn ground. The two brome-grass rotations differ from each other in only one respect. No. 12 is lengthened one year over No. 10 by introducing a crop of flax on the brome-grass sod and raising the oats on fall-plowed flax stubble.

In the brome-grass rotations the brome-grass is seeded with the wheat. Both the alfalfa and the clover are spring seeded without a nurse crop on fall plowing. In the rotations containing these crops there is consequently one year in which there is no production. This loss of the use of the land is avoided in the brome-grass rotations, which produce a crop each year. The brome-grass stands two years, the alfalfa two years in addition to the seeding year, and the red clover one year in addition to the seeding year. The experiments were not intended to study brome-grass or alfalfa to determine how long they would remain productive. Neither was the length of the rotations fixed by a consideration of what might be the most profitable practice. They were purposely made short to meet the exigencies of experimentation and to determine as quickly as possible the effect of seeding and breaking up these crops. It was thought that a full sod would be formed and the effect on succeeding crops determined as well by standing for two years as for longer periods.

No. 10 is a 5-year rotation of oats, corn, wheat with brome-grass seed, and two years of brome-grass meadow. The oats are seeded on brome-grass sod broken in midsummer of the preceding season. The average date of harvesting the hay crop is July 12, or about three weeks before grain harvest. The instructions are to break the sod as early as convenient and possible after the hay crop for the year has been secured. Generally the sod has been backset late in the fall. The average yield of oats for the 12-year period from 1908 to 1919 has been 27.7 bushels. This yield might be compared with an average yield of 30.5 bushels per acre of oats following wheat in three 3-year rotations of corn, wheat, and oats. The yield of corn on spring plowing following the oats has been slightly more than when following oats in 4-year rotations containing fallow and green manures and slightly less than following oats in 3-year rotations of corn, wheat, and oats. It can not be stated positively that the introduction of brome-grass sod into the rotation has had a significant effect on the yield of corn grown the second year after breaking the sod. The yield of wheat following the corn has been practically the same as that of wheat following corn in 3-year and 4-year rotations.

No. 12 is the same rotation lengthened one year by raising a flax crop on the brome-grass sod. The sod has been broken in the spring immediately before seeding to flax. This has usually been about the middle of May, the actual dates ranging from May 7 to June 2. This practice can not be considered a success from the standpoint of flax production. In some years the sod has been too dry to germinate and grow the flax, in some of the wetter years the flax has been choked out by the brome-grass, and in some years there has been loss from flax wilt. The highest yield was 13.2 bushels in 1909. In 6 of the 13 years the crop has been a total failure, reducing the 13-year average yield to 2.9 bushels per acre. Data from other stations indicate that better results might be obtained by breaking the sod the preceding summer, the same as is done for oats in rotation No. 10.

The flax ground is fall plowed for oats. The oats in this rotation have averaged about 4 bushels of grain and 500 pounds of straw per acre more than the oats in rotation No. 10, where they are the first crop following the brome-grass. The corn following the oats seems to have been increased about 500 pounds per acre in total yield by the introduction of the flax crop, but the wheat following the corn shows little or no effect from it.

The brome-grass in rotation No. 12 has yielded heavier than in rotation No. 10. As there is no good reason for this in the rotations themselves, it seems that it should be attributed to a difference in the soil, which might also account for the heavier corn yields in rotation No. 12.

For the 13 years, 1907 to 1919, the first-year yield of hay has averaged 2,332 pounds in No. 10 and 2,868 pounds in No. 12. The second-year yield has been 2,714 pounds in No. 10 and 3,083 pounds in No. 12.

No. 42 is a 6-year rotation consisting of oats on alfalfa sod broken the previous fall, corn on fall-plowed oat stubble, wheat on disked corn ground, one year for seeding to alfalfa on fall-plowed wheat stubble, and two years of alfalfa meadow.

In only two years, 1915 and 1916, have the oats following the alfalfa outyielded the oats following brome-grass in rotations Nos. 10 and 12. The 12-year average yield is about 3 bushels per acre greater on the brome-grass sod of rotation No. 10 than it is on the alfalfa sod of No. 42. The only oat plat in the field that has averaged less than the one on alfalfa sod is the plat continuously cropped to oats on fall plowing.

The yield of corn following oats in the alfalfa rotation is also less than in the brome-grass rotations. It is also less than following oats in either 3-year or 4-year rotations.

The yield of wheat is about 3 bushels less in the alfalfa rotation than in the brome-grass rotations; rotation No. 42 is somewhat separated from rotations Nos. 10 and 12 in the field, and its apparent inferiority may be due to a difference in soil. When the results are separated into 4-year periods and studied it is seen, however, that the brome-grass and alfalfa rotations have not been undergoing any changes in their relative yielding powers.

The manured rotation No. 71 adjoins rotation No. 42. The corn following oats and the wheat on disked corn ground in this rotation exceed in yield the corresponding crops in rotation No. 42.

No crop is harvested the year the alfalfa is seeded. In 1909 and again in 1918 the 1-year-old alfalfa winterkilled, while the new seeding did not. In 1919 both plats winterkilled. Aside from these failures there has been a crop each year. Three years it has amounted to over 2 tons per acre, but the 12-year average yield from each plat has been slightly in excess of 1 ton. Two crops have been cut in only 4 of the 12 years. In 1916 a third cutting was made on the older plat.

It is fairly evident from these results that alfalfa in this section must stand on its own merits as a crop, as its introduction into a rotation decreases rather than increases the yields of following crops. It appears that alfalfa fields should stand as long as they are satisfactorily productive, rather than be broken up for the sake of rotation.

No. 11 is a 5-year rotation of oats, corn, wheat, and two years of clover. One of the clover years is devoted to seeding down, and the second is the crop year. After the crop is harvested the sod is fall broken for oats. This rotation can be considered a failure, because the red clover so frequently fails to survive the winter. It has been a total failure in 5 out of 12 years and in 3 other years has produced less than 1,000 pounds of hay per acre. Its 12-year average is 1,160 pounds, or only a little more than one-half that of alfalfa and less than half that of brome-grass. The growth of clover has not increased the yields of the other crops in the rotations.

THE EFFECT OF THE SEASON ON YIELDS.

In the preceding pages the effects of diverse cultural practices on yields have been considered. It has been shown that in the average of a series of years the differences resulting from wide divergence of methods are very modest and in some cases not measurable by the methods of investigation employed. When the results are studied in detail year by year it is immediately seen that differences in yield resulting from differences in soil treatment are of minor importance when compared with the results of differences in seasons.

The effect of seasonal conditions is shown clearly enough in the average yields given in Table I, but it can be more effectively illustrated by the use of yields from individual plats representing widely contrasting methods. It matters little which are selected for this purpose, as all show much the same thing, as evidenced in the general averages presented in Table I. Typical illustrations are offered in rotations Nos. 5 and 8, which were described in considering the subject of small-grain stubble compared with fallow. Bare fallow might reasonably be expected to overcome the effect of the seasonal conditions as fully as any cultural method. There should at least be offered as wide a contrast between fallow and cropped land in their control by seasonal conditions as between any methods that might be selected.

In rotation No. 5 wheat is on fallow, and in rotation No. 8 it follows oats. In rotation No. 8 the oat crop is on fallow and in No. 5 it follows wheat. The yields of these two crops in these rotations are given in Table II for each year of the 14-year period from 1906 to 1919. In 1906, the first year, neither plat was on fallow, but all were on land in variety tests of small grain in 1905. The yields from 1907 to 1919 are shown graphically in figure 4. The upper portion of this diagram gives the yields of oats and the lower portion the yields of wheat. The yields on fallow are shown by circles connected by a solid line and the yields on land producing a crop the year before by crosses connected with a broken line. Both the figures of yield and the diagram are so clear as to need little comment. The yields of both methods go up or down with the seasons to a degree altogether disproportionate to any differences between the methods themselves.

Table II.—*Annual yields of wheat on fallow in rotation No. 5 and following oats in rotation No. 8, and of oats on fallow in rotation No. 8 and following wheat in rotation No. 5, showing the controlling effect of seasonal conditions at Edgeley, N. Dak., during the 14-year period from 1906 to 1919, inclusive.*

Year.	Yields per acre.			
	Wheat.		Oats.	
	Rotation No. 5.	Rotation No. 8.	Rotation No. 8.	Rotation No. 5.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
1906	15.8	15.0	50.0	55.6
1907	30.3	27.5	63.8	57.5
1908	11.8	8.5	30.9	27.5
1909	19.5	10.3	20.9	33.4
1910	29.8	26.6	56.2	63.7
1911	7.8	6.3	10.0	13.7
1912	2.7	.7	6.1	4.4
1913	39.0	28.2	72.5	65.9
1914	25.3	17.1	46.2	36.2
1915	38.7	37.0	100.7	82.2
1916	9.2	10.5	26.9	19.1
1917	10.0	13.3	8.1	16.9
1918	20.5	7.0	27.8	15.6
1919	1.7	2.8	11.6	22.8
Average, 1907–1919.	17.8	14.1	36.0	35.2

Several causes conspire to make this so, or there are several reasons why it is so. The season may be so dry, as in 1910 and 1911, that both methods are more or less complete failures, or the season may be so wet that both methods produce heavily, as in 1912 and 1915. The fallow season may be so dry that it is impossible to store water in the fallow, in which case it possesses no advantage in this respect over a cropped plat, or the rainfall between harvest and seeding may be so abundant that the cropped as well as the fallow plat is filled with water, in which case again the fallow would have no advantage so far as water supply is concerned. This is an especially common occurrence in a shallow soil of limited water-storage capacity and with a rainfall as high as that at Edgeley. Another factor that equalizes yields by reducing all to a common

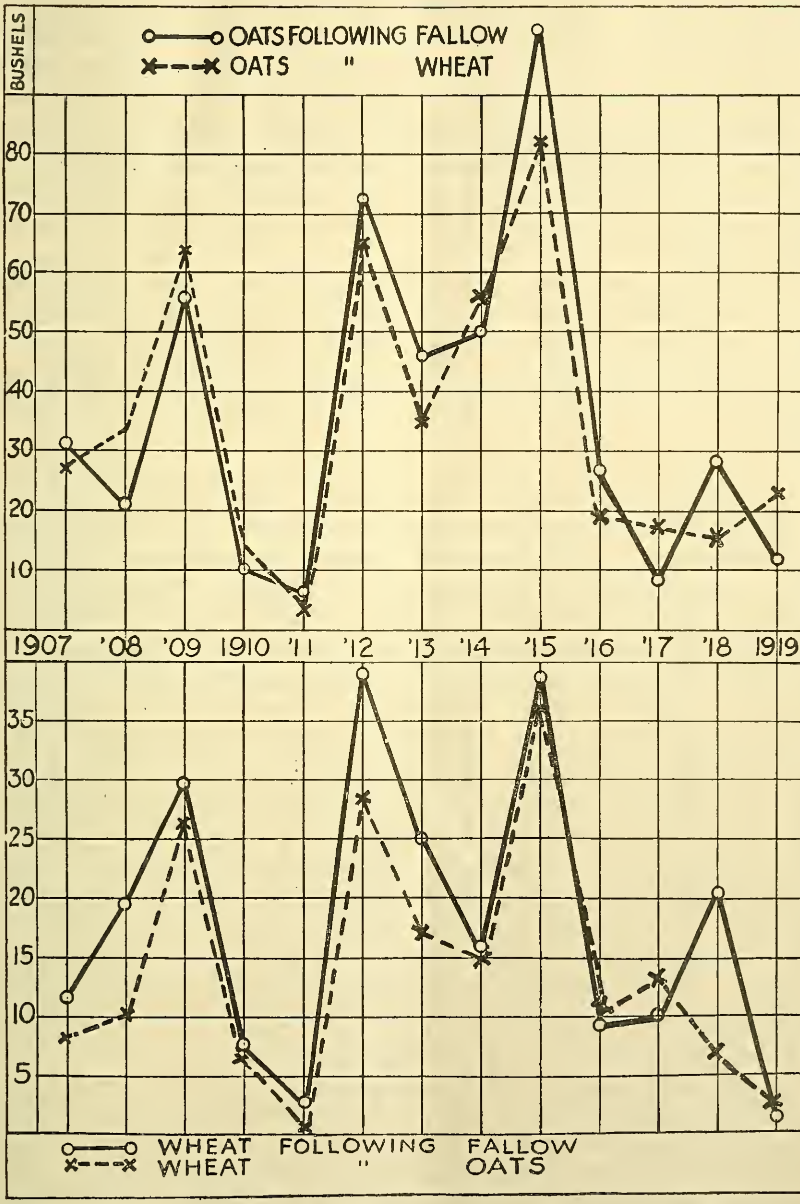

FIG. 4.—Diagram showing the data presented in Table II. The upper part of the figure gives the yield of oats on fallow in rotation No. 8 and following wheat in rotation No. 5 for the years 1907 to 1919. The lower portion shows the yield of wheat on fallow in rotation No. 5 and following oats in rotation No. 8. In each part of the diagram the yields on fallow are shown by circles connected by a solid line and the yields following a grain crop by crosses connected by a broken line.

low level is disease, of which the most important at Edgeley is rust. This generally occurs in wet years when yields would otherwise be relatively high. It was the cause of the low yields in 1916 and 1919.

Aside from disease, the most important factor controlling yields at this station is the rainfall during the growing season.

The precipitation for the months of April, May, June, and July for the several years was as follows: 1906, 14.03; 1907, 6.44; 1908, 9.18; 1909, 10.50; 1910, 5.08; 1911, 7.09; 1912, 15.63; 1913, 9.53; 1914, 13.23; 1915, 13.81; 1916, 12.48; 1917, 7.54; 1918, 8.58; 1919, 13.45; average, 10.47 inches.

There is a close relation between these figures and those of yields shown in Table II, except in those cases where disease interferes with the production of a good crop by a sufficient rainfall.

It will be noted that, generally speaking, a rainfall of over 9 inches during the growing season is necessary to the production of a good crop.

CONTINUOUS CROPPING COMPARED WITH ROTATION.

Considerable study has been devoted to the subject of changes that may be taking place in the relative yields of crops grown continuously on the same plats and those grown in rotation with other crops. The great fluctuations due to seasons and the relative response to methods of cultivation in different seasons tend to obscure results in even as long a series of years as that under study. There are, however, rather marked indications of comparatively decreasing yields under continuous cropping to any one small grain. This observation is not confined to this station alone, but is more or less general. After the first few years, from four to seven, on new land there appears to come a break in the relative yields from land continuously cropped to one grain. The most obvious reason for this, and one that in some cases clearly accounts for it, is the development of weeds. Diseases that are propagated in the soil are probably another reason. It is not believed that it is due to any impairment of the soil. Another bumper crop year such as 1915 was will be very interesting on account of the evidence it will furnish on this subject.

CONCLUSIONS.

The results attending the use of barnyard manure, various green manures (leguminous and nonleguminous), sod crops, and a continued and rather extensive test of commercial fertilizers which has been conducted at the station but is not considered in the present paper, all show that soil fertility is not a limiting or controlling factor of major importance in crop production at Edgeley. On the other hand, the seasonal variation in yields shows that the chief controlling factor is the seasonal rainfall. The full operation of its control is interfered with by plant diseases, of which the chief one not under control is rust. The nature of the soil and the amount and distribution of the rainfall are such that attempts to overcome the controlling influence of rainfall by means of cultural methods designed to store water in the soil in advance of the growing season meet with only limited success.

Phrased in other words, 15 years of thorough investigation have failed to discover any one method or any royal road to the solution of the problems of crop production in this section. Success is to be attained rather through the application of many small details embraced under the general term of good husbandry. Work must be well and timely done. Good seed of the best varieties, free from disease, should be sown in good season in a well-prepared seed bed free from weeds.

Whether plowing is done in the fall or the spring may be of material effect in any one year, and so also may differences in the time of plowing in the fall, but in the average of a series of years these factors are of minor importance provided seeding is not unduly delayed.

Fallow may be usefully enlisted as an emergency measure for cleaning up land that is infested with weeds or in preparing for a crop the following season an excess acreage that for any reason it has been impossible to utilize for cropping in the current season or on which for any reason there may be an early crop failure. Fallow does not, however, increase the yield over that on cropped land sufficiently to warrant giving it any recognized place in a cropping system.

Green manuring is entirely unjustifiable, as it increases the expense without increasing the yields. Any crop produced should be harvested, as little or nothing is to be gained by plowing it under.

The effect of barnyard manure is comparatively small, but it appears to be cumulative. The results indicate that one would not be compensated for any considerable expense incurred in manuring land for field crops, but that he will be paid for disposing of the available manure by judiciously applying it to the fields in a systematic rotation. It should be applied in preparation for the corn crop.

Corn has not been a strong competitor of the grain crops. In 14 years it has matured only five good crops of grain, averaging for this period a little less than 9 bushels per acre. In addition, it has produced an average of about 3,600 pounds of stover or fodder per acre. It deserves, however, an important place in the rotation. The yields of small grain following it are materially increased over those following small grain and fully equal or even exceed those on fallow. When properly handled corn can take the place of fallow in cleaning the ground of most weeds. Its inclusion in the cropping system distributes labor and team requirements better than unmixed grain farming and by preparing the ground for small grain helps to prepare for the early seeding of a large acreage. As the most valuable part of the average crop is the fodder, it tends to diversification, as live stock is necessary in order to consume it on the farm where produced.

Brome-grass has been found to lend itself well to use in a rotation. It has been a sure and reliable hay crop. There is also an aftermath eminently suited for fall pasture, but its value has not been determined in these experiments.

Alfalfa has also proved a valuable sod crop. The only failures have been from rather infrequent winterkilling. Its average tonnage is not quite as heavy as that of brome-grass, but it is of higher value. It does not lend itself to short rotations as well as brome-grass, because it is not desirable here to attempt to establish it by seeding with another crop, a practice which for 14 years has proved entirely practicable with brome-grass.

The effect of alfalfa in a rotation has apparently been to depress the yield of the crops immediately following. Brome-grass has had a slightly depressing effect on the first crop following it, but succeeding crops have neither been increased nor decreased in yield. It may well be that these experiments do not show what may fairly be expected from sod crops in rotation on a farm. Generally speaking, in these experiments the crops have been allowed to meet the weeds that attend their growth under the several cultural methods under trial, but it is necessary in plat work to prevent pernicious weeds, such as the mustards, wild oats, quack-grass, and perennial thistles, from becoming established, as they could not well be confined to single plats or rotations. As one of the effects of sod crops is to clean the land of weeds, it can not be said with certainty that their full effect has been measured in these experiments.

The results indicate that the sod crops, while forming a part of the rotation, should enter into it only as it is necessary to make new seedings and break up the old, in order to maintain the maximum production of the brome-grass or alfalfa.

The remaining ground should be in a rotation of corn on spring plowing, followed by wheat on disked corn ground, and it by wheat, oats, or barley. To make early seeding possible, fall plowing for the small grain is desirable. There is no objection to spring plowing except as it delays seeding. If it can be done in time to permit early seeding, it may be even better than fall plowing.

If one-third the land not in sod were devoted to corn, there would be one crop of wheat on corn ground and one crop of small grain on wheat stubble. The relative production of corn and small grain probably does not justify planting so large a proportion of the land to corn. The adoption of such a rotation would mean a radical change in the agriculture of the section, which is now based chiefly on wheat. It would also mean a decreased total production of wheat, as the increased yield of wheat on the corn ground over wheat following wheat would not compensate for the reduced wheat acreage. The rotation may be lengthened to meet the requirements by reducing the acreage of corn and letting small grain follow small grain for a greater number of years.

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BULLETIN No. 992

Contribution from the Bureau of Entomology
L. O. HOWARD, Chief

Washington, D. C. November 4, 1921

WALNUT HUSK-MAGGOT.[1]

By FRED E. BROOKS, *Entomologist, Fruit Insect Investigations.*

CONTENTS.

INTRODUCTION.

The larva of the walnut husk-maggot has long been known to persons who in autumn have engaged in hulling the nuts of our native black walnut (*Juglans nigra*). Soon after the nuts drop, a large percentage of them are frequently found with the hulls blackened and slimy within and containing multitudes of whitish maggots which move actively through the soft pulp. Such infested nuts are disagreeable to handle, and in hulling the husk sticks to the inner shell, leaving it dirty and unattractive in appearance (Pl. IV, *d*). Inasmuch as the fruit of the black walnut was not important commercially in the past this insect did not attract especial attention, and very few persons, even of those who were familiar with the maggots in the walnuts, ever saw the parent fly. If seen, it was probably seldom regarded as being in any way connected with the disgusting

[1] *Rhagoletis suavis* Loew; order Diptera, family Trypetidae. A closely allied species, *Rhagoletis juglandis* Cresson, has been recorded as attacking the nuts of *Juglans rupestris* and *J. regia* in Arizona and Texas. Several members of the same genus have attracted considerable attention in North America on account of the destructiveness of the larvæ to various kinds of fruit. *R. pomonella* Walsh, known commonly as the apple maggot or railroad worm, is an important pest of apples in the northern part of the United States and Canada. Two species, *R. cingulata* Loew and *R. fausta* O. S., attack cherries over practically the same region, while *R. ribicola* Doane frequently injures currants and gooseberries in the Northwestern States.

condition of the nuts. It was not until an interest developed in certain places in the East in growing the Persian or English walnut (*Juglans regia*) commercially that a demand arose for information regarding this pest. When the Persian walnut trees planted in the East began to fruit, these maggots attacked the nuts and practically ruined very promising crops in several localities. The injury to Persian walnuts and the fact that the eastern black walnut, one of the favorite food plants of the species, is becoming of increasing importance from the standpoint of nut production, have led to the investigation described herein. The project is not yet completed, but the outstanding features of the life history and habits of the insect are now known. Further studies of the species, particularly along the lines of control, are under way.

BRIEF DESCRIPTION OF INSECT AND INJURY.

The adult of the walnut husk-maggot is a two-winged fly about the size of the common house fly. The flies appear on the walnut trees at the time the nuts are approaching maturity and lay clusters of white eggs in punctures made in the husk with their sharp ovipositor (Pl. III, *e*) or in breaks which they may find in the husk of the nuts (Pl. II, *b*, *c*, *d*). Apparently no eggs are deposited in the nuts after they drop. The eggs soon hatch and the resultant maggots rapidly convert the green tissue of the husk into black pulp. After attaining full growth the maggots enter the ground and pupate, there being only one generation of the flies annually.

SYNONYMY.

The following data covering the synonymy of the species were furnished by Mr. B. A. Porter, of the Bureau of Entomology:

Trypeta suavis Loew, 1862, *in* Monogr. Dipt. N. Amer., pt. 1, p. 75.
Acidia suavis Loew, 1873, *in* Monogr. Dipt. N. Amer. pt. 3, p. 235.
Rhagoletis suavis (Loew), 1899, *in* Coquillett, Jour. N. Y. Ent. Soc., v. 7, p. 260.

DISTRIBUTION.

This fly probably occurs pretty generally over the natural ranges of the black walnut and the butternut (*Juglans cinerea*). In 1862 Osten-Sacken[2] gave its distribution as the "Middle States." In 1902 Babb[3] reared the fly from black walnut at Amherst, Mass. Washburn,[4] in 1905, listed the species among the flies of Minnesota;

[2] LOEW, H. MONOGRAPHS OF THE DIPTERA OF NORTH AMERICA (ed. by R. Osten-Sacken), pt. 1, p. 75. Washington, D. C. 1862.

[3] BABB, G. F. NOTE ON RHAGOLETIS SUAVIS LW., WITH A DESCRIPTION OF THE LARVA AND PUPARIUM. *In* Ent. News, v. 13, no. 8, p. 242. 1902.

[4] WASHBURN, F. L. DIPTERA OF MINNESOTA. . Minn. Agr. Exp. Sta. Bul. 93, p. 118. 1905.

and Banks,[5] in 1912, reared flies from butternuts at Plummers Island, Md. There are specimens in the United States National Museum from West Willow and Allegheny, Pa., and Dr. J. M. Aldrich, of the Museum, has in his personal collection specimens from Blue Ridge Summit, Pa., and La Fayette, Ind. During the present investigation the writer has collected or otherwise obtained specimens from the following localities: Boston, Mass.; Wallingford, Conn.; Lockport, N. Y.; West Willow and Washington Heights, Pa.; Columbus, Ohio; New Windsor, Md.; Washington, D. C.; and French Creek and other localities in West Virginia.

FOOD PLANTS.

The walnut husk-maggot has been known to attack commonly the husks of the black walnut (*Juglans nigra*) and the butternut (*J. cinerea*). The writer has reared adults from the husks of the Persian walnut (*J. regia*) and Japanese walnut (*J. sieboldiana*). Of the foregoing hosts the black walnut and Persian walnut are preferred to the others, probably on account of the thicker husks.

DESCRIPTION OF LIFE STAGES.

THE EGG.

The egg (Pl. II, *b*, *c*, *d*) is white, banana-shaped, distinctly curved, 0.9 to 1 mm. in length by 0.2 mm. in width, one end tapering gradually to a rounded point, the other end tapering more abruptly and ending in a minute but distinct spur or pedicle. The eggs are placed in masses compressed closely together (Pl. II, *b*, *c*, *d*) in oviposition punctures extending 2 mm., more or less, beneath the skin of the nuts. The female will oviposit freely in any fresh puncture which she may find in the skin made otherwise than with her ovipositor. Small punctures made experimentally in the husk with a sharp point usually were found promptly by the females and filled with eggs. In some cases such punctures would be packed with eggs and the flies would continue to oviposit on the surface until a small mound of eggs covered the opening in the skin (Pl. II, *d*). One artificial puncture in a black walnut was found to contain 186 eggs and several punctures made with the ovipositor were found to hold upwards of 60 eggs each. The eggs apparently hatch in from 7 to 10 days.

Oviposition takes place only in the green part of the husk, but after the maggots hatch and begin to feed the point of attack soon shows as a black spot on the surface (Pl. IV, *a*). This spot increases rapidly in size as the burrows of the maggots penetrate the tissues

[5] BANKS, NATHAN. THE STRUCTURE OF CERTAIN DIPTEROUS LARVÆ WITH PARTICULAR REFERENCE TO THOSE IN HUMAN FOODS. U. S. Dept. Agr., Bur. Ent., Tech. Ser. Bul. 22, p. 32. 1912.

beneath. Persian walnuts on the trees will often turn black from this cause during a period of only a few days. Quite often the first external evidence of the feeding of the larvæ within a nut will be a slight seepage of dark juice from the oviposition wound, which will flow down and stain the skin of the nut (Pl. IV, *b*).

THE LARVA.

The larva, or maggot (Pl. II, *e*, *f*; Pl. IV, *c*), is white or creamy white, and is not stained by the dye-like, semiliquid matter in which it feeds. The dark-colored contents of the alimentary canal, however, give to the immature maggots a brownish appearance. When full grown they average 10 mm. in length by 2 mm. in width. The maggots are active and move about rapidly, using in locomotion their two anal hooks. They often remain in the walnut husk until severe freezing weather occurs, but take advantage of warm periods in the late autumn to leave the nuts and enter the ground a short distance for pupation.

THE PUPA.

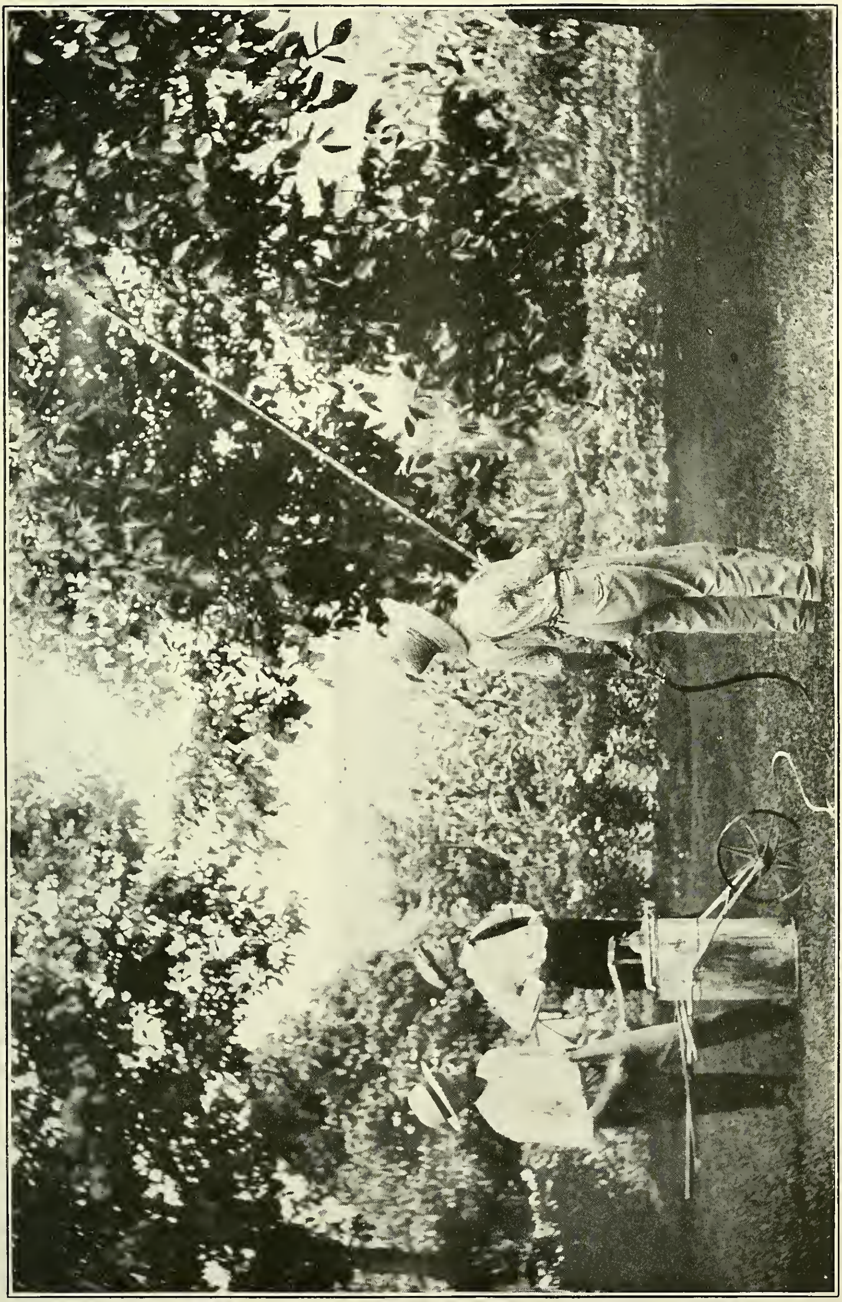
The pupa (Pl. II, *g*, *h*) is formed by the shrinkage of the larva and is pale yellow, cylindrical, tapers slightly from the middle toward the ends, and is 5 mm. in length by 2.5 mm. in width. There are 11 plainly visible segments, the intersegmental grooves being shallow but distinct. Each end bears a pair of small, brownish tubercles and there is a rough, brown spot near one end where the larval head was retracted. In size, shape, and color the pupa resembles a grain of wheat (Pl. II, *h*). The pupæ are formed in the ground, anywhere from half an inch to several inches beneath the surface, and the winter is passed in this stage. Most of the flies issue the following summer, but a few pupæ hold over the second winter and the adults appear therefrom during the succeeding summer.

THE ADULT.

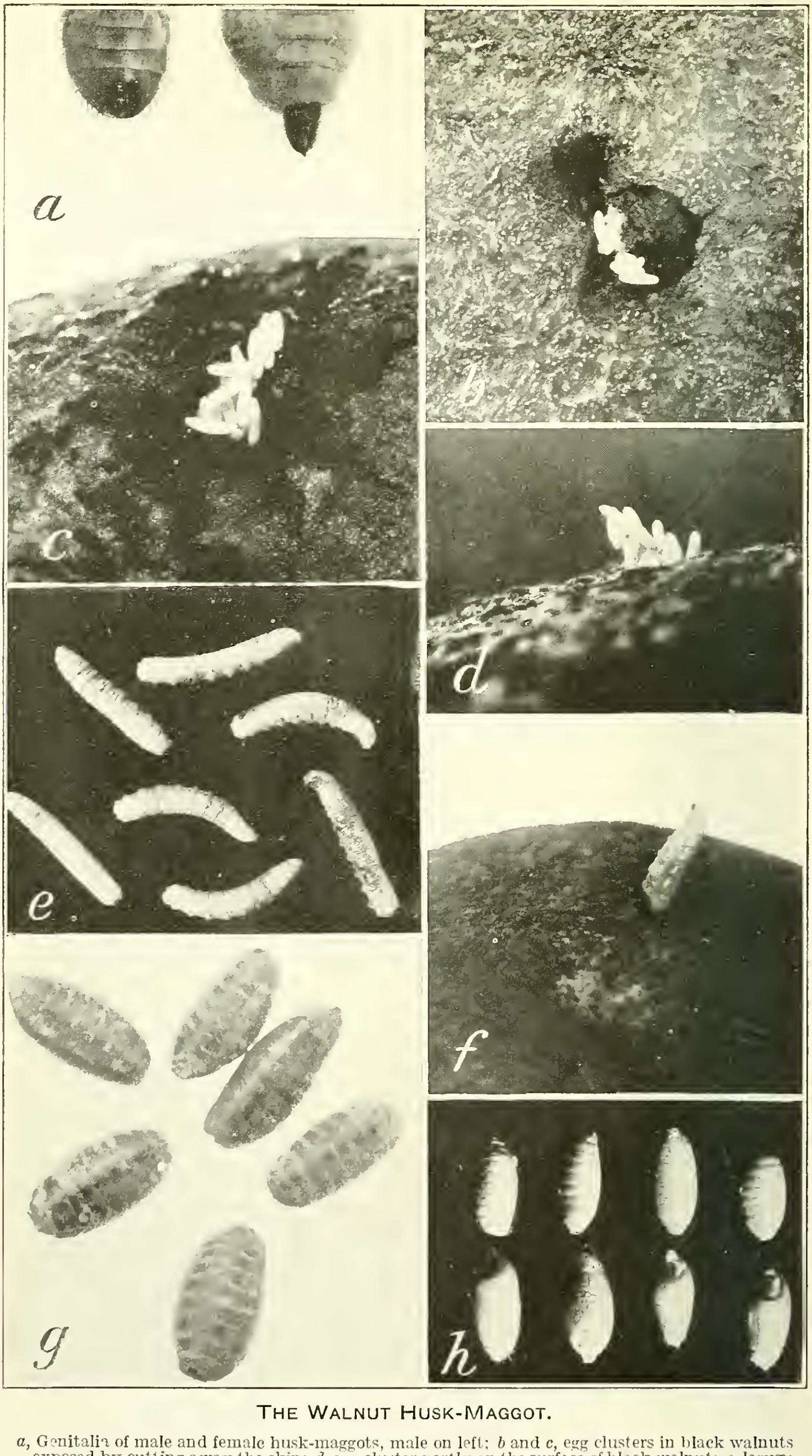
The adults of this insect vary considerably in size but average about 7 mm. in length. With the exception of the eyes, heavy wing markings, anterior margins of the abdominal segments, and bristle-like hairs, all of which are dark brown, the color is pale yellow. There is a lighter longitudinal line on each side of the thorax and the dorsal surface of the thorax is densely clothed with very short, yellowish hairs interspersed sparsely with long, stiff, dark-brown bristles. The head, sides, upper surface of the abdomen, and legs are covered more or less heavily with brown hairs. (Pl. III.)

ACTIVITIES OF THE FLIES.

The flies begin to issue from the ground at least as early as the middle of July in the latitude of West Virginia. In 1920 at French

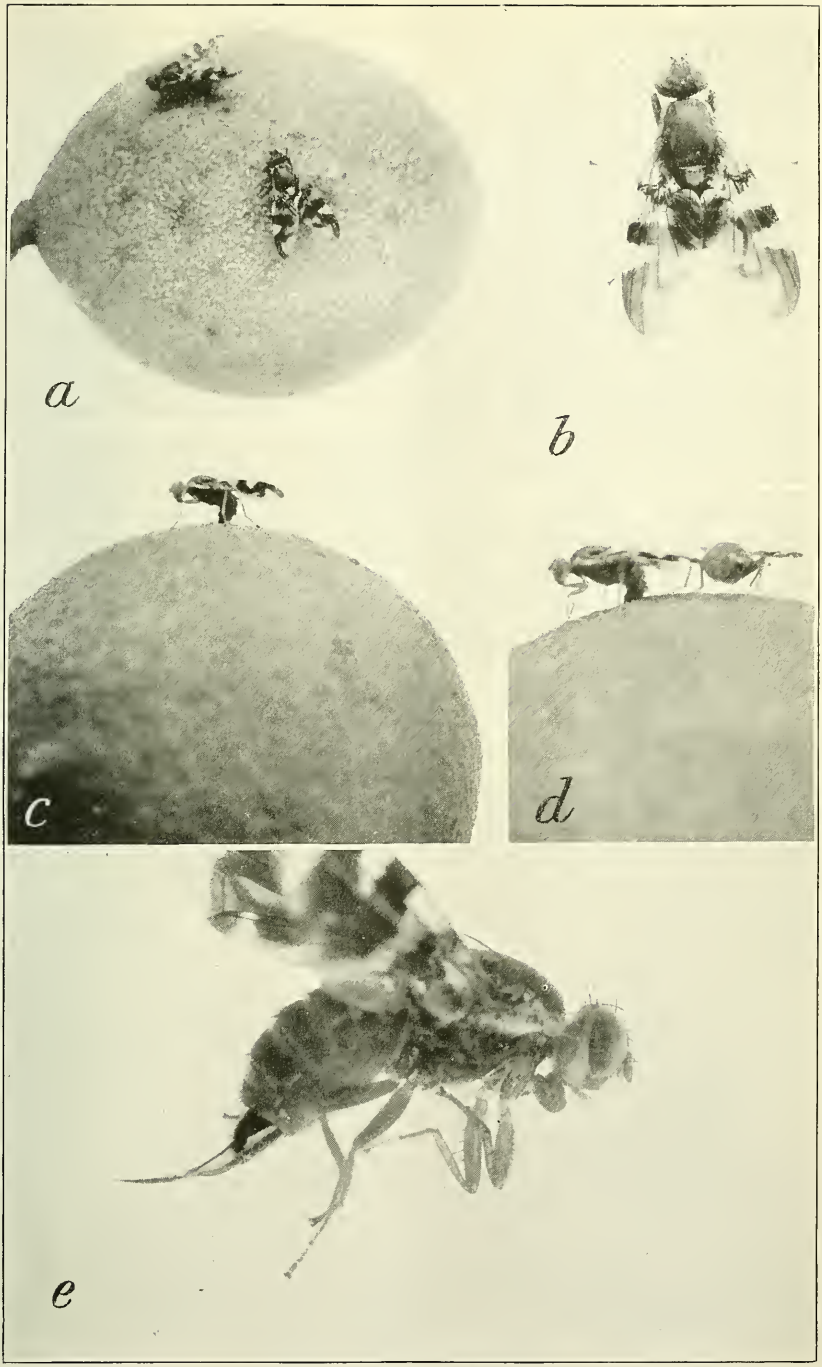


SPRAYING WITH LEAD ARSENATE TO CONTROL THE WALNUT HUSK-MAGGOT IN THE PERSIAN WALNUT GROVES OF J. G. RUSH, WEST WILLOW, PA.



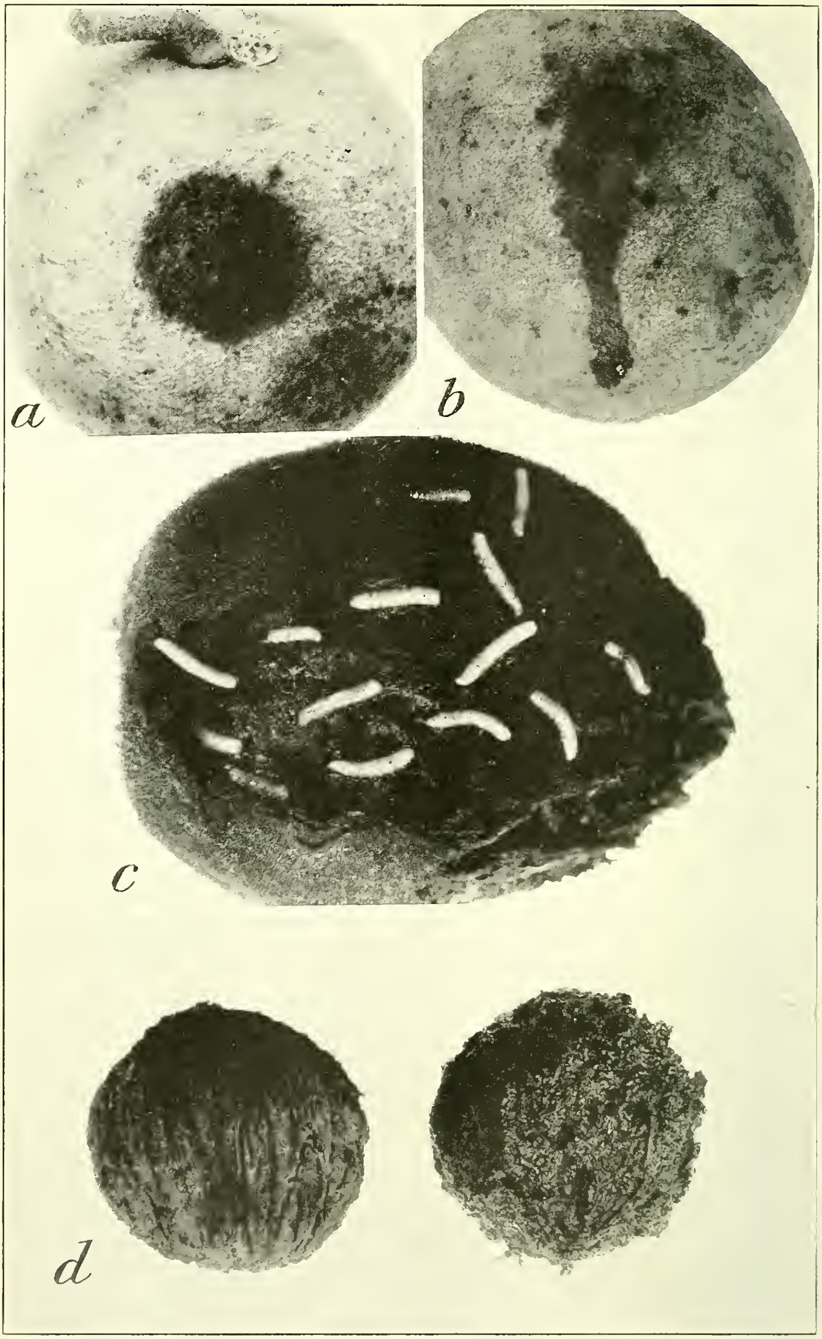
THE WALNUT HUSK-MAGGOT.

a, Genitalia of male and female husk-maggots, male on left; *b* and *c*, egg clusters in black walnuts exposed by cutting away the skin; *d*, egg cluster partly on the surface of black walnut; *e*, larvæ; *f*, larva escaping from a black walnut; *g*, pupæ; *h*, resemblance of pupæ, above, and grains of wheat, below. All enlarged.



THE WALNUT HUSK-MAGGOT.

a, Flies of husk-maggot on black walnut; *b*, fly of husk-maggot much enlarged; *c*, female in the act of depositing eggs in a black walnut; *d*, female laying eggs and guarded by a male; *e*, female with ovipositor extended. All enlarged.



THE WALNUT HUSK-MAGGOT.

a, Black walnut showing discolored spot on skin made by husk-maggots mining within; *b*, black walnut stained by juice flowing from oviposition scar; *c*, husk-maggots in Persian walnut; *d*, black walnuts with husk removed to show difference in hulling between sound and infested nuts; nut on the left sound, on the right infested. All about natural size.

Creek, W. Va., the first flies appeared in rearing jars on July 16, and on August 5 the first specimens were recognized definitely on the trees. Flies, apparently of this species, were seen on trees in both West Virginia and Pennsylvania several weeks earlier, but no specimens were captured and identification was not definite. Flies in rearing jars issued from July 16 to September 8, emergence covering a period of 55 days. Table I shows the time of emergence of 40 individuals in rearing jars.

TABLE I.—*Emergence of flies of walnut husk-maggot in rearing jars at French Creek, W. Va., in 1920.*

Date	Number of flies.	Date.	Number of flies.	Date.	Number of flies.	Date.	Number of flies.
July 16....	1	July 31....	1	Aug. 15...	3	Aug. 29...	0
17....	0	Aug. 1....	1	16...	0	30...	0
18....	0	2....	0	17...	2	31...	1
19....	2	3....	0	18...	2	Sept. 1....	0
20....	0	4....	1	19...	3	2....	0
21....	1	5....	0	20...	0	3....	0
22....	0	6....	1	21...	0	4....	1
23....	1	7....	1	22...	0	5....	0
24....	0	8....	1	23...	1	6....	0
25....	0	9....	1	24...	1	7....	0
26....	1	10....	0	25...	4	8....	1
27....	0	11....	0	26...	4	9....	0
28....	0	12....	2	27...	1		
29....	0	13....	1	28...	0	Total..	40
30....	0	14....	0				

Apparently flies are present on the trees several weeks before oviposition begins. At first they occupy the foliage chiefly, making short flights from leaf to leaf and resting quietly for long periods. During the preoviposition period, as well as later, they may be seen lapping at the leaves as though extracting food from deposits on the surface. As the time for the beginning of oviposition approaches the flies become more active, and both males and females show a tendency to gather about the nuts. The males habitually select certain nuts on which an individual will take his stand and often remain for hours at a time awaiting the coming of the female, combating, meantime, other males that approach. When a male alights on a nut already tenanted by another male the original occupant attacks it and usually the two rear up on their hind legs, facing each other, and engage in a brief but animated bout, belaboring each other with their forelegs. Usually the original occupant is the victor and the would-be interloper flies away.

A prick made in a walnut with a pin or other sharp point was sure to be found by a male, who, recognizing it evidently as a suitable place for the females to come to oviposit, would immediately begin standing guard over it. In one instance the writer pricked a dozen walnuts on the lower branches of a tree with the point of a small nail. Thereafter for several days a male was on guard at each of the punctured nuts and females were observed frequently to visit these nuts, where copulation and oviposition took place. In approaching these nuts the females usually came by easy stages, flying and crawling near the nut before alighting upon it. When the male would observe a female approaching he would become much excited, moving back and forth, whirling around, and raising and lowering the wings in rapid succession, but remaining near the puncture made with the nail point. On the arrival of the female upon the nut the male would usually back away from the nail puncture a short distance and there remain stationary, with wings elevated above the back, watching the female intently. When the female would find the puncture and start to insert the tip of her abdomen into the opening for the purpose of depositing eggs, the male would spring upon her and copulation would take place. There would then follow alternating periods of oviposition and copulation, the male sometimes continuing mounted while oviposition was in progress, and sometimes dismounting but remaining near by. (Pl. III, *d.*) Frequently there would be four or five periods of each before the female would fly away. After this procedure the male was likely to continue on guard at the same place, for the nail pricks were visited frequently by ovipositing females.

The flies were observed to be much more abundant on the lower than on the higher branches of trees, and there was a great difference in the numbers of flies on individual trees of the same species. On a group of heavy-laden Persian walnut trees of the variety known as Hall, at West Willow, Pa., it was estimated that one fly was present for every two nuts on the trees. The variation in the numbers of flies on individual trees was followed by a corresponding abundance or scarcity of maggots in the nuts of each.

Flies were observed to feed upon the juice that flowed from oviposition scars and upon the naturally more or less gummy surface of the nuts. In feeding they would eject from the mouth a particle of clear liquid onto the surface and after working it over with the purselike, external mouthparts would swallow it again.

NATURE OF INJURY.

In native black walnuts the eggs of the husk-maggot fly are usually deposited so late in the season that the resultant maggots do not prevent the nuts from maturing and dropping normally. Thus, while apparently all the eggs are laid in nuts on the trees, the development of the maggots and the blackening of the husks which results from their feeding take place chiefly in fallen nuts. In Persian walnuts, however, eggs appear to be laid earlier in the development of the nuts. Bearing trees were observed in Maryland and Pennsylvania, a short time before the crop had ripened, on which a large percentage of the husks of the nuts were blackened throughout and the surface covered with a gummy exudation from the maggot injury within. Some of the infested Persian walnuts drop prematurely and others hang to the branches until after the sound nuts have fallen. In nuts that are attacked before maturing the development is arrested and the kernel becomes unfit for use. The injury is thus threefold, in that it impairs the quality of the kernel, causes the husk to stick to the shell in the hulling process, and blackens and soils the shell, making the nuts unattractive for market.

NATURAL ENEMIES.

Only one parasite of the husk-maggot has been discovered. This is a hymenopterous species, *Aphaereta auripes* Prov., reared from the puparia by Babb ([6]) at Amherst, Mass. The writer, on September 8, 1920, found a small leaf-bug, determined by W. L. McAtee as a species of Lopidea, with its beak inserted through the skin of a black walnut sucking out the contents of a batch of fresh-laid husk-maggot eggs. An examination of the eggs showed that a number of them had been punctured and emptied by the bug.

METHODS OF CONTROL.

Experiments in controling the husk maggot with lead-arsenate sprays were conducted in 1920 in the Persian walnut groves of Mr. N. H. Baile, at New Windsor, Md., and of Mr. J. G. Rush, at West Willow, Pa. Only a single application of the spray was made in each case. The grove of Mr. Baile consists of about a dozen seedling trees of various sizes, some of them about 30 years of age. At the time of the spraying all were bearing heavy crops of nuts. This grove was sprayed by means of a power sprayer on August 10, with 3 pounds of lead-arsenate paste to 50 gallons of water. The grove of Mr. Rush consists of 18 trees of named varieties, all of bearing age. The trees were producing heavily at the time the spray was applied. The spraying was done on August 9, using 1½ pounds of lead-arsenate powder to 50 gallons of water. Two trees of the variety known as Rush, three of Hall, and two of Mayette were sprayed with the lead-arsenate solution to which enough molasses had been added to give the liquid a slightly sweetish taste. For treating the Rush grove a small hand sprayer mounted on a wheelbarrow was used (Pl. I). The trees of both groves had borne the previous season, but the crops had been injured seriously by the attacks of the maggots.

At the time the groves were sprayed the adults of the maggots were appearing on the trees and a close examination of the nuts in the Rush grove disclosed one batch of freshly laid eggs. After the spraying the Baile grove was not revisited until the nuts were almost

[6] Babb, G. F. op cit.

ripe. The Rush grove, however, was kept under close observation by Mr. Rush and the writer. The flies became very numerous on the trees of this grove for a period of a few days after the spray was applied and then decreased in numbers.

Examination and counts of the nuts of the sprayed trees in the Baile grove just before the crop was gathered showed that 4 per cent of the nuts had been attacked by the maggots, whereas at least 60 per cent of the crop had been destroyed by the maggots the previous year. In the Rush grove it was estimated that the condition was 75 per cent better than the year before when no treatment was given. No Persian walnut trees were found near either the Baile or Rush groves that were suitable for use in checking up definite results of the spraying. However, a comparison of the sprayed nuts with those produced by the same trees the previous season and with those produced in other localities the same season, together with the known abundance of the flies that appeared early upon the sprayed trees, indicates decidedly beneficial results from the treatment.

Flies confined in roomy wire-screen cages were observed to feed freely on sweetened water to which sufficient lead arsenate had been added to give the liquid a milky color. It must be admitted that these flies succumbed very slowly to the poison. Further tests of this treatment must be made before it can be recommended unreservedly as an effective and sure method of control for this pest.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 993

Contribution from the Bureau of Chemistry
W. G. CAMPBELL, Acting Chief

Washington, D. C. ▼ October 15, 1921

THE COMPOSITION OF CALIFORNIA LEMONS.

By E. M. CHACE, *Chemist in charge*, and C. P. WILSON and C. G. CHURCH, *Assistant Chemists, Laboratory of Fruit and Vegetable Chemistry.*[1]

CONTENTS.

THE CALIFORNIA LEMON INDUSTRY.

Beginning in 1887 with the shipment of 12 cars of fruit, the California lemon industry has increased a thousandfold, the 1919–20 shipment being approximately 12,000 cars. The California growers have generally settled upon the Eureka and Lisbon varieties as the most satisfactory in that State, and, although there are scattered orchards of other varieties, the new plantings are confined to these two.

According to A. D. Shamel (1),[2] the Eureka variety originated in 1858 in Los Angeles, through the planting of seeds obtained from Sicilian lemons. These seedlings bore about 12 years later, at which time several were selected as worthy of propagation. Buds from these trees are responsible for the present Eureka variety of lemon. The Lisbon variety was imported directly from Australia in 1874 (2). While some plantings now in existence can be traced to the original shipment, later importations are also responsible for the Lisbon, the most widely planted variety in California to-day. The Villa Franca lemon has been planted to some extent, but has generally been abandoned in favor of the Eureka and Lisbon varieties.

[1] The writers are greatly indebted to F. E. Denny for help with the calculations and for criticism of the manuscript, as well as to C. O. Young and R. H. Kellner for collaboration in the analytical work.

[2] Figures in parenthesis refer to Bibliography at end of bulletin.

At various times attempts have been made to utilize the culls from the lemon industry. The first effort which was ultimately successful was that of a company, organized in 1898, now manufacturing essential oils and citrate of lime. Another company, established early in 1914, at present produces citric acid and essential oil. Several smaller firms are making citric acid, citrate of lime, and bottled lemon juice. As the history of the undertaking has been treated by others (3) (4), it need not be considered further here.

PURPOSE OF INVESTIGATION.

So far as known, there has been no systematic attempt to study the composition of the California lemon. Analyses of scattered samples have been published, but no series of results from carefully selected trees, where sampling was continued throughout the season, has been reported. It is highly desirable that this information be made accessible to the lemon grower, as well as to the lemon by-product manufacturer, who is especially interested in the oil and acid content of the fruit which he purchases.

INVESTIGATIONAL WORK.

METHOD OF SAMPLING.

In a territory as extensive as the lemon-growing section of California, adequate sampling presents many difficulties. Since the number of samples which can be examined is necessarily limited by the size of the laboratory force and its facilities, care was taken to select typical locations in each well-recognized growing district. In some instances, circumstances prevented sampling, so that a small number of centers are not adequately represented, and in a few cases certain districts are more fully represented than was at first planned. In all, satisfactory samples were taken in about 20 locations in the following centers: Bonita, Chula Vista, Escondido, Whittier, Santa Paula, Carpenteria, San Fernando, Glendora, San Dimas, and Claremont. From other work conducted at the same time it was possible to obtain data on fruit grown at Corona.

The trees selected originally were such as to give an equal number of locations of the Eureka and Lisbon varieties. Because of irregular sampling, the final selections consist of 10 Eureka and 6 Lisbon trees. The judgment of experienced growers was the deciding factor in selecting typical trees. It is possible that some of the trees included in the final results are not of the best strains, but, as many groves of such trees exist in the State, the effectiveness of the data is not materially impaired.

Again, the number of fruits to each sample was a matter of concern. Manifestly, the larger the number the better the chance of satisfactorily representing the composition of the grove or district from which the sample came. After removing the sample for the experimental work, the trees from which they were taken were picked in the usual commercial way. In a few cases an insufficient number of fruits had reached the proper size when time for the next sampling arrived.

Both the Eureka and Lisbon varieties of lemons in California blossom throughout the year, and pickings of fruit are made monthly, except in September or October, when they are usually omitted. Whenever possible samples were taken at monthly intervals in the course of the investigation here reported.

As a rule, from 18 to 24 fruits were forwarded to the laboratory in cardboard cartons furnished for the purpose. Seldom were they more than 24 hours en route. At the laboratory they were kept in the cartons in cool storage (40° to 50° F.) until analysis was begun. Usually not more than three days elapsed between the time of picking and analysis.

METHODS OF ANALYSIS.

Unfortunately, in order to make a satisfactory determination of the essential oil of the fruit, it was necessary to divide the sample. After the specific gravity of the fruit had been determined by weighing in the air and under water, this division was made as evenly as possible, both as to size and color. Half the sample was ground by being passed through a food grinder three times, and the oil was determined in a portion of it by steam distillation, according to the method of Wilson and Young (5). The acidity of the whole fruit was determined on another portion of this sample by titration with alkali solution, using phenolphthalein as indicator.

The remaining lemons were quartered, the thickness of the skin estimated, and the juice expressed by a small hand press.

In estimating the thickness of the peel, the following arbitrary method was used: The cross section of the peel was measured in several places by calipers, and the average taken. When this was found to be less than 3 mm., the peel was designated as thin; 3 to 5 mm., medium; and above 5 mm., thick (fig. 1). Rarely did peel exceed 7 mm. in thickness.

The acidity of the juice was determined by titration against alkali. All acid is calculated as citric with the water of crystallization included.

RESULTS OF INVESTIGATION.

The data derived from the analyses of Eureka and Lisbon lemons grown in California are shown in Tables 1 and 2. Table 3 gives the results on samples of the Villa Franca variety; Table 4, those on samples of fruit from a Eureka location in central California; and Table 5, those on samples of lemons of an unknown variety from Arizona. It is not thought advisable to attempt to compare the results in Tables 3, 4, and 5 with those in Tables 1 and 2, for the reason that the number of Villa Franca locations was small, al-

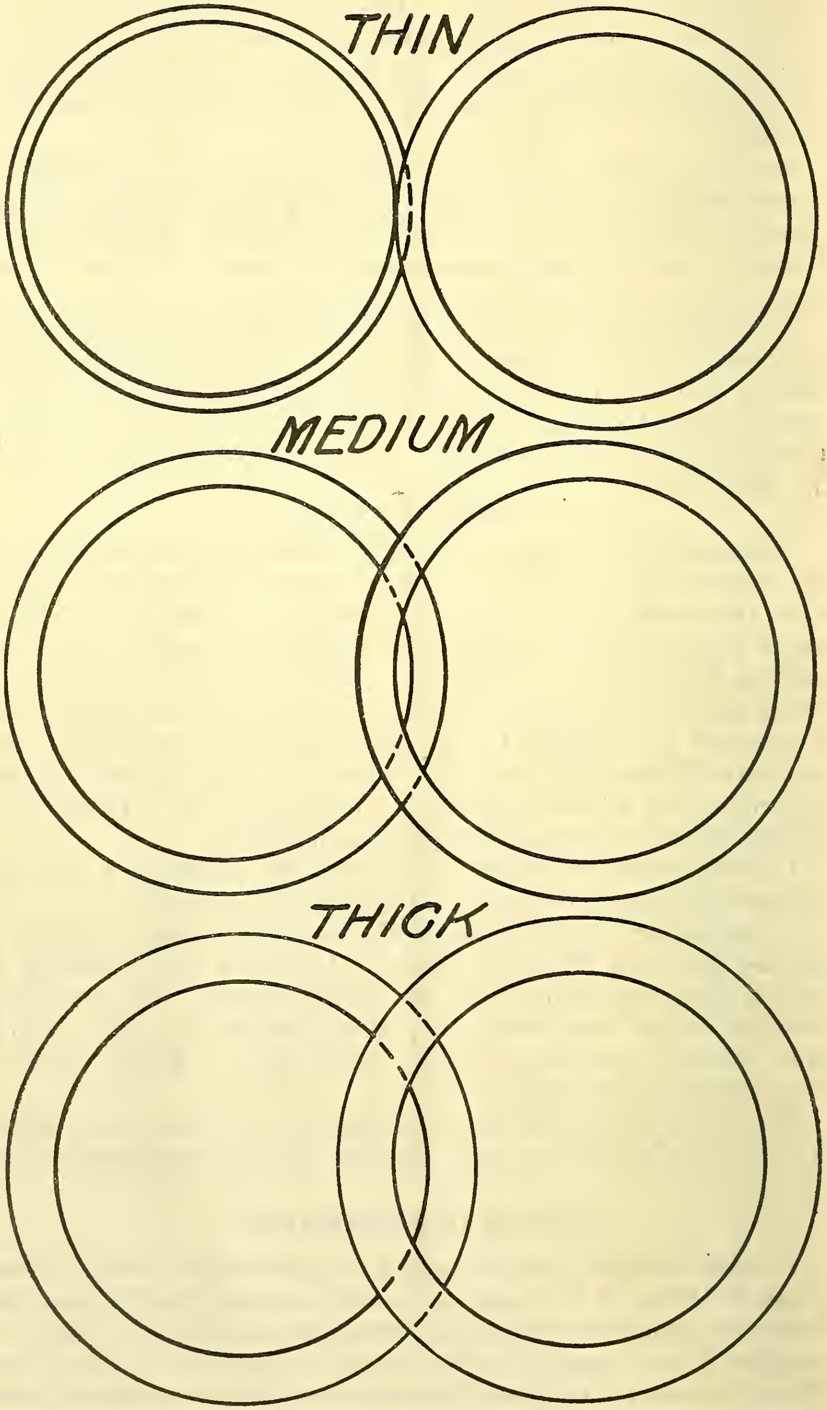

FIG. 1.—Standards used to determine the thickness of the peel.

though not too small to preclude satisfactory results had the variability encountered been less. While the averages of the three sets are taken from a sufficient number of samples to make them worthy of consideration, the monthly averages depend on but three samples, too small a number from which to draw conclusions. Moreover, neither Tulare County nor Arizona is a large lemon-shipping center, and the number of samples analyzed from each of these districts was small. In Tulare County the lemon season begins in September and lasts but a few months, so that comparison with lemons grown in other districts throughout the season is impossible. The data contained in Tables 3, 4, and 5, however, are of no little interest to lemon growers, and it is felt that they should be published here.

TABLE 1.—*Composition of Eureka lemons grown in various sections of California.*

Sample No.	Month picked.	Color.[1]	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.[2]	Acid per ton of fruit.	Acid in juice.[2]
			BONITA (TREE 1).						
					Per cent.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
489	July	DG-Y	Thin		0.52	10.4	3.86	77.2	7.23
564	Sept	DG	Very thin	0.9791	.41	8.2	4.27	85.4	6.82
594	Oct	LG	Thin	.9822	.34	6.8	4.41	88.2	6.57
628	Nov	LY	do	.9853	.42	8.4	4.16	83.2	6.63
673	Dec	FY	Medium	.9214	.66	13.2	3.73	74.6	7.25
778	Feb	LY	do	.9215	.45	9.0	3.10	62.0	6.91
821	Mar	LY	Thick	.9274	.44	8.8	3.24	64.8	6.55
881	Apr	FY	Medium	.9287	.45	9.0	3.62	72.4	6.72
919	May	FY	Thick	.9368	.52	10.4	3.48	69.6	6.88
974	June	FY[3]	Medium	.9537	.67	13.4	3.71	74.2	7.55
1026	July	LY	Thin	.9618	.56	11.2	3.34	66.8	
1056	Aug	LY	do	.9769	.51	10.2	3.66	73.2	
Average				**.9522**	**.50**	**9.9**	**3.71**	**74.3**	**6.91**
			SANTA PAULA (TREE 10).						
641	Dec	LG	Medium	0.9432	0.53	10.6	3.72	74.4	7.73
679	Jan	LG	Thick	.9220	.44	8.8	3.50	70.0	7.30
723	Feb	LY	Medium	.9238	.42	8.4	3.36	67.2	7.09
788	Mar	LY	do	.9162	.43	8.6	3.22	64.4	6.91
846	Apr	DG-LY	do	.9190	.40	8.0	3.27	65.4	6.37
891	May	LG	do	.9394	.39	7.8	3.41	68.2	6.71
940	June	DG		.9520	.44	8.8	3.83	76.6	7.00
984	July	LG-DG	Medium-thin	.9517	.50	10.0	3.87	77.4	7.21
1039	Aug	LG	Thin	.9524	.43	8.6	4.10	82.0	7.25
1073	Sept	LY	Medium	.9419	.57	11.4	4.06	81.2	7.74
1084	Nov	Y	Thin	.9627	.51	10.2	4.00	80.0	6.69
Average				**.9386**	**.46**	**9.2**	**3.67**	**73.3**	**7.09**
			SANTA PAULA (TREE 11).						
639	Dec	LG	Medium	0.9347	0.43	8.6	3.43	68.6	7.18
680	Jan	LG	Thick	.9238	.30	6.0	3.37	67.4	6.84
724	Feb	LY	Medium	.9357	.45	9.0	3.49	69.8	7.00
789	Mar	LG	do	.9241	.42	8.4	3.53	70.6	7.04
847	Apr	LG	Thick	.9201	.39	7.8	3.23	64.6	6.53
892	May	LG	Medium	.9347	.41	8.2	3.50	70.0	6.65
941	June	DG	do	.9478	.48	9.6	3.45	69.0	6.97
985	July	LG-DG	do	.9498	.46	9.2	3.43	68.6	6.76
1040	Aug	LG	do	.9568	.45	9.0	3.57	71.4	7.27
1074	Sept	LG-LY	do	.9393	.46	9.2	3.99	79.8	7.30
1086	Oct	LG-Y	do	.9447	.58	11.5	3.43	68.6	6.38
1113	Nov	LY-Y	do	.9773	.51	10.1	3.06	61.2	6.83
Average				**.9407**	**.44**	**8.9**	**3.46**	**69.1**	**6.90**

[1] DG, dark green; LG, light green; LY, light yellow; FY, full yellow.
[2] All acid is calculated as citric with water of crystallization.
[3] Much sunburn.

TABLE 1.—*Composition of Eureka lemons grown in various sections of California*—Continued.

SAN FERNANDO (TREE 13).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
					Per cent.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
631	Nov	LG	Medium	0.9332	0.57	11.4	3.61	72.2	6.62
678	Dec	LG	Thin	.9279	.60	12.0	3.64	72.8	6.79
717	Jan	LG	Medium	.9124	.57	11.4	3.47	69.4	6.30
769	Feb	LG	Thin	.9262	.55	11.0	3.50	70.0	6.53
842	Mar	LY	Medium	.9234	.54	10.8	3.51	70.2	6.39
897	Apr	LY	do	.9312	.58	11.6	3.50	70.0	6.41
927	May	LG	Thin	.9617	.61	12.2	3.95	79.0	6.60
973	June	DG	Medium	.9530	.53	10.6	2.84	56.8	6.39
1031	July	DG	do	.9513	.50	10.0	3.16	63.2	6.65
1055	Aug	DG	do	.9508	.47	9.4	3.41	68.2	6.90
1090	Oct	DG-LY	do	.9470	.62	12.3	2.31	46.2	6.48
1108	Nov	LG-Y	do	.9730	.64	12.8	3.06	61.2	6.90
Average				**.9408**	**.56**	**11.3**	**3.33**	**66.6**	**6.58**

WHITTIER (TREE 14).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
624	Nov	LG	Medium	0.9392	0.60	12.1	3.30	66.0	6.31
666	Dec	LY	do	.9488	.65	13.0	3.41	68.2	6.35
705	Jan	LY	do	.9321	.50	10.0	3.13	62.6	6.55
770	Feb	LY	do	.9227	.43	8.6	2.93	58.6	6.67
832	Mar	LY	do	.9115	.39	7.8	3.01	60.2	5.95
879	Apr	LY-DG	do	.9352	.38	7.6	2.99	59.8	6.21
928	May	LG	do	.9593	.48	9.6	3.01	60.2	6.51
968	June	DG	do	.9624	.55	11.0	3.10	62.0	6.33
1054	Aug	LG	Thin	.9653	.43	8.6	3.30	66.0	6.29
1076	Sept	DG-LY	Medium	.9538	.55	11.0	2.87	57.4	6.62
1088	Oct	LG	do	.9398	.52	10.3	2.75	55.0	6.58
Average				**.9427**	**.50**	**10.0**	**3.07**	**61.4**	**6.40**

WHITTIER (TREE 16).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
646	Dec	DG	Thick	0.9408	0.48	9.6	3.33	66.6	6.76
693	Jan	LG	do	.9164	.42	8.4	3.08	61.6	6.83
751	Feb	LG	do	.9 75	.38	7.6	2.92	58.4	6.91
808	Mar	LG	do	.9270	.31	6.2	2.94	58.8	6.65
863	Apr	LG	do	.9365			3.35	67.0	6.48
909	May	LG	Medium	.9453	.41	8.2	3.36	67.2	6.72
955	June	LY	do	.9554	.47	9.4	3.56	71.2	7.35
1013	July	LG	do	.9576	.46	9.2	3.34	66.8	7.04
1044	Aug	LG	do	.9528	.50	10.0	3.74	74.8	7.16
1070	Sept	DG-LY	Thick	.9350	.43	8.6	3.13	62.6	7.10
1082	Oct	DG	do	.9315	.42	8.4	3.22	64.4	7.00
1098	Nov	G-Y	do	.9247	.44	8.7	2.91	58.2	7.11
1117	Dec	LG-FY	do	.9729	.47	9.5	2.64	52.8	7.21
Average				**.9403**	**.43**	**8.6**	**3.19**	**63.9**	**6.95**

WHITTIER (TREE 18).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
664	Dec	LY	Thick	0.9206	0.62	12.4	3.41	68.2	7.21
713	Jan	LG	do	.8912	.42	8.4	2.98	59.6	6.41
791	Feb	LY	Medium	.8986			3.06	61.2	6.39
849	Apr	LY	Thick	.9000	.39	7.8	3.14	62.8	6.23
889	May	LG	Medium	.9359	.42	8.4	3.04	60.8	6.23
924	June	LY	Thick	.9199	.44	8.8	3.18	63.6	5.99
983	July	LY-DG	Medium	.9415	.45	9.0	2.87	57.4	6.06
1059	Aug	DG	Thin	.9500	.50	10.0	3.26	65.2	7.00
1078	Sept	DG-LY	Thick	.9359	.55	11.0	3.12	62.3	7.00
1091	Oct	LG	do	.9389	.52	10.3	3.02	60.4	6.58
Average				**.9232**	**.48**	**9.6**	**3.11**	**62.1**	**6.51**

TABLE 1.—*Comparison of Eureka lemons grown in various sections of California*—Continued.

SAN DIMAS (TREE 21).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
					Per cent.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
656	Dec	LG	Medium	0.9313	0.66	13.2	3.47	69.4	6.67
704	Jan	LY	do	.9187	.41	8.2	3.44	68.8	6.31
761	Feb	LY	Thick	.9186	.57	11.4	3.38	67.6	6.46
815	Mar	LY	Medium	.9176	.53	10.6	3.40	68.0	6.55
876	Apr	LY	do	.9260	.52	10.4	3.47	69.4	6.25
923	May	LY	do	.9346	.58	11.6	3.32	66.4	6.25
960	June	DG-FY	do	.9404	.46	9.2	3.00	60.0	6.16
1029	July	DG	do	.9498	.41	8.2	2.84	56.8	6.23
1051	Aug	DG	Thin	.9407	.35	7.0	2.99	59.8	6.36
1079	Sept	LG	Medium	.9611	.46	9.2	3.86	77.2	6.53
1087	Oct	DG-LY	Thick	.9370	.49	9.7	2.68	53.6	6.44
1102	Nov	LG-Y	Medium	.9780	.67	13.4	Lost.	Lost.	7.14
Average				**.9378**	**.51**	**10.2**	**3.26**	**65.2**	**6.45**

CLAREMONT (TREE 22).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
699	Jan	LY	Medium	0.9242	0.47	9.4	3.52	70.4	6.16
763	Feb	LY	do	.9141	.50	10.0	3.01	60.2	6.62
824	Mar	LY	do	.9187	.44	8.8	2.89	57.8	6.27
872	Apr	LG-FY		.9130	.46	9.2	2.88	57.6	5.95
908	May	LY	Medium	.9278	.47	9.4	3.64	72.8	5.88
957	June	LY-DG	Thick	.9329	.45	9.0	2.87	57.4	5.92
1019	July	DG	Medium	.9420	.39	7.8	2.59	51.8	6.42
1047	Aug	DG	do	.9507	.50	10.0	2.85	57.0	6.53
1068	Sept	DG-LG	do	.9560	.53	10.6	3.44	68.8	6.79
1083	Oct	DG	Thin	.9464	.52	10.4	2.57	51.5	6.11
1099	Nov	Y	Medium	.9735	.63	12.5	3.43	68.6	6.79
1119	Dec	LG-Y	do	.9775	.53	10.7	3.13	62.6	6.55
Average				**.9397**	**.49**	**9.8**	**3.07**	**61.4**	**6.33**

CARPENTERIA (TREE 24).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
682	Jan	LY	Thick	0.8991	0.49	9.8	2.64	52.8	6.58
726	Feb	FY	do	.9089	.45	9.0	2.66	53.2	6.63
792	Mar	LY	do	.8966	.32	6.4	2.66	53.2	5.90
850	Apr	LY	do	.9068	.32	6.4	2.28	45.6	5.39
902	May	LG	do	.9215			2.54	50.8	5.74
939	June	DG	do	.9504	.34	6.8	2.28	45.6	6.20
998	July	LG	Very thick	.9823	.40	8.0	2.21	44.2	5.74
1036	Aug	LG	Thick	.9421	.35	7.0	2.13	42.6	5.90
1067	Sept	LG	do	.9377	.39	7.8	2.56	51.2	6.27
1080	Oct	DG-Y	do	.9256	.41	8.2	2.07	41.3	5.95
1096	Nov	DG-Y	do	.9306	.44	8.8	1.91	38.2	5.75
Average				**.9274**	**.39**	**7.8**	**2.36**	**47.2**	**6.00**

TABLE 2.—*Composition of Lisbon lemons grown in various sections of California.*

Sample No.	Month picked.	Color.[1]	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.[2]	Acid per ton of fruit.	Acid in juice.[2]
			BONITA (TREE 2).						
					Per cent.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
490	July	LG-FY	Medium	0.8375	0.58	11.6	3.50	70.0	6.93
570	Sept	LY	Thin	.9252	.59	11.8	3.96	79.1	7.42
595	Oct	FY	Thick	.9186	.57	11.4	4.05	81.0	6.55
629	Nov	LG-LY	Medium	.9012	.57	11.4	3.52	70.4	7.35
674	Dec	LY	Thin	....	.52	10.4	3.94	78.8	6.97
779	Feb	LY	Medium	.8511	.44	8.8	3.17	63.4	6.79
822	Mar	LY	do	.9159	.41	8.2	2.92	58.4	6.23
882	Apr	LY	do	.9118	.44	8.8	3.24	64.8	6.21
920	May	LY	Thick	.9074	.49	9.8	2.94	58.8	6.49
975	June	FY	Medium-thin	.9148	.53	10.6	3.50	70.0	7.07
1027	July	FY	Medium	.9215	.48	9.6	3.43	68.6	6.83
1057	Aug	LY	do	.9455	.67	13.4	3.62	72.4	6.97
Average				**.9046**	**.52**	**10.5**	**3.48**	**69.6**	**6.82**
			CHULA VISTA (TREE 4).						
492	July	LG-LY	Medium-thick	0.8485	0.62	12.3	3.68	73.5	7.24
543	Aug	DG-FY	do	.9044	.50	10.0	3.57	71.4	6.90
573	Sept	LY	Medium	.9318	.52	10.3	3.59	71.8	6.93
597	Oct	DG-LG	do	.9173	.50	10.0	3.77	75.4	7.14
636	Nov	LG-LY	do	.9306	.61	12.2	3.60	72.0	7.54
662	Dec	LY	do	.9269	.66	13.2	3.87	77.4	8.05
764	Feb	LY	Thick	.8931	.53	10.6	3.08	61.6	6.83
851	Mar	LG	Very thick	.8990	.43	8.6	2.82	56.4	6.32
877	Apr	LG	Thick	.9101	.57	11.4	3.27	65.4	6.34
937	June	LY	do	.9081	.55	11.0	3.00	60.0	6.58
1025	July	LY	Medium	.9207	.54	10.8	3.47	69.4	7.42
1049	Aug	LG	do	.9405	.48	9.6	3.65	73.0	7.51
1072	Sept	DG-Y	do	.9263	.49	9.8	3.50	71.1	7.49
Average				**.9121**	**.54**	**10.8**	**3.45**	**69.1**	**7.10**
			CHULA VISTA (TREE 5).						
493	July	LG-LY	Thick	0.9423	0.56	11.2	3.41	68.2	6.79
544	Aug	DG	Medium	.9396	.50	10.1	3.43	68.6	6.82
574	Sept	LG	do	.9487	.59	11.8	3.94	78.8	7.32
598	Oct	LG-LY	do	.9368	.50	9.9	3.88	77.6	6.81
637	Nov	LG	do	.9307	.69	13.8	3.50	70.0	7.74
663	Dec	LG	do	.9421	.84	16.8	3.47	69.4	7.81
765	Feb	LY	do	.9084	.54	10.8	3.78	75.6	6.83
852	Mar	LG	Thick	.9152	.49	9.8	....	....	6.27
878	Apr	LG	Medium	.9268	.53	10.6	3.22	64.4	5.81
936	June	DG-LG	Very thick	.9314	.49	9.8	2.69	53.8	6.55
1023	July	LY	do	.9351	.49	9.8	2.99	59.8	7.44
1048	Aug	LG	Thick	.9363	.54	10.8	2.95	59.0	7.32
1071	Sept	DG-Y	Medium	.9280	.43	8.6	3.31	66.2	7.14
Average				**.9324**	**.55**	**11.1**	**3.38**	**67.6**	**6.97**
			ESCONDIDO (TREE 6).						
505	July	DG-FY	Medium-thick	0.9437	0.48	9.6	3.22	64.4	6.02
534	Aug	LG-FY	do	.9369	.50	10.0	3.22	64.4	6.23
568	Sept	DG	Thick	.9205	.60	12.0	2.87	57.4	6.12
599	Oct	DG	do	.9074	.58	11.6	2.82	56.4	6.42
626	Nov	DG	Medium	.9186	.63	12.6	2.99	59.8	6.37
671	Dec	LG	do	.9240	.59	11.8	3.03	60.6	6.51
766	Feb	LY	Thick	.8991	.42	8.4	2.62	52.4	6.20
826	Mar	LG	do	.9231	.49	9.8	2.76	55.2	6.28
885	Apr	LG	Medium	.9210	....	....	2.80	56.0	6.27
925	May	LG	do	.9247	.50	10.0	2.95	59.0	6.04
971	June	DG-LY	do	.9410	.50	10.0	2.97	59.4	6.27
1021	July	DG	Thick	.9313	.37	7.4	2.58	51.6	6.30
1062	Aug	LG	do	.9341	.39	7.8	3.03	60.6	6.97
Average				**.9250**	**.50**	**10.1**	**2.91**	**58.2**	**6.31**

[1] DG, dark green; LG, light green; LY, light yellow; FY, full yellow.
[2] All acid is calculated as citric with water of crystallization.

TABLE 2.—*Composition of Lisbon lemons grown in various sections of California*—Continued.

SANTA PAULA (TREE 12).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
					Per cent.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
640	Dec	LG-LY	Medium	0.9182	0.50	10.0	3.34	66.8	7.28
681	Jan	LY	Thick	.8955	.40	8.0	2.99	59.8	6.97
725	Feb	LG	Medium	.9140	.42	8.4	2.95	59.0	6.86
790	Mar	LG	do	.8973	.30	6.0	2.80	56.0	6.76
848	Apr	LG	do	.8908	.30	6.0	3.10	62.0	6.44
893	May	LG	do	.9099	.41	8.2	3.21	64.2	6.74
942	June	LG	do	.9205	.41	8.2	3.39	67.8	6.77
986	July	LG-DG	do	.9239	.49	9.8	3.47	69.4	6.88
1042	Aug	LY	do	.9204	.40	8.0	3.69	73.8	7.22
1075	Sept	LY	do	.8952	.40	8.0	3.83	76.7	7.25
1085	Nov	LG-Y	do	.9168	.42	8.4	2.95	59.0	7.28
1114	Dec	LG-Y	do	.9666	.47	9.5	2.98	59.6	7.18
Average				.9141	.41	8.1	3.22	64.5	6.97

WHITTIER (TREE 15).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
625	Nov	DG	Thick	0.9073	0.70	14.0	3.02	60.4	6.37
667	Dec	LY	do	.9049	.70	14.0	3.06	61.2	6.88
706	Jan	LY	do	.8867	.55	11.0	2.93	58.6	6.51
771	Feb	LY	Medium	.9053	.47	9.4	2.80	56.0	6.37
833	Mar	LG	do	.9056	.37	7.4	2.64	52.8	6.31
880	Apr	LY	do	.8834	.38	7.6	2.82	56.4	5.90
929	May	LY	Thick	.9067	.45	9.0	2.96	59.2	6.34
969	June	LY-FY	do	.8945	.46	9.2	2.92	59.4	6.37
1032	July	LG	do	.9445	.48	9.6	2.85	57.0	7.11
1053	Aug	DG-FY	do	.9297	.42	8.4	3.12	62.4	6.65
1077	Sept	LY	Medium	.9390	.49	9.8	3.32	66.4	6.79
1089	Oct	DG-Y	Thick	.9382	.54	10.7	2.57	51.4	6.48
Average				.9126	.50	10.0	2.92	58.4	6.51

TABLE 3.—*Composition of Villa Franca lemons grown in various sections of California.*

BONITA (TREE 3).

Sample No.	Month picked.	Color.[1]	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.[2]	Acid per ton of fruit.	Acid in juice.[2]
					Per cent.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
491	July	DG-LG	Medium-thick	0.9455	0.62	12.3	3.40	68.0	7.07
565	Sept	DG	Thin	.9628	.47	9.4	4.16	83.2	7.28
596	Oct	LG	Medium	.9557	.50	10.0	4.00	80.0	6.97
630	Nov	DG	Thick	.9319	.59	11.8	3.73	74.6	7.58
675	Dec	LY	Medium	.9304	.70	14.0	3.85	77.0	7.63
780	Feb	LY	Thick	.8957	.54	10.8	3.20	64.0	7.07
823	Mar	LY	do	.8753	.54	10.8	3.16	63.2	6.90
883	Apr	LG	Medium-thick	.8965	.58	11.6	3.35	67.0	6.65
921	May	LG	Thick	.9079	.62	12.4	3.70	74.0	7.11
976	June	LY-FY	do	.9095	.57	11.4	3.63	72.6	7.28
1028	July	FY	Medium	.9222	.55	11.0	3.41	68.2	7.14
1058	Aug	LY	do	.9631	.74	14.8	4.01	80.2	7.56
Average				.9247	.58	11.7	3.63	72.7	7.19

[1] DG, dark green; LG, light green; LY, light yellow; FY, full yellow.
[2] All acid is calculated as citric with water of crystallization.

TABLE 3.—*Composition of Villa Franca lemons grown in various sections of California*—Continued.

ESCONDIDO (TREE 7).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
					Per cent.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
504	July	LG-LY	Thin-thick	0.9388	0.48	9.6	2.87	57.4	5.46
535	Aug	DG-LG	Medium-thick	.9427	.58	11.6	3.10	62.0	5.42
569	Sept	DG	Thick	.9198	.60	12.0	2.20	44.0	5.74
600	Oct	DG	do	.9268	.58	11.6	2.61	52.2	5.92
627	Nov	LG	do	.9410	.50	10.0	2.58	51.6	6.27
672	Dec	LG	do	.9115	.65	13.0	2.19	43.8	5.99
767	Feb	LY	Medium	.9210	.38	7.6	2.56	51.2	6.16
827	Mar	LY	Thick	.9221	.42	8.4	2.54	50.8	5.81
886	Apr	LG	Medium	.9330	.38	7.6	2.65	53.0	5.67
926	May	LY	do	.9185	.50	10.0	3.06	61.2	6.13
972	June	LG-LY	Thick	.9395	.54	10.8	2.54	50.8	5.64
1022	July	LG	do	.9332	.42	8.4	2.63	52.6	5.99
1063	Aug	LG	Medium	.9598	.51	10.2	2.84	56.8	5.64
Average				.9314	.50	10.1	2.64	52.9	5.83

WHITTIER (TREE 17).

Sample No.	Month picked.	Color.	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.	Acid per ton of fruit.	Acid in juice.
647	Dec	LG	Thick	0.9077	0.62	12.4	3.30	66.0	7.11
694	Jan	LY	Medium	.9025	.50	10.0	3.24	64.8	6.79
752	Feb	FY	Thick	.8917	.52	10.4	3.17	63.4	6.46
809	Mar	LY	do	.8903	.44	8.8	3.00	60.0	6.70
864	Apr	LY	do	.9093	.44	8.8	3.31	66.2	6.67
910	May	LY	Medium	.9233	.51	10.2	3.45	69.0	7.11
956	June	LY	Thick	.9309	.46	9.2	3.37	67.4	7.23
1014	July	LG	do	.9311	.56	11.2	3.22	64.4	6.91
1045	Aug	DG	Medium	.9499	.58	11.6	3.12	62.4	6.69
1069	Sept	DG-LY	do	.9447	.59	11.8	3.40	68.0	6.44
1081	Oct	DG	do	.9167	.51	10.2	2.71	54.3	6.55
1097	Nov	LG-Y	do	.9515	.49	9.8	2.66	53.2	6.51
1118	Dec	LG-Y	Thick	.9435	.56	11.3	2.47	49.4	7.28
Average				.9225	.52	10.4	3.11	62.2	6.80

TABLE 4.—*Composition of Eureka lemons (Tree 9) grown in Lemon Cove, Calif.*

Sample No.	Month picked.	Color.[1]	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.[2]	Acid per ton of fruit.	Acid in juice.[2]
					Per cent.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
602	Oct	LG	Medium	0.9481	0.62	12.4	3.75	75.0	7.00
623	Nov	LY	do	.9406	.62	12.3	3.50	70.0	6.06
665	Dec	FY	do	.9368	.54	10.8	3.42	68.4	6.20
703	Jan	FY	do	.9166	.56	11.2	3.08	61.6	6.13
768	Feb	FY	Thick	.8752	.41	8.2	2.98	59.6	5.83
819	Mar	FY	Medium	.8485	.38	7.6	2.32	46.4	4.59
Average				.9110	.52	10.4	3.18	63.5	5.97

[1] DG, dark green; LG, light green; LY, light yellow; FY, full yellow.
[2] All acid is calculated as citric with water of crystallization.

TABLE 5.—*Composition of lemons (Tree 19), variety unknown, grown at Yuma, Ariz.*

Sample No.	Month picked.	Color.[1]	Thickness of peel.	Specific gravity of fruit.	Oil in fruit, by weight.	Oil per ton of fruit.	Acid in fruit.[2]	Acid per ton of fruit.	Acid in juice.[2]
					Per cent.	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*
620	Nov	LY	Medium	0.9636	0.65	13.0	3.99	79.8	6.93
643	Dec	FY	Thin	.9818	.68	13.6	3.95	79.0	6.81
657	Dec	LY		.9527	.57	11.4	3.72	74.4	6.77
762	Feb	FY	Very thin	.9325	.40	8.0	3.88	77.6	6.31
Average				.9576	.57	11.5	3.88	77.7	6.70

[1] DG, dark green; LG, light green; LY, light yellow; FY, full yellow.
[2] All acid is calculated as citric with water of crystallization.

TABLE 6.—*Summary of composition of Eureka, Lisbon, and Villa Franca lemons (Tables 1 to 3).*

Tree No.	Specific gravity of fruit.	Oil per ton of fruit.	Acid per ton of fruit.
Eureka:		*Pounds.*	*Pounds.*
1	0.9522	9.9	74.3
10	.9386	9.2	73.3
11	.9407	8.9	69.1
13	.9408	11.3	66.6
14	.9427	10.0	61.4
16	.9403	8.6	63.9
18	.9232	9.6	62.1
21	.9378	10.2	65.2
22	.9397	9.8	61.4
24	.9274	7.8	47.2
Average	.938 ± .004	9.5 ± .3	64.5 ± 1.3
Lisbon:			
2	.9046	10.5	69.6
4	.9121	10.8	69.1
5	.9324	11.1	67.6
6	.9250	10.1	58.2
12	.9141	8.1	64.5
15	.9126	10.0	58.4
Average	.917 ± .004	10.1 ± .3	64.7 ± 1.2
Villa Franca:			
3	.9247	11.7	72.7
7	.9314	10.1	52.9
17	.9225	10.4	62.2
Average	.926 ± .004	10.7 ± .3	62.6 ± 1.2

TABLE 7.—*Summary of analyses of different strains of Eureka and Lisbon lemons grown at Corona, Calif.*

Variety.	Number trees.	Specific gravity of fruit.	Oil per ton of fruit.	Rind.	Insoluble solids in pulp.	Sugars in juice.	Acidity of juice.
			Pounds.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Eureka	10	0.939 (±0.005)	9.5 (±0.4)	36.2(±0.9)	1.9 (±0.1)	2.5 (±0.1)	5.3
Lisbon	5	.905 (±0.004)	10.8(±0.4)	38.8(±0.5)	1.7(±0.07)	1.9 (±0.1)	5.7

TABLE 8.—*Relation between color and thickness of peel.*

Color.	Number samples examined.	Number samples found to be—		
		Thin skinned.	Medium skinned.	Thick skinned.
Eureka:				
Dark green	15	4	8	3
Light green	36	6	17	13
Light yellow	32	3	21	8
Full yellow	5	0	3	2
Lisbon:				
Dark green	6	0	2	4
Light green	21	0	14	7
Light yellow	24	2	13	9
Full yellow	3	1	1	1

TABLE 9.—*Relation of color to composition of fruit.*

Determination.	Dark green.	Light green.	Light yellow.	Full yellow.
Eureka:				
Specific gravity	0.950	0.939	0.926	0.929
Oil per ton of fruit (pounds)	9.1	9.2	9.6	11.0
Acid per ton of fruit (pounds)	62.0	66.0	66.0	69.0
Lisbon:				
Specific gravity	.921	.922	.912	.918
Oil per ton of fruit (pounds)	11.3	9.8	10.0	10.5
Acid per ton of fruit (pounds)	59.0	62.0	66.0	73.0

TABLE 10.—*Correlation between thickness of peel and composition of fruit.*

Determination.	Composition.		
	Thick skin.	Medium skin.	Thin skin.
Eureka:			
Specific gravity	0.924	0.936	0.958
Oil per ton of fruit (pounds)	8.4	9.9	9.6
Acid per ton of fruit (pounds)	59.0	67.0	72.0
Lisbon:			
Specific gravity	.913	.920	.920
Oil per ton of fruit (pounds)	10.3	10.0	11.2
Acid per ton of fruit (pounds)	60.0	65.0	75.0

TABLE 11.—*Comparison of composition of coastal with that of inland Eureka lemons.*

Location.	Specific gravity of fruit.	Oil per ton of fruit.	Acid per ton of fruit.
Coastal:		*Pounds.*	*Pounds.*
Bonita	0.962	9.9	74.3
Whittier	.943	10.0	61.4
Do	.940	8.6	63.9
Do	.923	9.6	62.1
Carpenteria	.927	7.8	47.2
Average	.939	9.2	61.8
Average (excluding Carpenteria data)	.942	9.5	65.3
Inland:			
Santa Paula	.939	9.2	73.3
Do	.941	8.9	69.1
San Fernando	.941	11.3	66.6
San Dimas	.938	10.2	65.2
Claremont	.940	9.8	61.4
Average	.940	9.7	67.1

DISCUSSION OF RESULTS.

DIFFERENCES IN VARIETIES.

The average composition of the Eureka, Lisbon, and Villa Franca varieties is shown in Table 6. The figures below the averages are the probable errors of the mean. For instance, under specific gravity the figure 0.938 is the average obtained from more than 100 samples. Had the specific gravity of each sample been 0.938, there would be no doubt that that figure represented the true average of the lot. This was not the case, however, and never is, where natural products are under consideration. The samples varied decidedly from this average, some having a higher and some a lower specific gravity. It is necessary, therefore, to use mathematical formulas applicable to such cases, with the result that the chances are even that the true mean is not greater than 0.942 or less than 0.934, or, as it is expressed, 0.938 ± 0.004. The same explanation applies to the other figures. The results reveal little difference in the composition of these varieties of lemons.

By applying other formulas it is possible to ascertain whether the differences shown are really significant, and, if so, to what extent. For instance, the odds are 78 to 1 that the difference between the specific gravity of Eureka and that of Lisbon lemons shown is significant. On the other hand, the odds are only even (1 to 1) that there is a significant difference between the specific gravity of Villa Francas and that of the Lisbons, and about 5 to 1 that the difference of 0.012 between the Eureka and the Villa Franca specific gravities is significant. It is probable also that no significant difference exists between the oil content of the Eureka and Lisbon varieties, nor between that of the Lisbon and Villa Franca lemons. The odds, however, are 18 to 1 that the difference between the oil content of the Eureka and that of Villa Franca lemons is significant. No significant difference is shown in the citric acid content of the varieties.

As these averages are obtained from trees located in all parts of the lemon-growing area of California and from samples taken consistently throughout the year, there is little doubt that the data are representative of the actual composition of these varieties as grown in California.

In this connection, it is interesting to consider some data obtained from analyzing 18 sets of samples of the Eureka and Lisbon varieties of different strains grown in two groves at Corona. These sets are derived from monthly samples taken over a period of two years. In considering them, the fact that all the Eureka trees were in one grove and all the Lisbons in another should be kept in mind, as this makes the data less desirable for comparative purposes than those from the field samples. The fact that these trees were chosen to illustrate differences between strains within their respective varieties rather than those between the two varieties also lessens their value for comparison. Interesting studies of the strains of these varieties have been reported by Shamel and his coworkers (1) (2).

There are certain marked differences, however, that are not apparent between strains within the variety, but become apparent when the varieties are compared. To illustrate, the fruit of 10 Eureka trees under observation had an average specific gravity varying from 0.925 to 0.989, the average being that shown in Table 7. The fruit of the three Lisbon trees had specific gravities ranging from 0.898 to 0.915, with the average shown in Table 7. Here it is perfectly apparent that the difference is one between the varieties, for the maximum specific gravity of Lisbon strains is lower than the minimum specific gravity of the Eureka strains. This difference corroborates that already found between the regular samples of each variety.

When the averages for oil are considered, the results are less satisfactory. The averages for all the Eureka strains vary between 7.6 and 11.2 pounds per ton; on the other hand, the Lisbon averages vary from 8.6 to 12.9 pounds per ton. The averages in Table 7, with the probable error of the means, show that the odds are 7 to 1 that the difference is significant in the case of these samples. Whether or not this significance would be maintained throughout the entire plantings of the State would depend largely upon the preponderance of the strains having high oil content. At present no data establishing such a preponderance are available.

Likewise, the acidity of the juice of the Corona samples shows some difference between the varieties, but there is a similar difference between the strains within the varieties, so that this is not significant when the varieties are considered as a whole.

The same conditions apply to the averages on percentage of rind shown in Table 7. Apparently nothing significant in the averages of the insoluble solids is shown, although a significant difference is apparent in some of the strains within the variety.[3]

The averages for sugar show a rather marked difference, which is more significant between the varieties than between the strains within the variety. Only a single Lisbon strain has an average sugar content greater than 2 per cent, while not one Eureka strain has an average below that figure. Therefore, the odds of over 200 to 1 that the difference is significant probably apply to the varieties as a whole.

SEASONAL DIFFERENCES.

The marked differences found in the samples of lemons harvested at different times of the year are interesting. As previously stated, lemons may be harvested during every month of the year, the selection being made according to size and not according to color. As the samples were harvested in the same manner as the commercial fruit, the changes which are discussed in the following pages are due not to the different stages of maturity but to the composition of fruit maturing at different times of the year. All of the samples analyzed were commercially mature.

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[3] This difference will be discussed in a forthcoming publication.

Figure 2 [4] shows the specific gravity of the fruit in both varieties as harvested monthly. The monthly average shown here must not be interpreted too literally, for usually the differences from month to month are small. A general trend is shown, however, and there is little doubt that the changes from season to season are really significant. For the first four months of the year, the Eurekas change but little, while there is a gradual increase in the specific gravity of the Lisbons. With the advent of spring, the Eurekas begin to increase rapidly, and this increase continues without interruption until midsummer. During the corresponding period, the Lisbons also increase rapidly, reaching the maximum in August. From midsummer to January there is a marked decline in the specific gravity of both

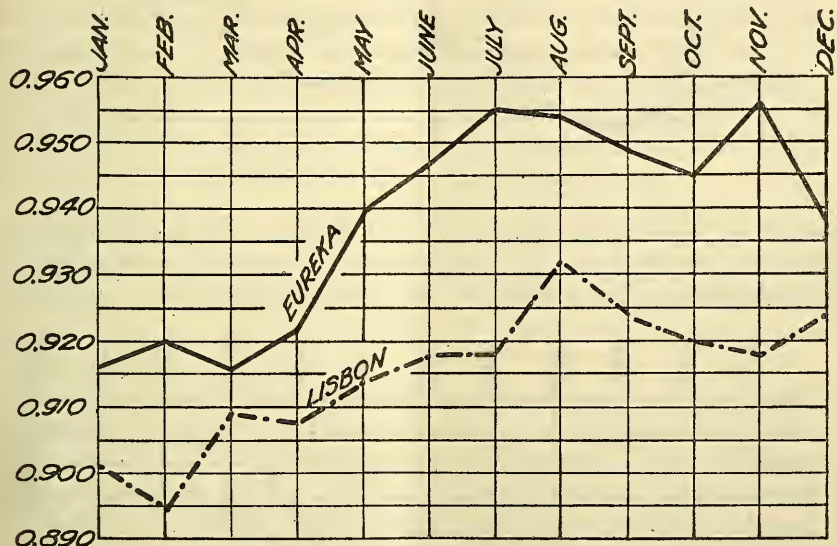

FIG. 2.—Monthly averages of specific gravity.

varieties. The data leave no doubt that both varieties have the lowest specific gravity during the winter months and the highest in midsummer.

Figure 3 shows the variation in the oil content of the fruit harvested each month of the year. Here again indisputable differences occur in both varieties, and the general trend of both is very much the same. The late winter and spring fruit contains a minimum amount of oil. The oil content is only slightly increased in the summer fruit, but with the advent of fall it rises rapidly, until December finds the oil content at a maximum in both varieties.

[4] In determining the monthly averages, where there are several monthly samples from one tree, the average is taken. Where monthly samples are missing, the results are interpolated, the average of the preceding and succeeding months being used.

Figure 4 shows the periodical differences in acid content. Apparently the acid content of lemons varies more from month to month than any other constituent, the graphs being very irregular. It would seem that the Eureka variety has a rather well-defined period of low

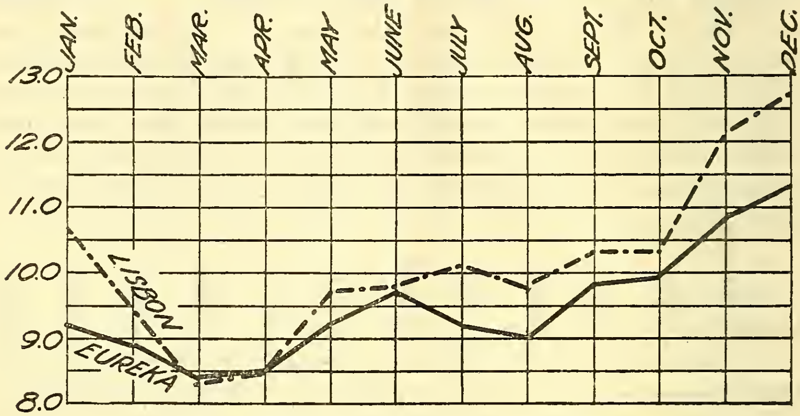

FIG. 3.—Monthly averages of pounds of oil per ton of fruit.

acidity in the late winter and spring months. Rising rapidly from that time, the acid is at its maximum in September, after which it again declines. The acidity of the Lisbon samples was much less

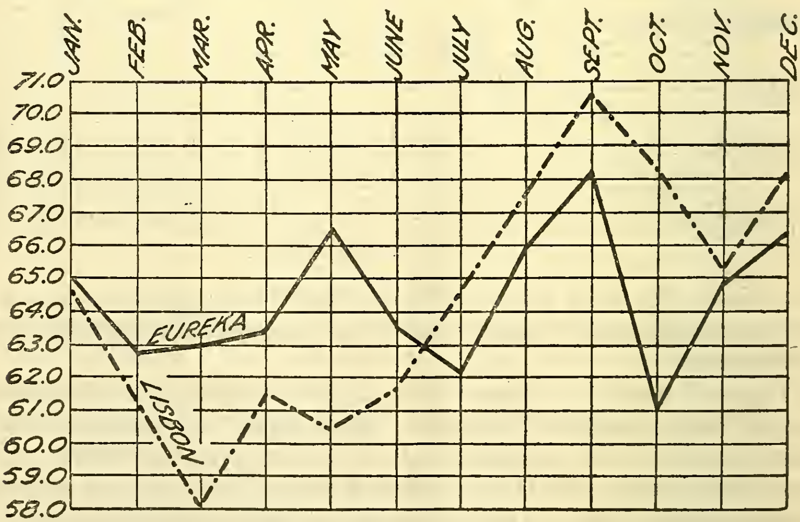

FIG. 4.—Monthly averages of pounds of acid per ton of fruit.

uniform, the general trend of the curve being broken by several inexplicable irregularities. While the maximum occurs in September, as with the Eurekas, there is no well-defined minimum, low averages being shown in both July and October. During the first six months of the year, the Eureka variety contains the greater amount of acid; during the last six months, the reverse holds true.

COLOR AND THICKNESS OF PEEL.

Apparently little correlation exists between the color and composition of the fruit. The data were carefully selected so as to omit those from samples containing too great a mixture of colors to be accurately estimated.

The better part of both varieties had peel of medium thickness, but the Eurekas had a larger percentage of thin-skinned fruit and a smaller one of thick-skinned than the Lisbons (Table 8).

Few conclusions can be drawn from these data. Where some correlation may exist in one of the varieties, it fails to show with the other. For instance, the Eureka seems to decline in specific gravity as the color lightens, but the Lisbons show no such tendency. Likewise, the acid seems to increase with the Lisbons as the color decreases, but this is not apparent in the case of the Eurekas, although the dark green and full yellow correlate.

Classifying the samples according to thickness of skin, 26 thick-skinned, 49 medium-skinned, and 13 thin-skinned Eurekas were found, and 21 thick-, 30 medium-, and 3 thin-skinned Lisbons (Table 8). Unfortunately there are too few thin-skinned Lisbon samples to render the results under this particular head of value, and no account is taken of them in discussing the data.

Two correlations seem apparent from these data: (1) The specific gravity increases as the thickness of the peel decreases; and (2) the acidity of the fruit increases as the peel decreases. Both seem in line with what might be supposed would take place. Thick-skinned fruit often has a hollow center and is generally coarser than that with thinner peel. Inasmuch as the peel contains no acid, naturally the fruit having the greatest amount of peel is likely to contain the least amount of acid. As the oil-bearing part of the peel is near its surface and does not correspond in any way with the thickness, it would hardly be expected to change.

EFFECT OF LOCATION.

It was thought at first that the data obtained in this investigation might throw some light upon the effect of environment on the composition of the fruit. Locations near the coast as well as in the inland valleys were selected, and if any marked difference in composition between lemons from the two sections existed it should have been revealed. The 10 Eureka locations were equally divided as to situation, 5 being on or near the coast and 5 inland or separated from the coast by ranges of hills. What at first appears to be a slight difference in the results (Table 11) is found in the oil content of fruit from the two sets of locations, and a more pronounced difference in the acid content. If, however, the location at Carpenteria, which is apparently abnormal as to the oil and acid content of the fruit, is discarded, the averages are too nearly the same to render any conclusion possible.

These data are offered not as a final statement upon the subject of the difference in composition between coastal and inland lemons, but merely to show that so far no difference has been found.

CONCLUSIONS.

A few well-defined differences between the varieties of lemons examined exist, the most striking of which is in the specific gravity of the fruit. The specific gravity of the Eureka variety is greater than that of the other varieties, and that of the Villa Franca appears to be practically the same as that of the Lisbon variety.

The Villa Francas have more oil than the Eurekas. Otherwise no absolute difference in the oil content is shown, although there is some indication that the Eureka has the lowest oil content.

There is no difference in the acid content of the three varieties.

A marked difference in sugar content between Eureka and Lisbon lemons exists.

The acidity of lemons is highest in the early fall. Lemons have the lowest specific gravity during the winter months and the highest in midsummer. Their oil content is lowest in late winter and spring and highest in the fall.

No absolute correlation between the color of the peel and the composition of the fruit was found. As the thickness of the peel increases, the specific gravity of the fruit decreases, as does the acid content.

No correlation is shown between color and thickness of the peel.

No difference in composition between lemons grown on the coast and those grown inland is shown.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 994

Contribution from the Office of Farm Management and Farm Economics
H. C. TAYLOR, Chief

Washington, D. C. | November 15, 1921

METHODS OF CONDUCTING COST OF PRODUCTION AND FARM ORGANIZATION STUDIES.

By F. W. Peck, *Farm Economist.*[1]

CONTENTS.

INTRODUCTION.

In 1902 the Minnesota Experiment Station began studies of the cost of production and of farm organization, which have been continued up to the present time. The Office of Farm Management, United States Department of Agriculture, began cost studies in 1906, and was closely followed by various State organizations.

The economic changes caused by the World War accentuated the growing demand for facts concerning the business side of the farmers' production of food. During the war it was necessary to husband the supply of certain food products; and to provide the food for large numbers in foreign countries it became imperative to obtain as large a production as possible of the staple food products. At the same time prices were fixed for various commodities for the purpose of stabilizing the market and acceleratiug the production and movement of war supplies. From the experiences with the setting of food prices it became apparent that there was a lack of comprehensive, conclusive data relating to the factors necessary to the understanding of the financial side of the farmer's business.

The rising prices brought about by the war created many local disturbances of prices of farm products, a ready example of which is found in the controversy over the cost and price of milk in many

[1] Since July 1, 1921, Director of Agricultural Extension, University of Minnesota.

consuming centers. Here, again, it was apparent that there was little accurate information by which to judge prices and on which to base findings as to cost of production. The result has been an insistent demand from producers and farmers' organizations for the cost of production data necessary to a full understanding of the farmers' problem of production.

The same urgent demand for cost figures has arisen in foreign countries, especially in England and Scotland. The authorities in these countries have appointed cost findings committees to develop accounting methods on the farm in order to obtain representative cost figures that will aid in a more complete understanding of the farm business.

The complicated details involved in the farmer's method of production and distribution make it inevitable that any hasty attempt to collect cost data will result in superficial, misleading, and usually inadequate information. This was apparent in many instances during the war. Out of the hodgepodge of estimates of costs and profits, often made for a specific purpose by various agencies, there has sprung a general misunderstanding as to the function and purpose of cost data and also considerable skepticism as to methods and results. There is no thorough understanding of the value and uses of cost of production data, and little material concerning methods of attacking the problem from its economic side is available.

The purpose of this bulletin is to throw some light on the fundamental concepts of cost data and to describe methods of study and the uses to which the data may be put.

THE USES OF COST STUDIES.

Absolutely accurate or universally applicable cost of production figures do not exist. This is apparent with farm products because of the many joint costs involved in the production of most of the staple products, and the necessarily more or less arbitrary allocation of some of the cost factors. The extreme variation from farm to farm in the cost of producing the same product, and the variations from field to field and in different animal units on the same farm become at once apparent in the tabulation of farm cost data. However, the value of the results of careful studies of cost is not impaired by this fact; for what the farmer needs in the reorganization of the farm business is figures which show the comparative profitableness of competing enterprises. For such purposes the figures obtained by the methods now used in farm cost of production studies are probably as satisfactory as are the results obtained in commercial accounting for similar purposes.

Sample Sheet

DAILY LABOR REPORT

Day *Friday* Date *4/20* 19*20*, Farm of *A. B. Smith*

REGULAR WORKERS

Name of Workman	Kind of Work	Field or Crop	No of Hours	No of Horses	No of Horse Hours
John	*Plowing*	*A*	*4½*	*4*	*18*
"	*Disking*	*B*	*5*	*3*	*15*
	Chores		*1*		
Fred	*Market Hogs (6 Sows)*		*4*	*2*	*8*
"	*Harrow*	*B*	*5*	*4*	*20*
	Chores		*1*		
Self	*Market Milk*		*2*	*Auto*	*2 A*
"	*Repair Fence*		*3*		
"	*Shell Corn*		*3*		
"	*Plow Garden*		*2#*	*2*	*4*
	Chores.		*2*		
No. of Men / Paid or Exchange	EXTRA DAY LABOR				

Remarks: *Weather fair & warm*
Ground in good condition

Fig. 1.—Daily labor report blank.

DETERMINING RELATIVE PROFITS.

The individual farmer in any line of production is primarily interested in his total farm profit. Naturally his desire is to increase the total profit by eliminating the losing enterprises or the relatively low-paying ones, and to increase the returns from the better-paying lines of production. This means that his interest lies largely in comparing the profitableness of his separate enterprises, which usually allow more or less latitude for selection and for varying the intensity of production and the general farm practices. Hence, one of the prime uses of cost studies to the individual is to determine the relative profits realized from the different parts of his business, with a view to pointing the way to changes in management and organization which will increase the total profit.

Year in and year out, losses and low profits may be more often caused by low yields in crops and low efficiency of production in live stock than by the wrong choice of enterprises, yet right choice of enterprises is the starting point in good farm management.

Not all the enterprises on the farm need be equally profitable to justify keeping them in the system of farming. Profits are influenced by the way enterprises fit together in utilizing labor, equipment, land, and products. A given enterprise must prove more profitable than any other enterprise which will fit into the same place in the program of the farm if it is to be introduced or retained.

The oat crop is notoriously low paying from a market standpoint on many farms in the corn belt, yet because in many places it pays better than wheat or barley, serves as a nurse crop, supplements corn from the standpoint of the labor program, and serves as a horse feed and a supplement in dairy and other stock rations, it increases the total farm profit. Beef cattle feeding has often been shown by standard accounting to appear unprofitable, yet because it provides a ready market for coarse feeds and by-products, a return for labor that would otherwise be wasted, and additional fertility for the field crops, it may add to the total profits.

Cost of production figures are valuable in making clear the comparative profitableness of the different enterprises and the different methods of production and thus give basis for intelligent decisions on what to produce and how to produce it in order to secure maximum net profits.

DETERMINING ECONOMY OF VARIOUS OPERATIONS.

An important function of cost data lies in their application to the ever-present farm problem of determining the relative economy of various methods of performing farm operations. The costs of producing field crops, for example, are usually reduced by increasing efficiency in the use of labor and equipment. One of the advantages of a good rotation of crops lies in the resultant weed control which often eliminates tillage operations that would otherwise be necessary.

The problem of intensity of culture is a question of relative costs per pound or per bushel as affected by the different combinations of the elements of costs in production. The choice of various methods of doing farm work depends almost solely upon relative costs as they bear upon the profits of the entire farm business. The knowledge required to make these decisions must be gained largely through cost studies.

Form A.

Regular Worker's Daily Time Sheet.

U. S. Department of Agriculture in cooperation with C. A. Smith, Oakdale, Mich

Day of Week: Tuesday Date April 30, 1912

	KIND OF WORK. Include implements used, number of loads, etc.	FIELD.	MAN HOURS.	HORSE NO.	HORSE HOURS.
4.30					
5.00	Care of Horses		1/2		
5.30 6.00	Feeding Cows and Milking		1 1/4		
6.30 7.00	Breakfast		—		
7.30 8.00 8.30 9.00 9.30	Plowing for Corn, 7" deep 16" Riding Plow	A	3	3	9
10.00 10.30 11.00 11.30	Disking for Corn (John Deere 12 Disk)	B	1 3/4	4	7
12.00 12.30	Dinner		—		
1.00 1.30 2.00 2.30	Hauling Manure Spreader, 3 Loads. Working with Ed Moore	A	2		
3.00 3.30	Rain – Nothing Done		—		
4.00 4.30	Repairing Fence		1		
5.00 5.30	Feeding Cows and Milking				
6.00	Care of Horses		1/4		
6.30 7.00 7.30 8.00	Supper				

WORKMAN Sam Edwards TOTAL HOURS 10 3/4

REMARKS

REPORT O. K. C. A. S. Prop

8—84

FIG. 2.—Daily time sheet.

EDUCATIONAL USES.

From the standpoint of society, there is need for a study of farm costs to make available to the consuming public the facts that will place the producer and the consumer on a better basis of mutual understanding. That the consumers do not understand the various elements of cost and their relative importance is apparent. Publicity methods have rather confused the real issues in this regard and there is need for plain statements of facts. Reliable cost data, properly presented, should go far toward doing away with much of the misunderstanding now existing.

Cost data have an important educational value to those starting a farm business. Just as engineering data obtained from records of experience in engineering pursuits are of value to subsequent engineering projects, so farm cost data, particularly as expressed in basic terms, are of value to farmers in planning the organization of their farms so as to obtain the largest profits. As experience accumulates in studying costs and prices, and as knowledge of the forces that affect these factors of the farm business increases, there should be a gradual increase in efficiency among the more backward farmers

USE OF COST OF PRODUCTION DATA IN FIXING PRICES.

Price fixing became popular during the war, largely because of the idea that it would solve a pressing economic problem. In view of developments, however, it has become apparent that the economic problem in question was not solved by the setting of prices.

There may be times when the setting of prices becomes necessary to stabilize the market and to insure a fair price, particularly when competition ceases and a monopoly charge prevails at some point in the middleman prices. However, the setting of food prices was not based on this hypothesis; indeed one of the principal purposes was to stimulate a larger production by making an attractive price. In many cases, however, it appears that the competitive price would have been more profitable to the producer and therefore would have stimulated at least an equal if not a larger production.

The problem of price fixing during the war was more difficult because of the unsatisfactory character of the data available, and the prevalence of the notion that cost of production was the only thing that should be considered. There is an important relation between cost of production and price, but it is clear that other factors than cost enter into the problem. The prices of most staple farm products are made by competitive forces in which market demands, fluctuating supply (which itself is affected by cost of production), transportation, custom, substitution, and other factors have important bearings.

There is a certain interrelation between cost and price that should be kept in mind if price fixing is considered on the basis of cost. An example will illustrate. With wheat at $2.50 per bushel, land valued at $200 per acre, with a normal yield, will pay 5 or 6 per cent, net. But 6 per cent of the land value has already been charged as a rental value of land in determining the cost to the farm concerned. Lower valued land of equal fertility and equally good location will produce wheat at a lower farm cost and leave a higher net return; hence this land will rise in price under competitive conditions. Not only is this true but the price of the product is usually a basis for calculating the cost of seed in the process of growing the wheat crop. As the price of the product goes up or down over a period of time land values and labor costs tend to fluctuate accordingly. Thus if the market price of land is determined in part by the price of its products and in part by speculation, and the cost basis is used in determining prices, there becomes operative a pyramiding process that first increases the cost and then the price, with a consequent still higher cost, and still higher corresponding price.

The variation in farm costs in any product is so wide and the farmer's reaction to losses or low margins of profit so slow that the theory of farmers changing their type of production because of lowered margins of profits is often not substantiated in practice. Many farmers are satisfied with a lower rate of interest than is used in computing the cost. Anticipated increases in land values and the use of the farm as a home are compensating factors that enter into the concrete situation.

One of the outstanding differences between the methods used in the setting of prices on industrial products and that used in the setting of the price on the farmer's products has been that averages have been used in the case of farm products, while in the case of other commodities individual arrays of costs have been used to arrive at a bulk line or representative cost figure to include most of the production.

An expression of farm costs much needed is the array of individual costs per unit of production so as to show causes contributing to variations, and the proportion of the total number of units produced at the various levels of cost.

The average has not only been misunderstood but has been abused, in that it has been expected to serve a function for which it is not adapted, and hence gives a result which is often misleading and of less value than the frequency groups and ranges of individual costs. The use of the average in the consideration of the relation of farm cost to price has been particularly misleading because, in most instances, a very small percentage of the total production of a given product has been used as a basis of estimating the average cost, and the data secured were interpreted with little knowledge of how the use of the average figure would affect the large number of producers whose costs were above the average.

BASIC ELEMENTS OF COST.

Complete farm cost data necessarily deal with quantity requirements of crops and live stock, such as hours of labor and quantities of feeds and materials that are used in production. Such expressions of costs are of more value than money costs because of their more stable character, and the various uses to which they may be put. It is essential, for example, to know rather definitely the measure of a day's work with various implements and various-sized power units under various farm conditions. It is important to the farmer to know how much labor is required, just when this labor is likely to find it hard to keep up with the business, and when work must be provided to give profitable employment during slack periods. It is important to know approximate feed requirements of various classes of live stock. With such information, the farmer can sometimes buy feed and supplies in advance in sufficient quantities to effect a considerable saving in operating expense.

Such measures of cost are here called "basic elements" because of their relative stability, as compared to money costs. Well-established quantity factors make it possible to estimate costs at any time by applying current prices to the requirements in hours of labor and bushels of seed.

The proportions of certain major costs to the total cost may often be considered basic in that the relative proportions do not change greatly under ordinary conditions, and calculations, the results of which closely approximate accurate costs, are readily made by using the proportions that are worked out by long-time cost studies.

PRESENTATION OF RESULTS.

Unfortunately, a considerable amount of the available information relating to the cost of producing farm products is solely in the form of dollars and cents, with the basic data as to labor and materials lacking. Furthermore, the time that elapses between the closing of the study and the publication of the data is often so long that a part of the value is dissipated because of the rapidly changing conditions.

Cost data should be so itemized as to allow detailed analysis and regrouping of items as desired. As an example, interest on capital should be shown as separate from operating expense, so that various computations of net earnings, gross profits, and other items may readily be made.

The principal factors to be kept in mind in the presentation of the results of cost data, particularly from a farm organization standpoint, may be mentioned in the following order:

1. Description of the physical conditions and contributory influences that affect practices and economic results of cost studies in a locality.
2. Data in basic quantity form (days of labor, bushels of seed, pounds of fertilizer) providing economic measures of capacity and production more or less widely applicable.
3. An array of individual variations in costs, profits, yields, and practices, to illustrate not only averages, but the extremes and the bulk line figures.
4. Arrangement of individual results into frequency groups with the interval selected to show the necessary dispersion and desired grouping.

PRESENTATION OF RESULTS FROM THE STANDPOINT OF OPPORTUNITY COST VERSUS OPERATING EXPENSE.[1]

Practically all publications of Federal and State departments of agriculture on the cost of producing farm products have very properly presented the figures on the basis of opportunity or alternative cost. This basis assumes some or all of certain premises as a background of consideration of the cost figures. Briefly, these premises usually are:

1. That the present-day capital value of the farm plant could readily be liquidated and the money invested with an assured interest return, thereby entailing the use of capital for which a charge should be made. This assumption is reflected in the charges for the use of the land against crop enterprises, in the building and equipment charges against the various enterprises, in the horse labor rate, in the man labor rate, and in the charges made against capital invested in live-stock enterprises. This entails including interest in all these phases as a cost and not as a part of the income to be distributed as a part of the profits.
2. That all labor is entitled to a certain credit per hour regardless of whether paid for in cash, in kind, or furnished gratis to the farm.
3. That, in some instances, account shall be taken of consumption by growing crops of fertility other than that placed upon the land by the farmer as manure or commercial fertilizer.
4. That a charge should be made for insuring the complete farm business on the assumption that if the farmer does not carry commercial insurance the farm business must sooner or later stand losses according to the risk.

As contrasted with the results obtained from this basis, which are called the "opportunity cost," it has been shown that individual farmers are constantly confronted with the actual bills of operating expense in the operation of their farms. It is pointed out that there is often no actual interest on the expense side of the farmer's ledger; a very small amount of labor is paid for in cash; there is no apparent decrease in yield due to consumption of fertility beyond that cared for by applications of manure and fertilizer; and on many farms little, if any, live-stock or crop insurance is carried.

Those who advocate including only actual expense as a cost basis emphasize the fact that on the opportunity cost basis many enterprises show a decided loss on the books, with perhaps a minus labor income for the farm as a whole, and the farmer is told that he has received no pay for his labor through the year and that the quality of his enterprises is such as to make them undesirable in a profitable

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[1] *Opportunity cost* is here used in the sense of alternative uses being assumed for capital, feed, and labor. On this basis a land-rent charge is included in the cost of producing crops; seed is charged to the crop at its market price less cost of hauling to the farm; farm-grown feed is charged to live stock at the local market price less cost of hauling to the farm; and interest is charged on the capital invested in all forms of capital except circulating or working capital.

Operating expense is here used to express the cost estimated by excluding all interest charges on capital invested in land and buildings. Farm-grown feed is charged to live stock at the cost of growing the feed on the farm, but all labor concerned in the enterprise, whether paid for in cash by the farmer or not, is included in the expense. Seed is charged to the crop at the cost of production with the result that the only item not paid for directly by the farmer is that of the operator's and the family labor that may be included in the enterprise.

farm scheme. Nevertheless, this same farmer may have put money in the bank from the year's business, improved his home, perhaps expended money in the education of his family, and altogether may feel that he has not done so badly after all. One of the criticisms of cost of production studies for the past 10 years has been that theoretically most farmers have been put out of business, while actually they have continued to prosper and to improve their homes and increase their savings in the banks.

Form 57.-FM

U. S. Department of Agriculture
Office of the Secretary,
Farm Management.

Farm of Otto Leetch
Post Office Albania, N.Y.

REPORT OF REGULAR DAILY WORK AND NUMBER OF HEAD OF LIVE STOCK FOR THE MONTH OF July 1919

1. Fill out this blank on the last day of the month or as soon as possible thereafter.
2. Put down the number of head of each group and age of animals that you owned on the last day of the month, as given in the following list.
3. Estimate the average daily time of man and horse labor spent on the different kinds of regular work during the month past.
4. Inthe various columns under the heading "Changes in Number of Live Stock Owned" enter the number of head of each group sold, bought, born, died, or killed during the month, giving approximate dates.

Kind and age of stock	Number of head on hand on the last of month.	Average time per day for each kind of regular work.		Changes in Number of Live Stock Owned During Past Month					
				Stock disposed of			Stock acquired		
		Minutes man labor.	Minutes horse labor.	No.	Date	Here state whether sold died or	No.	Date	Here state whether bought or born.
HORSES: Work,	4	50							
Driving	1	5							
Other									
Colts,									
COWS: Milking	3	40							
Dry,									
CATTLE: 1-2 yrs	1			1	27th	freshened	1 1	10th 27th	bought freshened
0-1 yrs	1						1	27th	born
Bulls,									
Beef,									
SHEEP:									
HOGS: Breeders	7								
Pigs 0-6 mos	52	60					8	14th	farrowed
Other hogs	13								
POULTRY	50	10		2	10th	Killed			

FIG. 3.—Regular chore work and live-stock report.

Form 26-FM

U. S. Department of Agriculture, Office of Farm Management.

Farm of John Smith

Post Office ______________

REPORT OF FEEDING LIVE STOCK FOR THE MONTH OF October 19 20

1. Fill out this blank on the last day of the month or as soon as possible thereafter
2. Put down the number of head of each group and age of animals that you owned on the last day of the month.
3. Enter the various kinds of feeds used during the month at the head of each column under "Average Daily Feed."
4. Under these feed headings and opposite the name of the stock, fill in the average daily ration. Give the ration in terms of quantity per head per day except where animals (as beeves, hogs, sheep, and poultry) are fed in groups, when the ration may be stated in terms of total quantity of each feed per day for each group.

Kind and age of stock.	Number of head on hand on last of month	Average Daily Feed. (POUNDS PER HEAD)							
		Oats	Corn	Bran	Skim milk	Silage	Hay	Straw (Inc. bedding)	Field pastured
HORSES: Work,	5	10	8				15		
Driving,	1	8					15-21		A-10days
Other,									
Colts,	2	3	2				10		A-10days
COWS Milking,	12	2	2	4		30	12-21da.		B-10days
Dry,	3			4#-10da.		20			B.
CATTLE 1-2 yrs.	5					20			B
0-1 yrs.	4				25# to all				B
Bulls,	1					25	10		B
Beef,									
SHEEP:	24								Stubble fields
HOGS: Breeders									
Pigs 0-6 mos.									
POULTRY	75	No extra feed							

FIG. 4.—Feed report blank.

It may readily be shown by figures for a 20-year period that many dairymen in almost any given dairy section, from an opportunity cost standpoint (occasionally stressing more or less violently the various assumptions), have lost money practically every year, and the conclusion may be drawn that dairying as a business is decidedly unprofitable. It would require but a brief survey of actual conditions in a locality, however, to make clear that the farmers had nevertheless prospered, that homes had been built and improved, fairly adequate standards of living maintained, money placed in the bank, and mortgages paid off, so that, altogether, one might say that dairying was a fairly prosperous business. From an efficiency standpoint, that is, when improvement of farm organization is the object, the weakness of this latter point of view is apparent.

Recognizing that the farmer should know the opportunity cost results and attempt to obtain a satisfactory organization that will provide the greatest net profit, it may be of interest in this connection to show examples that make it clear why farmers continue to produce at prices apparently ruinous from an opportunity cost basis.

The difference between the opportunity cost and the actual operating expense in a live-stock enterprise is particularly striking. This is true because the assumption that feed consumed by live stock could be marketed at local farm prices is an important feature of computing the cost on this basis.

Form C.

STATEMENT OF RECEIPTS AND EXPENSES. Sheet No. 10

In cooperation with Office of Farm Management, U. S. Department of Agriculture.

Form of O. A. Lee

P. O. Oakhill, Ill.

DATE. 19 20	ITEMS—DESCRIPTION.	AMOUNTS OTHER THAN CASH.	CASH RECEIVED.	CASH PAID OUT.
July	On hand—Cash balance forward		545 35	
1	Sold 2 tons hay to J. Jones		50 00	
4	Bought 100# binder twine			20 00
5	Bought 2 ton bran on account	42 00		
7	Rec'd milk check for June		135 61	
7	Bought coal for threshing, 2 tons			22 50
8	Bought binder, paid 40.00 cash			
	& gave note for balance	200 00		40 00
10	K. Ogg paid for seed corn,			
	he bought May 20.		8 75	
11	Exchanged 12 doz. eggs for groceries	5 42		
16	Paid hired man for June			60 00
18	Sold horse to K. Dell, took			
	90 day note	175 00		
20	Cash prizes won at the Fair		28 50	
24	Expense, exhibiting at Fair			6 50
24	Paid for bran, bought July 5			42 00
24	Clothing for self			12 00
25	Sold 6 hogs 1435#		215 25	
25	Repairs on wagon			2 00
26	Paid insurance on crops			30 00
	Cash totals		983 46	235 00
	Cash balance			748 46

NOTE.—The cash balance should be the same as the amount on hand and in bank. Always compare cash balance with cash on hand and carry balance forward when correct.

Remarks:

8—4133

Signed: O. A. Lee

FIG. 5.—Cash account sheet.

TABLE 1.—*Beef-cattle loss and gain (actual farm figures).*

Number of steers	48
Farm income	$8,398.00
Labor income	$2,996.00
Book loss (feed at farm price plus interest on cattle capital)	$1,103.63
Book loss per head	$23.00
Gain (feed at cost of production, no interest)	$659.62
Gain per head	$13.76

Table 1 illustrates the point from a beef-cattle enterprise. On the farm in question, which yielded a farm income of over $8,000 and labor income of approximately $3,000, the book record on 48 steers, with feed at market prices and interest included as a cost, showed a net loss of over $1,100, amounting to $23 per head. Viewed from this angle only, a man having this experience might be considered quite speculatively inclined if he were to continue to feed steers.

Charging the feed to the steers at the operating cost of production, however, with no interest on land charged as a cost, there is a gain for the cattle enterprise of $659, amounting to $13.76 per head. This approximates what the farmer actually received from feeding cattle. In other words, while he did not receive fully quoted farm prices for all the feeds consumed by the steers, he pocketed what might be termed a fairly satisfactory return for his handling of the cattle if there is no thought of what might have resulted if he had perchance done otherwise. It would not be surprising if this farmer were to continue his feeding operations.

Carrying the comparison of opportunity and operating cost into the feeding of hogs, Table 2 illustrates the returns from the feeding of hogs for three years on a Minnesota farm.

TABLE 2.—*Hog profits on a Minnesota farm.*

	1913		1914		1915	
	Cost per bushel.	Farm price per bushel.	Cost per bushel.	Farm price per bushel.	Cost per bushel.	Farm price per bushel.
Corn	$0.39	$0.48	$0.32	$0.53	Soft corn.	
Oats	.16	.40	.28	.32	$0.18	$0.42
Barley	.29	.56	.28	.54	.34	.45
Hog profit per head	10.62	5.52	10.24	.84	4.30	2.20

This table presents the comparison of the operating expense per bushel of corn, oats, and barley produced on the farm and the average farm price, which was used as the charge for the feed consumed by the hogs under cost-accounting procedure. It will be noted that the profit in 1913 in charging the feed at farm prices was fairly satisfactory from a cost standpoint, amounting to $5.52 per head. Charging the feed at actual operating expense to the farmer showed a profit to the hogs of $10.62 per head. It was still more striking in 1914, when the book profit was only $0.84 per head under the opportunity cost, while on the other basis the profit was $10.24 per head. In 1915, owing to the condition of the corn crop, the amount of profit per head was not as great, but the difference in the two methods was about the same as in 1913.

A danger may lurk in the farmer being satisfied with a nominal profit and not attempting to increase the productivity of his enterprises for further profits. Any analysis should make clear that the live-stock profit on the actual expense basis includes in reality a profit on the crops grown for feeding purposes and that with each enterprise standing on its own feet from a relative cost and profit standpoint the result would not be the same. This point is more fully discussed under methods of charging feed to live stock.

Thus there is an obvious need for analysis, both of the opportunity cost and the actual operating expense in a farm business, of the one for the purpose of pointing out possibilities and fostering more profitable farm organization, of the other to show why production is continued and prosperity real, though not apparent from a business point of view. For certain purposes presumptive results have a working value, but actual results may well go along with the opportunity cost figures to maintain the balance of the analysis.

THE SEVERAL METHODS OF STUDY.

There are several distinct methods and combinations of methods which may be used in obtaining cost of production and farm organization data. The two outstanding methods may be termed (1) the accounting method and (2) the survey method. The following outline sets forth the various modifications and combinations of these methods that have been used more or less successfully. They will be discussed in the order they are listed below.

1. Accounting method.
    1. Route plan.
        a. Entire farm business.
        b. Enterprise and farm business study.
        c. Extensive enterprise study.
    2. Occasional visit and book plan.
    3. Correspondence plan.

II. Survey method.
    1. Farm business analysis.
        a. Single extensive survey.
        b. Continued surveys.
        c. Periodic repeated surveys.
    2. Enterprise cost studies.
        a. With farm business analysis.
        b. Without farm business analysis.
    3. Questionnaire.

III. Combinations of I and II.

FARM PRODUCE USED IN HOUSE

Farm of J. Henry Month Jan. Year 1919 Value

Cream	8	qts.	22	% test @	57¢
Whole Milk	45	"	4	% " @	57¢
Skim Milk	30	"		% " @	$1.00 cwt.
Butter	6	lbs		% " @	55¢
Eggs	15	doz.		@	45¢
Poultry	10	lbs. dressed		@	36¢
Potatoes	2½	bu.		@	$2.60

5	Regular boarders	155	Man Days
2	Extra boarders	10	Man Days
	Total	165	Man Days

Number women doing housework 1

FIG. 6.—Monthly household record.

THE ACCOUNTING METHOD.

Detailed farm cost records are the outstanding feature of cost of production studies by this accounting method. This tends to narrow the number of farm records that can be obtained with a given fund for research. As contrasted with the survey method, it entails the keeping of direct, individual accounts, whereas the survey statistics are gathered in a rougher fashion that enables the investigators to cover ground more rapidly.

The principal advantage of the accounting methods is its accuracy. It provides a body of fact that is valuable as a basis for fundamental cost and organization studies. Its disadvantage lies in the comparatively small number of farms that can be studied with a given fund, and in the danger that at least a part of the number selected will not be typical or representative of a sufficient number to make the data worth while. Another disadvantage, from an investigational standpoint, is the need of close supervision of the work, which not only is costly from a money standpoint, but requires efficient, experienced supervision that is relatively difficult to obtain.

Several plans have been developed for making use of the accounting method. The three most common are (1) the "route" plan, originated, and maintained with but few changes, by the Minnesota Experiment Station; (2) the occasional visit and book plan, as used by Cornell University in the State of New York; and (3) the correspondence plan, as inaugurated and maintained for a number of years by the Office of Farm Management, United States Department of Agriculture. The principles underlying the accounting practice are similar in all plans and these will be touched upon before considering specific plans or methods.

PRINCIPLES OF FARM-ACCOUNTING PRACTICE.

The first step in starting the detailed accounting study on farms is to make a detailed inventory at the beginning of the farm year. It is essential that the farm year start before active field work on the season's crops begins, and it is a common practice to start either January 1, February 1, or March 1. Particular emphasis should be laid upon the accuracy of taking the opening inventory. Cost studies are usually organized on a five-year basis, and it is essential that a proper start be made, with a careful, accurate, detailed inventory of all the forms of capital that enter into the farm business. Because of its importance it is felt that it is worth while to mention a few of the principal items that often cause difficulty in making a satisfactory farm inventory.

REAL ESTATE.

The term "real estate," as it is commonly used in investigational work, includes the land, buildings, and land improvements such as drainage systems, water systems, fences, and other physical improvements.

The question at once arises as to the most serviceable basis of valuing the land. The productive capacity of the land is often advocated as the proper basis, but all farm business analyses indicate that considerably lower values result when the earnings are capitalized at going rates of interest than obtain when going sale values are used. For example, in parts of the corn belt the farm earnings net 2½ to 3 per cent to the owner-operators of land with a valuation of $250 per acre. With the values of land arrived at by capitalizing the earnings at 5 or 6 per cent the land values would be correspondingly reduced.

The weakness of capitalizing a cash land-rental charge to arrive at a value lies in that thus we capitalize only the current year's rent, leaving out of consideration the future earnings, which should be considered. Theoretically, this method might be used if land were more stable in production, with long-time records of performance available. It should be kept in mind that the values arrived at on a sale basis may involve unearned income which has been added to the price in anticipation of future advances in value. Thus, in arriving at the net farm earnings, interest on unearned capital is involved as a factor. Also, in showing the farm earnings in the form of a certain per cent of the capital value, or in the form of labor incomes, there is ample opportunity for misinterpretation of the results and for a wide variation in the results, depending upon the value placed on the land. The common practice is to carry the value of the land in the closing farm inventory at the end of the year the same as at the beginning of the year if the object is to learn the net income from operation. If the land has increased in value, in the opinion of the operator, this increase should be kept separate from the current farm earnings.

The common basis of land valuation for farm organization and cost studies has been the conservative, going sale value of land. This appears at the present time to be the most practical basis, though numerous attempts have been made to apply various theories in arriving at land values.

The site value of the farm as a home has an important bearing on the selling price of a farm as well as on a valuation for loan or for investigational purposes. We can not ignore the fact that a farm is a home site as well as a business plant, and that a certain portion of its value may be due to location and the personal desire of the occupant to live in that particular spot. It would doubtless be advantageous to studies in farm economics to express the farm value both as site value and productive value, each of which would be useful, depending on the nature of the study and the use to be made of the resultant figures.

It is best to assign separate values to each of the buildings entirely distinct from the value of the land and its improvements. The separate values of the buildings are necessary to the proper allocation and distribution of the building charges. A common method of arriving at the value of the bare farm is to set what is considered a fair valuation for the farm as it stands, including the land, improvements, and buildings, and then deduct the value of the buildings, estimated separately.

For some purposes it is advisable to go further and to evaluate different parts of the farm at varying prices. For example, some crop land is more valuable than other crop land, and very often more valuable than permanent pasture, woods, and land too rough for tillage purposes.

In placing a value on a building, it is worth while to note its size and jot down a brief description, along with the valuation. There are two methods which may be used in arriving at the present value of farm buildings. One is the common accounting practice of basing the present value on the basis of the original cost and the number of years it is estimated that it will be in use on the farm. This is known as the "original cost basis." The other method is that of estimating the present replaceable value, depreciated on the basis of the number of years the building has been used and the number of years it is estimated it will last.

FARM PRODUCE

Farm of J. Smith Month Jan. Year 1920

Date	Eggs Laid	Poultry Used	Milk Used	Butter Made	Butter Used	Pork		Potatoes	
1	24		2 Qts						
2	26								
3	32								
4	28								
5	24			5lbs.					
6	27	3lbs.							
7	22								
8	19					Killed			
9	21			6lbs.		Hog			
10	24	3lbs.				Wt			
11	18					180			
12	17					lbs.			
13	17			4lbs.					
14	19								
15	16								
16	15								
17	18	4lbs.	Same each day	7lbs.	3 lbs. per week			3 bu. for month	
18	19								
19	14								
20	15								
21	12			6lbs.					
22	15								
23	12	5lbs.							
24	13								
25	14			5lbs.					
26	10								
27	11								
28	10			5lbs.					
29	9	2lbs.							
30	10								
31	12								
Totals	543	17lbs.	62qts	38lbs	12lbs	180lbs		3bu.	

NOTE.—The weights of any farm animals, such as hogs, veal, etc., slaughtered during the month should be recorded in one of the blank columns above.

FIG. 7.—Daily household record.

The argument in favor of using the replacement value as a basis is that it places the values consumed in shelter and storage uses on the present-day price level. There may be considerable difference, for instance, between the shelter cost computed on the basis of original cost for a cow housed in barn that originally cost $1,000 fifteen years ago and the cost computed on the basis of the barn's replaceable value, since such a barn would probably cost $3,000, with materials at 1920 prices.

The permanency of the price level is one of the factors to be considered in changing from the original cost to the replacement-value method. If building materials are on a more or less permanent level of prices and the decline to a lower level may be expected to be gradual, then the practice of estimating present values on the new price level becomes a much safer basis then if the prices of building materials were likely to fall suddenly to their former price level.

The safer basis of valuing buildings and equipment over a term of years is that of the original cost, thereby eliminating the dangerous practice of estimating present-day values, in the face of shifting prices of building materials and farm machinery. It has been pointed out by some that if the original cost basis of valuing buildings and machinery is maintained the original cost basis should also be used in computing the interest on the actual investment in land and its improvement. There is considerable difference, however, between charging depreciation on buildings and interest on land. Buildings and equipment always depreciate, whereas land often becomes more and more valuable. Land is therefore likely to remain at its increased price, at least for a considerable length of time, but the value of buildings if raised must be depreciated again. For the purpose of comparing costs and relative profits the land value basis adopted by the leading authorities in the study of the farm business has been the conservative ready sale value, regardless of the original cost of the land and improvements.

EQUIPMENT.

The equipment on the farm should be itemized in detail and classified according to its use. It is always advisable, if possible, to learn the date of purchase and the original cost of each implement concerned in the farm operation. Two methods have been advocated in placing the present value on farm machinery; one based upon the first cost, depreciated by the number of years of use and its present condition, and the other that of estimating the present depreciated value by assuming the machinery cost at present prices when new, and depreciating it by the number of years and its present condition. Theoretically, the amount of work done should have a strong influence in the fixing of present values. Practically, this factor may be relatively unimportant, as other factors, such as shelter, adjustment, care, and obsolescence, often affect depreciation far more than its actual use.

The high prices of farm machinery at the present time (1921) compared with those of the prewar period (1916) make a considerable difference in the results obtained by the two methods suggested above. Over a ten-year period, under normal conditions, there would not be a great deal of difference, but during the last year this has been a much discussed question.

The same advantages and disadvantages are apparent in valuing farm equipment as mentioned under farm buildings, namely, that the discrepancy between the two price levels, the original cost and the present cost of machinery, is so great as to be very noticeable in estimating the enterprise costs of machinery by the two methods. If prices should show a slow decline from their present level over a number of years, the use of replacement cost in estimating present values of machinery consumed would prove more satisfactory than if the price level should drop suddenly to its former level. Inasmuch as most of the machinery now on the farm will be replaced by new machinery at new prices within a five to eight year period, the original cost basis will soon be reestablished. Herein the equipment differs from farm buildings, as it will be a long time before the present farm buildings are replaced, as compared with the replacement of equipment.

LIVE STOCK.

In farm cost-accounting practice the farm live stock is divided into two general classes, productive and indirectly productive or nonproductive, according to whether the stock under consideration is directly income producing. Ordinarily the work horses are considered in the indirectly productive or nonproducing class, and as such are classed in the fixed capital assets of the farm.

The most common basis of valuation for all live stock, including work horses, is that of the ready sale value, regardless of the cost of production. This sale value is presumed to take into account the age, fitness for duty, weight, size, condition, and other factors relating to the values of live stock.

A characteristic difference between live stock and other equipment is that of appreciation of animals, not only while growing to work or producing age, but for a certain period after that time. A ready example is the increase in value of horses up to 6 years of age and of cows to 5 or 6 years of age, before they have reached what is ordinarily termed "their prime." Thus it is that many farmers plan on meeting the depreciation of producing herds and working units by the raising of young stock. In cost accounting practice, however, the young stock is usually kept separate from the older stock, with depreciation playing a prominent part in the records of the older animals.

Where purebred stock is maintained the element of appreciation from a breeding standpoint is always present, but depreciation also becomes quite striking, particularly in view of risks of disease or injury incurred in the maintenance of purebred herds. An important source of loss arises when young animals prove to be indifferent breeders. Conformation qualities are detected early in life but breeding qualities only after maturity. At the same time a distinction is noticeable in estimating depreciation in purebred herds between the value of the animals as producers of salable products, such as milk, and their value as breeding animals.

In connection with the depreciation of live stock, the block value of breeding stock for consumption purposes should be kept in mind, as this enters into any percentage figure which is used to indicate the approximate depreciation from the previous inventory value.

In all inventories of live stock it will be seen that the fluctuations in market prices have an important influence on the values ascribed to each class of stock. This was particularly noticeable during the war period, when the market prices of certain classes of stock increased to a high level while others increased slowly, in the case of horses scarcely at all.

FEEDS AND CROPS HELD FOR SALE AND FOR FEED.

Where it is possible to separate crops held for sale from the feed that will be used for live stock, there is no question as to the basis of valuation for the products held for sale. The farm value, which is the market value less the cost of marketing, should be the basis for valuing all crops held for sale which appear in the inventory.

There is a difference of opinion as to the proper basis of valuing feeds to be fed to live stock. There are usually two classes of such feeds, namely, the salable feeds, such as oats, corn, and hay, and the nonsalable, such as silage, corn stover, and low-grade hay. The common basis used by most farm accounting authorities for salable product inventories is that of the farm price, which, as indicated above, is the market price less the cost of marketing. This feed is usually charged to stock at the going monthly farm price. The other basis, that of the cost of production, is advocated by some, particularly English authorities, who maintain that the cost of producing live stock for the market should be based upon charging the feed consumed at its actual cost and not at the price that might have been obtained for the feed if used in an alternative way.

In deciding which basis of valuation to use for the salable feeds, one of the fundamental uses of cost of production figures in the farm business must be taken into account. This important function is that of affording a comparison of the profits of the various farm enterprises and an indication of the preferable uses of the various forms of farm capital. For example, shall the crops grown on the farm be fed to dairy cattle, to beef cattle and hogs, largely to hogs alone, or sold for cash on the grain and hay markets? Does it aid in understanding the farm business to show the profits from growing crops as credits to the live stock that may be maintained? It is plain that if, for example, the intention is to show the profits in dairying, it can often readily be shown that very low-producing cows will show a profit if the basis for charging crops fed is the cost of production on a farm where the land is fertile and good yields are realized. But if a crop is looked upon as a separate enterprise, it is desirable to find out the status of the enterprise with the return considered as being available for use either in the form of cash from sale of the product or in the form of feed charged to live stock at what the feed would be worth were it purchased.

On the other hand, it is apparent that one might consider the returns from his farm as a double profit if he computed the profits from his crops, and at the same time the crops when fed to live stock were charged at cost and the crop profits again reflected in the live-stock accounts. As a matter of fact, most farmers are interested in the grand total profit and in eliminating as many of the low-producing enterprises as possible. Where a farmer does not go into the details of his costs in an analysis of his business, the easiest way of expressing his profits from farming is simply to show the difference between expenses and receipts in one lump sum. For example, if the principal salable products from the farm business are cattle and hogs, one may learn the profits from this business by deducting all expenses of running the farm from the total receipts, and in expressing the cost per unit of doing business it would be justifiable for the operator to divide the total expense by the total number of salable units. However, this process of accounting would not necessarily indicate that there might not be more profitable alternative uses for the crops that were fed to the cattle and hogs and for the other forms of capital consumed in their production.

Thus it will be seen that two entirely opposite conclusions may be reached by the two different methods of considering the cost per unit of product put on the market. Taking the example already cited (p. 13), where home-grown feeds largely constituted the feed consumed, the steers might cost, say, $60 per head, if the feed be valued at its cost of production. If the feed is valued at its farm value, which is the market value less the cost of marketing, the same live-stock units might show a cost of over $100 per head. If we assume that the live-stock units were sold at $100 per head, the first method would show a profit of $40 per head, while by the second method a loss would be indicated. As a matter of fact, the operator knows that there is an appreciable return from his total farm operations, and to tell him that he suffered a loss on every live-stock unit he marketed is confusing to him. The confusion here lies in the analysis of the business. In one case it should be realized that the profits from growing the crops are returned in the form of live-stock products, and it might be equally true that were the field crops sold at their local market prices there might have been a still larger amount left in the bank after the expenses were paid. The farmer is primarily interested in comparing profits on the separate enterprises as well as knowing the total profit from the entire business.

For the nonsalable crops the common basis used by the Office of Farm Management and Farm Economics, and by most experiment stations, is that of the cost of production, as nearly as it can be estimated. In taking the opening inventory on a farm it is sometimes difficult to estimate the cost of production of such products as fodder, wild hay, roots, and other crops that have no ready sale value. Usually a very close estimate can be made, however, on the basis of the yield, the seed-bed preparation, the cost of harvesting, and other cost factors of the particular crop. With regard to corn silage, when the yield can be fairly accurately estimated in terms of bushels of marketable corn, it is quite satisfactory to estimate the value per acre of the corn crop at time of harvesting, minus the cost of husking, plus the cost of putting the corn in the silo. The cost of the latter operation is estimated on the basis of the approximate amount of time and the force necessary to fill the silo, and the engine and equipment charge in the operation.

Another basis that has been used in estimating roughage values is that of the comparative feeding value, taking from experimental data the comparison of the feeding value of wild hay, silage, corn stover, corn fodder, and similar feeds as compared with the feeding value of marketable hay grown by the farmer or of a commercial feed, such as bran.

The basis for valuing perennial or growing crops in the field at the time of inventory should be that of cost of production to the date of inventory, taking into consideration land preparation, value of seed, and any labor spent on the care of the crop chargeable to the current year's expenses. In the case of a crop like alfalfa, where no nurse crop has been used and where no crop has been obtained the previous year of seeding, it is necessary to include land rent and taxes for the previous year, but this charge should be distributed over the number of years which the crop will last with the original seeding.

ITEMS IN QUESTION IN COST ACCOUNTING.

Supervision.—In computing the cost of producing a farm product the point has been raised repeatedly as to the value of the operator's labor that has gone into the enterprise. The point is made that the going rate of wages paid to hired men is not a fair figure to cover the management and supervision given by the farm proprietor. In instances where hired managers are employed the total cost of their employment is distributed as a labor cost over the various enterprises, so that this question usually arises only with reference to the work of a proprietor.

The position is taken by the Office of Farm Management and Farm Economics, and by most authorities, that the net returns from an enterprise or from the farm as a whole should pay for the supervision of the proprietor, and that the work he does should be counted as a charge at what such service could have been hired for. If a separate estimate of the value of the farmer's time is used as a supervisory charge, there is always a question as to the validity of the estimate made, and in some instances this estimate may distort the cost so that the results will be valueless for comparison.

Fertility.—Not only have questions been raised as to the method of charging crops with the manure applied to them, and at the same time crediting it to the live stock responsible for its production, but the point has been made that in estimating the costs of producing crops an allowance should be made for the value of the fertility consumed in production, regardless of whether any fertilizer is applied.

In instances where commercial fertilizer is used the practice has been to charge the first crop with all or a share of the actual cash cost, depending on the rate of availability of the fertilizer. In the case of farm manure the increase in returns due to the application of the manure is very difficult to estimate accurately, as the increase varies greatly with the kind of soil, the topography of the farm, the present yielding qualities of the land, the kind of manure, the time of year applied, the rate of application, the manner of handling in the barnyard, and other factors that complicate the problem.

It is apparent that an application of manure or fertilizer to a crop in one year provides a residue that is made available to succeeding crops through a term of years. In the case of barnyard manure it has been arbitrarily decided, where the farm is operated on a more or less definite rotation plan, to apportion the manure expense on the basis of either 50, 30, and 20 per cent over three years, or 40, 30, 20, and 10 per cent over four years, depending somewhat upon the nature of the soil. In the case of commercial fertilizer, the more quickly acting fertilizers, such as nitrate of soda, are often charged as an annual expense, but lime and rock phosphate are usually charged over a four or five year period. More definite results from experimental work will probably give a more definite basis for this charge in the future than exists at the present time.

Confidential Information,

COST OF PRODUCING 1919 WHEAT CROP.

Office of Farm Management
U.S. Department of Agriculture,
Washington, D. C.

1. Name J. Smith Address Kansas R.F.D.

2. Farm operated by owner or tenant Owner

3. No. of acres in farm 240 Value of land per acre with improvements $ 225

4. Acres of wheat seeded, 1919 65 Acres harvested, 1919 65

5. Total yield of wheat, 1919 1180 Yield per acre 18 Usual yield 22½

6. TOTAL DIRECT LABOR ON ENTIRE WHEAT CROP, 1919.

Operation	No. Men	No. Horses	Total Days	Hours per day	Operation	No. Men	No. Horses	Total Days	Hours per day
A. Manuring	1	3	2	10	H. Seeding	1	4	5	12
B. Plowing	2	4	22	10	I. Cutting	1	4	7	12
C. Tractor Labor					J. Shocking	2		14	12
D. Disking	1	4	11	10	K. Stacking				
E. Harrowing	1	4	5	10	L.				
F. Cleaning and Treating Seed	2		1	12	M. Threshing	21	18	41½	12
G. Hauling Seed or Fertilizer	1	2	2	12	N. Marketing	1	2	5	12

7. No. of acres fallowed in 1918 for 1919 wheat crop 42
8. Estimate the total man hours 220 Also total horse hours 220
and total tractor hours None on this fallow land
9. Was this fallow labor included in Table 6? Yes
10 Quantity of seed used per acre 5½ pk. Total seed used 90 Price per bu. $2.10
11 Acres of wheat land fertilized —— Tons per acre Price per ton
12 Acres of wheat land manured 10 Loads per acre 5 Value per load None
13 Total lbs. of twine used on wheat 163 Lbs. per acre 2½ Price per lb. 23¢
14 Cash premiums paid for wheat insurance None Wheat insurance received
15 Total cash cost for threshing wheat $118. Rate per bushel 10
16 What items are included in threshing charge? Machine bill only
17 Rental paid per acre for wheat land Own land
18 Total value of material purchased for seed treatment $1.00 Value per lb. —
19 Interest rate on farm mortgages in your section? 6%
20 Taxes for entire farm $87.50 How often do you have partial crop failure 4th yr.
or complete crop failure once in 20 yrs
21 Yield of wheat straw per acre 2 tons Value per acre How utilized
22 Total value of wheat pasture None Value per acre
23 Rotation followed 2 yrs corn, 2 yrs wheat and 1 yr. clover
24 Value of man labor per hour 60¢ Value of horse labor per hour 30¢
25 Any other production costs?

FIG. 8.—Questionnaire used in wheat study.

As for the value of the fertility removed from the soil, irrespective of fertility applied, the common practice has been to make no charge if no fertilizer has been applied. It is obvious that if such a charge is made, certain crops, particularly the leguminous crops, should have credit for providing nitrogen and other fertilizer constituents to the soil. The argument is advanced that land can not indefinitely produce crops without having fertility returned to it in some form, and that to figure costs without taking this into consideration is simply to charge the land with a deferred payment which must be made later on. In practice, however, difficulty arises in reducing the charge for plant food consumed to a definite and practical basis. Soils are so variable in physical condition and soil theories are still so unsettled as to make it extremely difficult to set a standard which will be generally acceptable. Assuming that a charge for consumed fertility might be made against the crop, it is obvious that the account to receive the credit would be the land. This would mean making land values variable, according to the kind of crops grown. It can readily be seen that this would lead to great confusion.

The fertilizer cost item illustrates the extreme variability that exists in the cost of farm products because of the great variation in soil types, farm practices, and fertility methods. Without more definite data than are now available it becomes dangerous to make arbitrary charges for the fertility removed from the soil.

Interest.—Considerable difference of opinion exists as to the practice of including interest as a cost in farm-cost accounting. Commercial accountants are divided into two schools on this question and two procedures are followed in commercial accounting. Many authorities include interest for certain organization studies and omit it as a cost in arriving at conclusions on other lines. Cole [1] states that proper accounting is based primarily on the purpose served, and relates only secondarily to the object with which the expense chances to be identified. The principal purpose of farm cost accounting, from the standpoint of the farmer, is to provide figures that will make it possible to compare the costs and profits of competing enterprises on individual farms. Hence the inclusion of interest as a cost in farm accounting as a matter of fact is not contrary to the principles of commercial accounting if more profitable farming is the object.

The use of capital, whether in the form of land, live stock, or equipment, whether borrowed or provided from a surplus, is an element of cost in production that must be reckoned with and allowed for in any adequate accounting system. Statements of business men, economists, and at least a representative number of accountants confirm this practice in comparative analyses of various units of industry.

Hatfield [2] clearly points out that where it is essential to determine whether capital shall go into a given industry or not, what is wanted is a correct estimate of the net income after deducting all interest on capital and other items frequently excluded from cost accounts themselves. "The information necessary to show whether an enterprise is ultimately successful is very different from that which shows whether an enterprise once established should be continued." The comparison of farm enterprises in this connection clearly necessi-

[1] Accounts—Their Construction and Interpretation, by William Morse Cole, p. 114.

[2] Modern Accounting, p. 307.

tates the charging of interest on the capital concerned in order to arrive at the correct result in considering the combining of various enterprises into the proper farm organization. That interest may be used in commercial accounting for similar purposes is stated by Gerstenberg.[1] He states that "In general it is desirable to include interest in cost where materials must be stored for long periods while the seasoning process is being completed and where it is desired to show the effects of variations in the amount of capital employed and in the lengths of the periods during which the capital is employed."

Further use of this common practice in farm cost accounting is found in the adaptability of the figures thus obtained in comparing the efficiency of various parts of the farm business on different farms. Many farmers rent their farms for cash, others for a share of the product, others pay interest on mortgage indebtedness, others own their farms entirely free from debt, while still others pay different forms of rent for various parts of their farms. To compare various factors of efficiency on these farms it is essential to have them on a common basis. This should be considered a secondary reason for the inclusion of the interest in the cost of conducting the business.

In any case, interest on all forms of fixed farm capital[2] should be kept separate, where practicable, and perhaps for the sake of clearness considered a supplementary cost rather than an operating expense, whether the interest is actually paid or not.

One particular point in dispute regarding the charge of interest is the rate that should be used. This assumes a very definite importance when it is considered that many a farm business has a capital value of from fifty to one hundred thousand dollars, the interest on which is often larger than the labor income or the so-called farm profit computed from the year's operations.

The point often has been raised that one is not justified in arbitrarily selecting a rate that it is assumed the capital should earn, thereby dividing that which is commonly referred to as profits into "interest" and "profits." The position is taken in farm cost accounting that this practice is at least as valid as the common practice of assuming arbitrary salaries for personal services rendered in a business. Going rates of interest in communities are well known, and for comparative purposes the fixing of the rate at one-half or even 1 per cent higher or lower than the money possibly might be obtained for does not materially affect the usefulness of the results.

The rate usually used by the Office of Farm Management and Farm Economics in its northern agricultural studies has been 5 per cent upon the entire farm capital and in its southern studies 7 per cent, the difference being due to the regional difference in the interest rates on well-secured mortgages on farm property.

[1] Principles of Business, p. 763.

[2] Interest is not usually applied to working capital as a cost.

In enterprise surveys, such as studies of dairying, beef cattle, and special classes of farm investment, the interest rate is often increased slightly, usually by 1 per cent, as compared with the total farm capital rate, since short-time loans are often made to cover such operations at a rate of about 6 or 7 per cent. This should be charged upon the average capital used in the enterprise during the period of study. On beef cattle it may often run from three to six months, while on dairy cattle it would be for the entire year.

The point is often raised as to whether interest should be charged on feed on hand at the start of the year and purchased during the year that is fed to live stock. One method of handling this charge is to assume that the farm price from month to month should cover the interest, while another method that has been used is to charge interest at the short-time loan rate on one-half the value of the feed which is consumed during the entire period. The same argument might be used for charging interest on the value of seed, the returns from which are not obtained until the crop is harvested.

The practice of the Office of Farm Management and Farm Economics has been usually to ignore this charge on supplies and feeds, on the assumption that, strictly speaking, only two general kinds of farm property should bear an interest charge for any purpose, namely, the fixed assets and the specific current investments, such as cattle and hogs purchased for resale purposes.

Overhead.—One of the most difficult phases of cost accounting to the beginner is the composition and distribution of the overhead expense. There are various uses of the term "overhead." In some instances it may be found to cover a large number of items and to amount to as high as one-third of the costs, or it may embrace only those charges that can not be apportioned directly to the enterprise in hand.

The latter usage is the proper one, namely, to keep the amount charged to overhead as small as possible and to include under this head only those items of expense that are so general as to preclude direct charging to the various accounts. Common among the cash items that go to make up the overhead in a well-conducted system of cost accounting are general farm advertising, stationery, telephone rents, subscription to farm journals, and postage, while the principal labor expense is made up of the labor that is necessary to maintain the farm business in running order but which can not be charged directly to any particular enterprise, such as work on weed control, road maintenance, picking stones, etc. Overhead also includes interest and taxes on the roads and lanes, on the farmstead, and on the headlands of the various fields.

One of the misuses of this item has been to include the shelter costs of live stock, equipment expense of live stock, sire service for cows, miscellaneous cash expenses of the farm enterprises, and similar items which should all be placed directly against the proper accounts.

Distribution of the overhead expense should be on the basis of the direct expense incurred by the productive enterprises of the farm, namely, the field crops and classes of live stock. The capital investment and productive crop acres and units of live stock have been proposed as bases, but inasmuch as the labor requirements and other costs of the various enterprises vary widely, these methods of apportioning the overhead do not place the proper share of expense against the various enterprises. Inasmuch as all expense is similar in source—that is, is incurred through the use of land, labor, and capital in the operation of farming—the distribution of the overhead expense on the basis of direct expense seems to be a more equitable basis than any other.

Business risk.—There are many classes of business risks, such as loss from hail, drought, fire, diseases, weeds, pests, and employers' liability. It is seldom that a farmer carries a large amount of insurance, and that which is carried is usually not for the full value, so that the farm carries the remainder of the risk. The insurance that is carried for a certain business risk is charged directly to the proper account. If no insurance is carried, it is not common practice to charge the farm with the risk as an expense but rather it is assumed that the profits should be great enough to carry this risk.

Some authorities have advocated the charging to crops and classes of live stock the full insurance charges against these various risks, whether carried or not, on the assumption that the farm business must stand the loss if such is entailed, and that therefore an insurance charge is warranted. However, inasmuch as insurance is a direct cost, it is doubtful if it is good accounting to charge any other than the actual expense incurred for the risk involved. It is nevertheless true that the net returns should be such as to cover uninsured risks of the business.

Profit.—In complete cost-accounting studies there has probably been little misuse of the term "profit," inasmuch as the accounts are in sufficient detail to bring out the actual profit or loss made. In a great many publications, however, the term is misued by applying it to the return from an enterprise or a farm business above one or two of the principal expenses. For example, it has been quite common practice to call the return above feed of dairy cows "profit." In some cases the labor may be included as a cost along with the feed, and the difference between these charges and the receipts called "profit." As a matter of fact the miscellaneous and indirect charges of some farm enterprises amount to one-third of the total cost of operation, and to leave these items out of consideration in determining the cost of the enterprise is erroneous and misleading.

The various uses of the term "profit" illustrate the need for a more general understanding as to the nomenclature used in farm accounting studies. Doubtless the time is coming when "profit" will mean just one thing to everyone interested in the farm business, while "farm income," "labor income," "interest on investment," and other kindred terms will express the precise meaning intended, by virtue of a wider dissemination of the correct definitions and the proper use of these terms.

In common farm-accounting practice the profit from a farm business is that amount which remains after all expenses, including the labor used on the farms, and interest on investment in the farm business, have been deducted from the total receipts, the total receipts to include cash receipts, farm products consumed on the farm, and increase in inventory other than an increase in the value of land owing to an unearned rise in value. If the inventory is properly kept, any permanent improvement added to the farm as an expense will be counterbalanced by a proper increase in the value of the farm, but a more or less arbitrary increase in the value of the land should not be included as a receipt in the operation of the year's business.

In commercial accounting practice, however, interest on investment or capital is not commonly included in the costs. The position is commonly taken that profits can not be divided into "interest" and "profits," but that the total remainder above all operating expenses represents the profit, which may be expressed as a certain percentage of the capital investment. Interest can not arbitrarily be estimated and taken out in computing the costs and arriving at the total profit. In comparing farming as a business with other lines of business, when a total profit or net return is used interest on the farm capital should not be included in the costs in determining the profit.

There is also need for distinguishing between the profit from a particular enterprise on the farm and the profit from the entire farm business. From an accounting standpoint, for example, the field crops, considered as separate enterprises, will often show a very good profit, while the live-stock enterprises which consume these crops may show a very small profit or an actual loss; nevertheless, the returns from the farm business at the end of the year are such as to be satisfactory to the farm operator.

THE ROUTE PLAN.

The route plan of obtaining cost of production data, as conducted at the present time by the Office of Farm Management and Farm Economics, involves studies of a group of from 20 to 25 farms in a locality. A field statistician spends his entire time in the vicinity, visiting the farms at regular intervals, not less than twice each week, for the purpose of gathering the necessary data for the entire farm business. This means that the man must visit from 6 to 8 farms each day, obtaining a record of the labor in detail for the period that has elapsed since his former visit, supervising the keeping of the cash account, and obtaining data as to yields, production of live stock, feeding practices, household consumption of farm products, etc. From the field blanks the data are usually transcribed by the field men to office forms, which are then forwarded to the local office, at which practically all the records are summarized and from which reports are sent back to the farmers.

Following is a brief description of the primary records collected by the route agent in the field, no attempt being made to illustrate or describe the methods of tabulating and summarizing the complete records of the farm business for the year.

THE LABOR RECORD.

One of the most difficult cost records to keep accurately is the detailed labor record. One of the strong features of the route plan is the frequent personal visit which enables the route man to keep track of the labor expenditures. Often the record of the labor is taken directly from the farmer's verbal report to the field man, but it is becoming more common practice for the farmer to record all the labor performed each day on a convenient blank, which is quickly copied and checked by the field agent.

One of the principal difficulties in connection with the daily labor report is that of accounting for the entire day for all the farm workers. With the multitude of tasks involved in the farm business, it is very easy to overlook certain operations that are really important.

This is one reson why the route plan seems to give better results than some other methods, since the agent is at hand to check at once any discrepancy, or to ask for further information if the daily labor reports are not complete.

The record of the daily chores, or regular daily work, is taken in total each day, but distributed to the classes of stock once or twice a month. It has been found by statistical analysis of a great many records that the chores through a given month will require about the same amount of time each day unless the number of stock changes considerably. It is much easier for the farmer to report the total time of regular daily work each day, and to divide it once or twice a month among the classes of stock that require the chore labor, than it is to attempt to distribute the chore labor each day. For convenience in reporting the chore labor and for the recording of changes in the number of live stock each month, a special form has been prepared, entirely separate from the regular daily labor report. (See fig. 3.)

Figure 1 illustrates the blank labor form used in recording labor in the cost-accounting studies now in progress. It shows how the record is kept by the farmer for himself and his hired help on the same page. Space is provided on the labor sheet for extra day labor employed in harvest or other seasons when extra day labor is needed.

Figure 2 illustrates a form of labor report which is kept by each man working or where each man's report is filled out separately for him by the proprietor. The men usually draw lines to indicate the actual hours spent in various operations, indicating the field number and the number of horses used. The tabulator or the field man can get the number of man hours by figuring the time between the lines drawn across the sheet. It is then a matter of multiplication to get the horse hours.

The advantage of this form is that it accounts for the full day and is kept by each man on the farm. The disadvantage lies in the large amount of tabulating and summarizing necessary in posting the records. This form has been used with very good success in the correspondence plan of obtaining farm data.

Figure 3 illustrates the form used for the average monthly distribution of the daily chore labor, together with the changes in the number of live stock during the month. This form does not always give the operations separately, as "feeding cows," "milking," "cleaning the barn," "separating the milk," etc., but it has been found very satisfactory in distributing the regular daily work time over the various classes of stock. When this report is received by the office tabulator, it is checked with the total amount of labor reported daily for the total chore time.

FEED REPORT.

The feed report is one of the most difficult records to obtain accurately. It is comparatively easy to arrive at the total amount of feed consumed on the farm by all classes of live stock, through recourse to the inventories, the yields, and sales and purchases of the various crops and feeds used on the farm. The difficulty arises in determining the total feed or the feed per head consumed by various classes of stock where they are all fed out of the same mow, the same corn crib, and the same granary. On large farms it is often possible to keep a bulk feed record for different classes of stock, inasmuch as they are often separated in the different barns and fed from different mows, bins, and cribs.

The most satisfactory system of obtaining the feed record where all classes of stock are fed from a common source is that known as the "unit" system, usually based on the amount of each of the different kinds of feed consumed per mature head of stock per day. On the cost-accounting routes an attempt is made to have the farmer use the measuring unit in his feeding operations. For example, in the feeding of horses a pan or measure is usually kept for the grain fed, or so many ears of corn are fed per meal or per day. Cattle are often fed by the scoop. Silage is usually fed by the basket or cartload. Bundle corn is fed by the bundle. The route agent determines the average weight per measure or per unit of feed, and with this computes the amount consumed per head daily.

For some classes of stock it is frequently possible to have a bulk record of grain and roughage fed, and thus note is simply made of the number of days required to consume the total amount of feed that is set aside. In hog and beef cattle feeding this method is often used to very good advantage.

No attempt is made to determine feed weights daily, but the farmer reports to the route agent in case the number of measuring units is changed, so that the proper computation of the feed consumed for the specific class of live stock may be made by the agent.

An important feature of the work of keeping the feed record is known as "checking" the inventories, crop yields, and sales and purchases against the amount consumed by the live stock. Checking is particularly important in the case of the roughage feeds, for which it is sometimes difficult to get an accurate measuring unit. It is frequently necessary to make adjustments between the feeding record and the yield record, particularly in the case of hay, corn fodder, stover, and like feeds, inasmuch as it is usually impossible to get yields accurately by weight. On some farms it is necessary to keep a monthly adjustment feed sheet, on which the total feed consumed since taking inventory is checked monthly with the inventory and sales and purchases.

The question of the price to be placed on the various kinds of farm feeds is often confusing to the route agent. Farm feeds vary so greatly in quality, and there are so many feeds for which there is not a ready market quotation, that it is frequently difficult to be sure that the proper price has been used. It is sometimes necessary for the route agent to use his judgment as to the relative value of different grades of hay, and of ear corn fed in fodder, based upon market quotations of marketable hay and upon the yield of corn in the corn fodder. It is the usual practice to require the route agent to send to the office a monthly market report of the local prices on all feed and live-stock products so that adjustments may be made later if necessary. Allowance is always made for the cost of hauling, which is either added to or deducted from the market price of feed according to whether the feed is purchased or home grown.

Figure 4 illustrates the form used by the route agents in reporting the feed record to the office. Usually the rough notes of the number of measures of feed and the weight of the measure is kept in a pocket notebook, and the record from the notebook transcribed to the form illustrated in figure 4. It will be noted that, unless otherwise specified, the figures in the record indicate the amounts consumed per head per day for the various kinds of stock.

FINANCIAL REPORTS.

The cash account is usually one of the easiest records to obtain, inasmuch as in most types of farming there is no large number of cash items to be entered on the books in any one month. This record is often kept by the farmer in a common notebook or ledger book, and is transcribed to a form kept by the route agent, or the farmer may keep the cash account in a book such as that illustrated in figure 5. Usually this account is kept in duplicate, so that the farmer or the route agent simply tears out one sheet, leaving a permanent cash record on the farm. The duties of the route agent in connection with the financial account are to see that it is kept up to date and that all items are included.

The purchases and sales on credit are recorded in the first column on the form illustrated in figure 5, and it is essential for the route agent to watch this column in connection with the cash payments as they are made later on in the year.

SUPPLEMENTARY CROP DATA.

There are certain minor items concerned in the production of crops and maintenance of live stock which are often overlooked in the keeping of the farm record. Such items are, the quantities of seed used in the various fields, the amount of binder twine used, quantities and cost of the spraying materials for the crops, orchard, and garden, the containers used in harvesting certain crops, the amount of manure produced and used on the farm, and the amount of fertilizer applied to various fields.

To facilitate keeping this record up to date, the route agent is furnished with a supplementary data sheet, calling attention to these items so that they may be kept in mind. It is a common practice for the farmer to report the quantities of seed, fertilizer, twine, spray material, and other items consumed for each field, along with the labor record sheet from time to time as these materials are applied, and the record is transcribed from this daily labor sheet to the supplementary crop data sheet by the route agent.

HOUSEHOLD RECORDS.

To obtain the cost of labor to be charged to the various enterprises the board cost becomes an essential part of the labor record. This means that there must be a household account of the cost of feeding the laborers on the farm. To obtain a complete crop and live-stock account, it is also essential to have recorded the amount of farm produce grown on the farm which is consumed in the home. It is common practice to inventory the kitchen, dining room, and the bedroom equipment used for the laborers, and to allow going wages for the household help in arriving at the cost of board and lodging of the hired laborers.

It is not always a simple matter to determine accurately the amount of produce consumed in the home. To facilitate the keeping of this record the garden is usually charged in toto to the household account, and if any garden produce is sold the return is credited to the household account at the end of the year. This saves the trouble of attempting to record and evaluate various items of vegetables as they are consumed. The dairy, poultry, and other live-stock products are the principal items that must receive attention in this record as they are consumed.

Where married men are kept on the farm in separate tenant houses certain perquisites are usually furnished in the way of the keep of a cow, a share of the chickens, and a garden plot. In an estimate of the cost of hired labor these items must be taken into consideration along with the cash wages paid. It is also common practice on many farms for the married help in the tenant house to board the single hired men who may be employed. The most common practice in this regard is for the owner of the farm to pay the board of the single hired men at an agreed rate per month.

There are two ways of getting the household record. One is to get from the housekeeper a monthly estimate of the amounts of the various products consumed, as illustrated in figure 6. When this form is used the quantities are estimated by the housekeeper and the values placed on each item by the route agent. Another way is illustrated in figure 7. This card is tacked up in the kitchen in a convenient place, and the housekeeper records on it daily the essential farm products consumed. Each of these forms has proved very satisfactory in cost-accounting studies.

PRODUCTION RECORDS.

In most instances the production record applies to the yield of the various crops and to the dairy production. Where the milk is weighed, either daily or weekly, the ordinary commercial forms for dairy records are used on the cost-accounting routes. The yield record of the various crops, by fields, is usually taken down on the farm by the route agent in an ordinary notebook and later transcribed to the supplementary crop-data sheet, which affords opportunity for the rechecking of the yields. Often the yields must be expressed for the time being in terms of the number of loads rather than in weight, particularly in the case of feeds that shrink much in the curing process.

FIELD MAP.

It is essential in all cost-accounting work on the farm to have measured acreages of the various fields on which records are being kept. From the organization standpoint a carefully drawn map of the fields and the farmstead also aids the farmer by emphasizing any change in farmstead and field arrangement that will make for the more economical operation of the farm. This is one of the first steps toward the reorganization of a farm business, as the layout of the farm is one of the important features of its organization. If the map is made on a reasonably large scale it may be found possible to note on it the rotation and the yield of the crop in each field, together with the amount of fertilizer and manure applied, the amount of seed and twine used, and other items of value for each particular field.

THE ROUTE METHOD OF ENTERPRISE STUDY.

For certain types of farm production the route method, when applied to a single enterprise, has proved successful. Studies conducted by this method are usually a combination of the survey and accounting methods, inasmuch as a record of the entire year's business for the farm is obtained at the end of the year by the survey, while the accounting method is applied intensively to the special enterprise studied. Good examples of this combination of the two methods are found in the cooperative tobacco cost study conducted in Kentucky, and in the cooperative studies of the cost of fattening cattle in the corn-belt States.

In the tobacco project each route consisted of 75 farms, a route man taking care of the tobacco project by the accounting method, while a survey was made on each farm at the end of the farm year to cover the other activities of the farm business. These studies are most sucessful on specialized farms where the enterprise studied is the most important item of production. Detailed labor records are kept for the special crop, and the acreage of this particular crop is measured carefully by the route agent. All financial records pertaining to this crop are carefully made, and at the same time an attempt is made to get a complete financial record of the entire farm business through the year. In the case of tobacco it is practically a year's study, inasmuch as the marketing operation on the tobacco crop occupies a long period of time and often a part of the crop is held over after the succeeding crop is planted.

In the case of the beef-cattle studies, a survey of the previous year's business on 75 to 100 farms was made in each locality, and 25 to 30 of these farms were formed into a group to be visited by the route agent throughout the cattle-feeding season. This season usually lasts from five to seven or eight months. During that time the enterprise record covers in detail the feed, labor, and cash requirements of the cattle and the hogs following them. When the cattle are marketed, however, the route agent discontinues his routine visits, but returns to each farm at the end of the farm year and makes a survey of the entire farm business.

OCCASIONAL VISIT AND BOOK PLAN.

Under the occasional visit and book method, labor, feeding, financial, and production records are kept by the farmer in a book provided for that purpose, and occasional visits are made to the farm by the supervising agent in charge of the project. These visits may be made once in two months, or as infrequently as once in three months.

The value of this method [1] lies in the large number of farmers who may be carried on the accounting project with a correspondingly low cost per farm. It seems essential with this method to select the farms very carefully, since much depends on the interest and accuracy of the farmers.

CORRESPONDENCE PLAN.

The Office of Farm Management some years ago developed a correspondence plan of cost accounting which was placed in operation on a considerable number of farms in various parts of the United States through approximately a 10-year period.

The advantages of this method were the large number of farms that could be covered with a given fund for study and the wide range of conditions that could be represented. The disadvantages were the lack of personal supervision in the recording of the data, the constantly arising question as to the completeness and accuracy of the records, the difficulty of keeping up the interest of the cooperators, and the danger that the cooperator might lack the ability or inclination to give the accounts through the year. The question of unconscious bias is one that enters into all accounting records, and lack of supervision with the cooperators far above the average in intelligence and ability are factors in the bias problem. There is also a tendency for cooperators to drop out after the first year, for it often becomes a heavy task to keep the labor record up to date. For this reason it is usually impossible to obtain long-time records by this method.

Because of the disadvantages enumerated above, it has been felt that the route plan, combining some of the reporting features of the correspondence method, is preferable, since it provides the supervision and attention to details that are essential to complete farm records.

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[1] The system is fully described and explained in the revised Farmers' Bulletin 572, "A System of Farm Cost Accounting."

DISTINCTION BETWEEN "COMPLETE COST ACCOUNTING" AND "FARM RECORDS."

Many persons interested in the farm business are inclined to confuse the keeping of ordinary farm records with detailed cost accounting. Most of the agricultural colleges, in cooperation with the extension agencies of the United States Department of Agriculture, have prepared farm record books for the recording of inventories and cash accounts for individual farms, and recently these have been used extensively in the making up of the income-tax statements required by the Federal Government. Keeping such records is a most important step in the business operation of the farm, but it should not be called "complete cost accounting," nor should it be implied that the farmer will know the cost of producing his separate products by the keeping of such a book.

The farm inventory and cash account will give the farm receipts, the farm expenses, farm income, labor income, the net worth, the interest earned on investment, and other figures that are very important to the farmer. Cost accounting goes considerably further in that it includes the labor record, feed record, production record, and the summarizing of the data at the end of the year so that each productive enterprise bears its share of the overhead or general farm expense. One is relatively simple and the other is so complex that few farmers can afford to give the attention necessary to keeping a set of detailed cost accounts. It is believed, however, that every farmer would find it advisable to keep a simple farm record book.

To illustrate the wide difference in the results obtained by the detailed cost-accounting method as compared with the common farm record book, the following comparison is made:

Results obtained from simple farm records.

1. Total profit or loss.
2. Total receipts, expenses, farm income and labor income.
3. Distribution of receipts and expenses.
4. Total capital.
5. Total net worth.
6. Income-tax statement.
7. Crop acres per man and per horse.
8. Receipts per acre and per animal unit.
9. General distribution of farm area.

Results obtained from detailed cost-accounting studies.

(Other than those given for simple farm records.)

1. Relative profitableness of enterprise.
2. Distribution of capital, income, cost, and profit or loss by enterprises.
3. Relative importance of the elements of cost.
4. Labor requirements of enterprises.
5. Distribution of labor by days, months, and seasons, and by enterprises.
6. Utilization of various sized power units by operation.
7. Comparative cost of operation of various forms of farm power.
8. Utilization and working life of farm implements.
9. Cost of maintaining farm work horses.
10. Quantities of feed consumed per head by seasons by various classes of stock.
11. Productivity of live stock.
12. Length of working day, by individ uals, by seasons.
13. Yielding qualities of the soil.
14. What the farm contributes to the family living.
15. Utilization of farm area by measured acreages.
16. Arrangement of fields and farmstead.

THE SURVEY METHOD.

FARM BUSINESS ANALYSIS.[1]

When the survey method was first used in studying the profits of the farm business the studies were commonly called "Farm Management Surveys." To distinguish the general survey from other surveys of parts of the farm business, the term has been changed to "Farm Business Analysis." This is primarily the study of farm profits and of the fundamental principles underlying the organization of the farm from the standpoint of financial return. The Office of Farm Management has made a large number of farm business analysis studies and has recognized three types of this method of analysis. The first is the analysis of a large number of farms typical of a rather well-defined type of farming in a region for one year only. The second type is the continuing analysis, repeated on a number of farms in the same locality each year for two or more successive years. The third type is the repeated periodic analysis in a region usually after the lapse of a 5 or 10 year period.

ENTERPRISE COST STUDIES.

By an enterprise is meant a separate crop or class of live stock. In this type of studies emphasis is laid upon one particular enterprise. The studies are conducted along the lines of the farm business analysis, in that the personal visit method is employed, questions being asked of the farmer, who depends largely upon his experience and knowledge of his farm practice for the answers. Of recent years the keeping of farm records by farmers has greatly increased the accuracy of the personal visit method, both in the study of the farm profits and in the study of the cost of the operations of a particular enterprise.

Enterprise studies are best obtained for special or more or less staple products, such as wheat, cotton, sugar beets, potatoes, milk, and fruit. Since such products constitute an important part of the farm business, knowledge of the requirements for their production is usually uppermost in the farmer's mind.

An important phase of the enterprise work is the practical application of the data to farm organization problems. Along with the enterprise records it is usually desirable to obtain a farm business analysis record of the entire farm, in order to understand the economic place of the enterprise in the scheme of farming. This procedure is especially advisable when it is intended to draw conclusions as to the advisability of continuing or increasing the production of the particular crop or class of live stock under consideration. By

[1] For a complete description of the business analysis method, with a statement of the results obtained by the Office of Farm Management over a term of years, and examples of the application of this method, see Farmers' Bulletin 1139, "A Method of Analyzing the Farm Business."

having definitely in mind the relation that exists between the special enterprise and the farm business as a whole, it is often possible to bring out facts leading to conclusions not indicated by the enterprise alone.

These data are extremely valuable also in the calculation of the overhead charge which each productive enterprise on the farm must carry. For example, in the study of the cost of producing wheat, unless the wheat land is valued high enough per acre to cover the nonproductive acres on the farm, the carrying charge for these nonproductive acres is not included in the cost of the wheat crop. There is also a certain amount of farm labor spent in the maintenance of the farm which it is impossible properly to distribute over the productive enterprises without having a record of the entire farm business, though in localities where the detailed cost-accounting method is followed it may be possible to arrive at a percentage figure which may be used to approximate the overhead charge on farms studied by the survey method.

NORMAL COST FACTORS.

A very important function of the enterprise cost study is to establish normal figures for various operations, yields, and costs for each of the farms visited. By "normal" is meant the average over a number of years. The advantage of this information lies in the opportunity it affords of comparing the results for a particular year with what may be expected in the long run. Such comparisons provide a fundamental background for a more accurate study of the variations that are likely to occur in connection with the enterprises considered.

BASIC ELEMENTS OF COST.

From the data obtained in the enterprise surveys may be determined the basic and stable factors of labor and materials necessary to production in the given enterprise, which constitute a basis for practical estimating of such costs at different rates for labor and materials. Further, the method allows the covering of a large area and the study of a greater number of instances than the detailed cost-accounting method, with a given expenditure of time and money. The enterprise surveys yield data on special crops or live-stock enterprises which it would be difficult or impossible to obtain through the cost-accounting method, as the farms are often so widely scattered that the accounting method would be too costly. To obtain representative evidence of the economic factors of the production of an enterprise, it is advisable to obtain a volume of data that can not be economically supplied by the latter method.

THE ENTERPRISE RECORD IN DETAIL.

The first consideration for the record of any enterprise cost study is the size and value of the entire farm, with the distribution of the acreage and values of the land used for the production of the various crops for the previous year, and a statement of the yields and cash receipts from the various crops.

Man labor.—In the special enterprise to be studied, the principle and most difficult items of direct expense are considered in turn. The first of these is the direct labor on the enterprise. The labor is first considered in terms of the hours of man and animal or mechanical power required by the various operations concerned in the production of the crop or animal product in question. This is expressed in terms of the normal rather than as the extreme time in which the operation may be performed. It is usually approached in such a manner as to arrive at the number of acres covered in a day of 9 or 10 hours with a certain power unit; this factor, applied to the acreage, say of a particular crop, provides the total time required on that crop. This has been termed the practice side of an enterprise study; that is, obtaining the basic information as to what are common practices and the amount of time necessary to perform the operations. Next, it is essential that a record be obtained of the cost of all labor used on the farm, together with an approximate record of the total number of months of man labor expended, the amount of wages paid, and an estimate of the cost of board consumed by the hired help.

Horse labor.—In studying by the survey method an enterprise in which horse labor is an expense, it is always difficult to arrive at a satisfactory rate per hour of horse labor without reference either to detailed cost accounts for similar types of farming or to information obtained by the survey method on this particular point. It is often possible to obtain fairly accurate figures on feed requirements and other costs of maintaining farm work horses along with the enterprise survey, thus providing a means of determining approximately the cost of horse labor per hour.

Materials.—"Materials" include the seed, twine, spray material, feeds, etc., used in production. With figures on the quantities of materials actually used are recorded also current prices, but the quantities are noted on a normal basis as well as for the current year. It is advisable to record, in this connection, the approximate total expense of operating the farm, in order to be able to compare the enterprise studied with the total earnings, expenses, and the labor income of the farm as a whole.

Equipment.—The next item of importance is farm equipment, with special emphasis on the equipment used for the enterprise studied. Usually it is advisable to obtain a very complete list of the larger machines, with the farmer's estimate of the approximate length of time they will last, and the amount spent for repairs during the year.

Buildings.—Figures are obtained on the present value of the farm buildings, usually divided as farm dwelling, tenant houses, and other farm buildings. This information is of value in arriving at the overhead charge which is to be carried by the productive enterprises of the farm.

SUMMARY OF ENTERPRISE DATA.

The following summary gives the items and principal elements of cost which should be obtained in an enterprise study for the particular enterprise in mind and also for the entire farm business:

For the enterprise.

1. Normal yield and acres of crops or normal number of live stock by years for a three-to five year period.
2. Direct labor requirements.
3. Feed and material quantities and expense.
4. Proportion of total labor chargeable to enterprise.
5. Proportion of equipment expense chargeable to enterprise.
6. Proportion of overhead.
7. Special marketing notes.
8. Special enterprise notes.

For the entire farm.

1. Area, value, and distribution of farm area.
2. Live-stock inventories.
3. Inventory of equipment.
4. Inventory of buildings.
5. Cash receipts from all sources.
6. Cash expenses.
7. Inventory of feeds and supplies.
8. Total amount of all labor, with rate of wages for hired labor.
9. Estimated expense of maintaining work stock.
10. Total amount of horse labor.

Data as above outlined will permit the working out of the basic requirements for producing enterprises and will provide a basis for the distribution of fixed charges, including overhead expense. With the data from the entire farm business, the relation of the enterprise to the farm is shown by its proportionate use of land, labor, and equipment, and by its costs and earnings, as compared with those for the whole farm. It is also possible to compute from these data labor income and interest on the farm investment, which are of value in considering the status of the enterprise studied. This is especially true if the product in question is by far the most important, such as cotton on cotton farms and wheat on wheat farms.

ENTERPRISE STUDIES WITHOUT COMPLETE BUSINESS ANALYSIS.

A number of separate studies of farm enterprises have been made by the Office of Farm Management and Farm Economics without attempting to obtain a complete business analysis of the farm. Similar studies have also been made by various State institutions, but usually the enterprise in question has been of an outstanding, special type, and of considerable commercial importance. Among these studies may be mentioned those of the cost of producing sugar beets, apples, potatoes, beans, sweet corn, cabbage, onions, and tomatoes. This manner of studying the enterprise does not permit taking into consideration the relation of the enterprise to the entire farm business, which is often of great importance from a farm organization standpoint. From a strictly accounting standpoint, the lack of complete farm data increases the difficulty of accurately apportioning the overhead expense to the enterprise. There is also danger of drawing erroneous conclusions as to the relative importance of the enterprise, but this disadvantage has generally been minimized by the selection of enterprises that bring by far the greater part of the cash return of the farm business.

Experience has shown that it is usually best to include the farm business analysis data with the enterprise studies, when this can be done without putting too great a burden on the farmer. Extremely long schedules are tiring, and there is a consequent lagging of interest, often resulting in inaccurate estimates of important details.

SURVEYS BY QUESTIONNAIRE.

Certain kinds of cost data and farm organization material can be obtained quite satisfactorily by the questionnaire method. The enterprise to be considered by this method must be one in which simple, easily estimated direct costs are to be obtained and one in which considerable data are available by other methods of investigation in order to provide figures on the miscellaneous items of cost that can rarely be accurately obtained through the questionnaire. Where it is essential to study widespread trends of simple farm practices the questionnaire affords a means of obtaining a large number of estimates at a comparatively low expense.

One of the characteristics of the results obtained by using the questionnaire method is that they are usually expressed in averages. This is because the information is usually more general in character than the results obtained by specific studies and a very large number of individual cases are examined to make up the average. For some purposes the average is not applicable, while for others it serves an important function, particularly in indicating trends in various practices.

A decided advantage of this method is that a small investigational force can make an extended study and at a very small cost, the principal expense being for the clerical force necessary to tabulate the large number of returns obtained. A further advantage lies in using this method to obtain a relatively quick estimate of the changes in the price levels of certain cost factors which may be used with the basic elements of cost obtained by other methods in bringing cost data up to date. For example, where the basic factors of producing cotton have been worked out, it becomes relatively a simple matter to estimate the average cost for any given year if the current rates for labor, fertilizer, ginning, seed, etc., are known. This information may often be obtained very satisfactorily by the use of the questionnaire. In general, however, results obtained by this method should be considered with its limitations in mind, for usually a relative figure is obtained, which is indicative rather than specific.

The Office of Farm Management and Farm Economics has made a number of studies by the questionnaire method, principally with reference to the experiences of farmers with tractors and other mechanical farm equipment. By way of experiment, the Office, during 1919, sent a questionnaire on the cost of producing wheat into the same areas covered by the survey method. The usable returns constituted approximately 20 per cent of the total number sent, which was considered merely a fair return for the rather simple questionnaire used. This method was also employed in the fall of 1919 to institute a farm motor truck survey, in which study approximately 60,000 questionnaires were mailed to farm motor truck users, with a usable return of approximately 12 per cent. Considering the length of the questionnaire and the number sent out, this return is considered well worth the expense used in obtaining the information. Figure 8 illustrates the questionnaire used for the wheat crop. Following is the questionnaire used in the motor truck study:

OFFICE OF FARM MANAGEMENT,

UNITED STATES DEPARTMENT OF AGRICULTURE,

Washington, D. C., January, 1920.

Name .... P. O. address ....

What make is your motor truck? ...... What is its rated size? ...... (Tons.) Did you buy it new or second-hand? ...... How long have you owned it? ...... (Months.) What did it cost, including freight? $...... What did you pay for extra equipment not included in price of truck? $...... Do you own a trailer for use with it? ...... Please give the *important* road hauling with your truck both *from* and *to* your farm, showing total amount hauled, average weight of load, length of haul, and time required for one round trip, *this to include time for loading and unloading.* Show how same hauling was done *before* buying truck.

Road hauling done with my truck during past year.					How same hauling was done with wagon before purchase of truck.			
Material hauled.	Total amount per year.	Weight of load.	Miles one way.	Hours, one round trip.	Weight of load.	Miles one way.	Hours, one round trip.	Horses per wagon.
....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....

What part of the time do you have return loads, i. e., loads both ways with truck? ...... Please give below the *principal* road hauling you still do with horses.

ROAD HAULING DONE WITH HORSES DURING PAST YEAR.

Material hauled.	Total amount per year.	Weight of load.	Miles one way.	Reasons for using horses instead of truck for this hauling.

Give below *principal* hauling on your farm (not hauling *from* or *to* the farm) with truck.

PRINCIPAL HAULING ON MY FARM (IN THE FIELDS) DONE WITH TRUCK DURING PAST YEAR.

Material hauled.	Total amount per year.	Weight of load.	Average length of haul.	Reasons for using *truck instead* of horses for this hauling.

On what kind of roads do you usually run your truck? .... (Dirt, Tarvia, macadam, etc.) How long during the past year were the roads in such condition (because of mud, snow, etc.) that you could not use your truck? .... (Weeks.) What is its average speed on the road when loaded? .... (Miles per hour.) When empty? .... (Miles per hour.) On about how many days per year do you use it? ...... How many miles does it run per year? ...... How many miles per gallon of gasoline do you get? ...... How many miles per quart of cylinder oil? ...... What do you pay for gasoline? ...... (Per gallon.) What for cylinder oil? .... (Per gallon.) What kind of tires do you use on front wheels? .... (Solid or pneumatic.) What kind on rear wheels? .... (Solid or pneumatic, single or dual.) What do you pay for solid tires? ...... How many miles will they run? ...... What do you pay for pneumatic casings? ...... How many miles will they run?...... How many new tires have you bought since buying your truck? ...... What kind are best for your conditions? .... (Solid or pneumatic.) To date how much have you paid for repairs on truck, *not including new tires?* $...... What is the license fee per year for your truck? $...... What per cent of the time do you lose when using it because of motor and tire trouble, breakage, etc.? ...... How many days during the past year was it out of commission when needed? ...... How many more years will your truck give satisfactory service? ...... Please give principal custom work (hauling for hire) with your truck during the past year.

PRINCIPAL CUSTOM WORK DURING PAST YEAR.

Material hauled.	Total amount per year.	Weight of load.	Miles one way.	Price per trip; ton, mile, etc.

What was *total* amount received for *all* custom work done in past year? $..... Was the custom work you did profitable for you? ...... How many acres in your farm (owned and rented)? ...... How many acres are never to crops? ...... Please give main crops grown and kinds of live stock kept last year.

Crop.	Number of acres.	Kind of live stock.	Number of head.
....	....	....	....
....	....	....	....
....	....	....	....

How many head of work stock (horses, brood mares, and mules) do you now keep on your farm? ...... How many head of work stock have you disposed of since buying truck? ...... Has the truck reduced your expense for hired help, either man and horse? .... (Yes or no.) If so, how much per year? $...... Who usually drives the truck? .... (Self, son, hired man, etc.) What was your principal market before its purchase? .... (Name of town.) How far from your farm? .... (Miles.) Where is the material marketed by truck usually taken now? .... (Name of town.) How far from your farm? .... (Miles.) If you changed to a new market when using your truck, please give reasons for change. Has your truck been a profitable investment? .... (Yes or no.) What is best size for your farm?........ (Tons.) What part of your truck has given you the most trouble?........ What is the principal advantage of a truck for farm use?........ What is the principal disadvantage?........ Do you own a tractor?........ Do you own an automobile? ....

Please give below names and addresses of other farmers you know who purchased motor trucks for farm use (if more space is needed, use other side of page):

Name.	*Address.*
....	....
....	....

THE COMBINATION OF THE ACCOUNTING AND SURVEY METHODS OF STUDY.

There are many instances where the combination of the two methods of study has been used to advantage in supplementing the data from either a cost survey or a farm business analysis investigation.

It has been found distinctly worth while when an enterprise cost study is being made to have recourse to records obtained from the detailed accounting method in order to adjust more accurately the charges for overhead expense, machinery, risk, hours of labor, and other elements of cost.

In the cooperative cost of beef-production studies in the corn-belt States routes have been established containing approximately 25 farms each, employing the detail accounting method in arriving at the cost of producing beef on these farms. At the end of the year the survey method is used in studying the business and the cost of production of cattle on approximately 75 other farms in the same community. The data from the detailed accounting method have assisted in more accurately and satisfactorily interpreting some of the results from the surveys.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 995

Contribution from the Bureau of Plant Industry
WM. A. TAYLOR, Chief

Washington, D. C. ▼ October 14, 1921

THE BEET-SUGAR INDUSTRY IN THE UNITED STATES IN 1920.

By C. O. Townsend,
Pathologist in Charge, Office of Sugar-Plant Investigations.

CONTENTS.

BEET-SUGAR MILLS IN THE UNITED STATES.

In the United States in 1919, 98 beet-sugar mills were standing and equipped for extracting and refining sugar from beet roots. The oldest one of the mills now standing was built in 1870 at Alvarado, Calif. During the summer of 1919, 4 of the 98 mills had been erected and equipped for the campaign of 1919–20, 6 additional ones were built and equipped for the handling of the 1920–21 crop, and two others are in process of construction, making a total of 106 beet-sugar mills now standing. (Table I.)

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TABLE I.—*American beet-sugar mills in 1920.*

No.	Location.		Date of erection.	Name of company.	Capacity.[a]		Date enlarged.
	State.	Town.			Original.	Present.	
					Tons.	*Tons.*	
1	California	Alvarado	1870	Alameda Sugar Co	500	800	[b]1894
2	Nebraska	Grand Island	1890	American Beet Sugar Co	350	500	1916
3	Utah	Lehi	1891	Utah-Idaho Sugar Co	300	1,200	1900
4	California	Chino	1891	American Beet-Sugar Co	400	1,100	1895
5	do	Los Alamitos	1897	Los Alamitos Sugar Co	350	900	1898
6	Wisconsin	Menomonee Falls	1897	Wisconsin Sugar Co	500	600	1901
7	Utah	Ogden	1898	Amalgamated Sugar Co	350	1,000	1912
8	California	Oxnard	1898	American Beet Sugar Co	2,000	3,000	
9	do	Betteravia	1899	Union Sugar Co	500	1,200	1908
10	do	Spreckels	1899	Spreckels Sugar Co	3,000	4,500	
11	Colorado	Grand Junction	1899	Holly Sugar Corporation	350	700	1906
12	Michigan	Holland	1899	Holland-St. Louis Sugar Co	350	500	
13	do	Bay City	1899	Michigan Sugar Co	600	1,400	1912
14	do	Alma	1899	do	600	1,400	1912
15	do	West Bay City	1899	West Bay City Sugar Co	500	900	
16	do	Caro	1899	Michigan Sugar Co	600	1,200	1902
17	Colorado	Rocky Ford	1900	American Beet Sugar Co	1,000	1,800	1912
18	do	Sugar City	1900	National Sugar Mfg. Co	500	500	
19	Ohio	Fremont	1900	Continental Sugar Co	350	600	
20	Michigan	Marine City	1900	Independent Sugar Co	350	600	
21	do	Bay City	1901	Columbia Sugar Co	400	1,500	1907
22	do	Lansing	1901	Owosso Sugar Co	600	800	
23	Colorado	Loveland	1901	Great Western Sugar Co	1,000	1,950	1912
24	Utah	Logan	1901	Amalgamated Sugar Co	400	700	1912
25	Colorado	Greeley	1902	Great Western Sugar Co	700	1,050	1911
26	do	Eaton	1902	do	600	1,200	1911
27	Michigan	Carrollton	1902	Michigan Sugar Co	800	900	
28	do	Mount Clemens	1902	Mount Clemens Sugar Co	600	600	
29	do	Croswell	1902	Michigan Sugar Co	600	750	
30	do	Sebewaing	1902	do	600	850	
31	Utah	Garland	1903	Utah-Idaho Sugar Co	700	900	1912
32	Idaho	Idaho Falls	1903	do	600	900	1905
33	Michigan	St. Louis	1903	Holland-St. Louis Sugar Co	500	600	
34	do	Menominee	1903	Menominee River Sugar Co	1,000	1,200	1907
35	do	Owosso	1903	Owosso Sugar Co	1,000	1,300	1907
36	Colorado	Fort Collins	1903	Great Western Sugar Co	1,200	2,150	1911
37	do	Windsor	1903	do	600	1,150	1911
38	do	Longmont	1903	do	600	2,350	1911
39	Wisconsin	Chippewa Falls	1904	Chippewa Sugar Refining Co	600	600	
40	do	Janesville	1904	Rock County Sugar Co	600	700	
41	Idaho	Blackfoot	1904	Utah-Idaho Sugar Co	600	800	1911
42	do	Sugar City	1904	do	700	900	
43	Utah	Lewiston	1905	Amalgamated Sugar Co	600	800	1911
44	Michigan	Blissfield	1905	Continental Sugar Co	600	1,000	
45	Illinois	Riverdale	1905	Charles Pope, Chicago	350	500	
46	Colorado	Lamar	1905	American Beet Sugar Co	400	500	1907
47	do.	Sterling	1905	Great Western Sugar Co	600	1,050	1912
48	Wisconsin	Madison	1905	United States Sugar Co	600	600	
49	Colorado	Brush	1906	Great Western Sugar Co	750	1,100	1912
50	do	Fort Morgan	1906	do	600	1,200	1912
51	do	Swink	1906	Holly Sugar Corporation	1,200	1,200	
52	Montana	Billings	1906	Great Western Sugar Co	1,200	2,000	1912
53	Kansas	Garden City	1906	Garden City Sugar & Land Co	1,000	1,000	
54	California	Hamilton City	1906	Sacramento Valley Sugar Co	600	700	
55	Minnesota	Chaska	1906	Minnesota Sugar Co	600	800	
56	Colorado	Las Animas	1907	American Beet Sugar Co	700	1,000	
57	Iowa	Waverly	1907	Iowa Sugar Co	400	500	1907
58	California	New Delhi (Santa Ana).	1908	Southern California Sugar Co	600	600	(c)
59	Nebraska	Scottsbluff	1910	Great Western Sugar Co	1,200	2,000	1912
60	Ohio	Paulding	1910	Columbia Sugar Co	700	900	
61	Nevada	Fallon	1911	Lahontan Valley Sugar Co	500	500	
62	Ohio	Findlay	1911	Continental Sugar Co	600	900	
63	Utah	Elsinore	1911	Utah-Idaho Sugar Co	500	750	
64	California	Anaheim	1911	Anaheim Sugar Co	500	1,200	1911
65	do	Huntington Beach	1911	Holly Sugar Corporation	750	1,200	1912
66	do	Dyer (Santa Ana).	1912	Santa Ana Sugar Co	600	1,200	1914
67	Idaho	Burley	1912	Amalgamated Sugar Co	400	700	1912
68	Ohio	Toledo	1912	Toledo Sugar Co	1,000	1,500	
69	do	Ottawa	1912	Ohio Sugar Co	600	700	1917
70	Indiana	Decatur	1912	Holland-St. Louis Sugar Co	700	800	
71	Utah	Payson	1913	Utah-Idaho Sugar Co	500	750	
72	do	Layton	1915	Layton Sugar Co	500	600	
73	Wyoming	Sheridan	1915	Sheridan Sugar Co	600	900	
74	do	Lovell	1916	Great Western Sugar Co	600	600	

[a] Number of tons of beets that may be sliced each 24 hours.
[b] Rebuilt in 1879, 1887, and 1889.
[c] Acquired by the Holly Sugar Corporation.

TABLE I.—*American beet-sugar mills in 1920*—Continued.

No.	Location.		Date of erection.	Name of company.	Capacity.		Date enlarged.
	State.	Town.			Original.	Present.	
					Tons.	*Tons.*	
75	Idaho	Twin Falls	1916	Amalgamated Sugar Co	600	800	......
76	Nebraska	Gering	1916	Great Western Sugar Co	1,000	1,100	......
77	Utah	Spanish Fork	1916	Utah-Idaho Sugar Co	750	1,000	1916
78	.....do	West Jordan	1916	.....do	500	750	......
79	.....do	Brigham	1916	.....do	500	750	......
80	Idaho	Paul	1917	Amalgamated Sugar Co	500	600	......
81	Utah	Smithfield	1917	.....do	500	700	......
82	.....do	Delta	1917	Utah-Idaho Sugar Co	1,000	1,000	......
83	Colorado	Brighton	1917	Great Western Sugar Co	1,000	1,000	......
84	Nebraska	Bayard	1917	.....do	1,000	1,000	......
85	Iowa	Mason City	1917	Northern Sugar Corporation	1,200	1,200	......
86	California	Manteca	1917	Spreckels Sugar Co	1,000	1,200	......
87	Utah	Moroni	1917	People's Sugar Corporation	400	400	......
88	.....do	Cornish	1917	Amalgamated Sugar Co	600	600	......
89	Idaho	Shelley	1917	Utah-Idaho Sugar Co	600	750	......
90	California	Tracy	1917	Alameda Sugar Co	500	500	......
91	Wyoming	Worland	1917	Wyoming Sugar Co	600	600	......
92	Washington	Yakima	1917	Utah-Idaho Sugar Co	600	750	......
93	Utah	Springville	1918	Springville-Mapleton Sugar Co	350	350	......
94	.....do	Centerfield	1918	Gunnison Valley Sugar Co	450	450	......
95	.....do	Hooper	1919	Pioneer Sugar Co	400	400	......
96	Washington	Sunnyside	1919	Utah-Idaho Sugar Co	750	750	......
97	Idaho	Rigby	1919	Beet Growers' Sugar Co	800	800	......
98	Washington	Toppenish	1919	Utah-Idaho Sugar Co	750	750	......
99	Nebraska	Mitchell	1920	Great Western Sugar Co	1,000	1,000	......
100	Idaho	Whitney	1920	Pioneer Sugar Co	600	600	......
101	Michigan	Mount Pleasant	1920	Columbia Sugar Co	1,000	1,000	......
102	Iowa	Belmond	1920	Iowa Valley Sugar Co	600	600	......
103	Wisconsin	Green Bay	1920	Green Bay Sugar Co	600	600	......
104	Utah	Honeyville	1920	Utah-Idaho Sugar Co	600	600	......
105	Colorado	Delta	1920	Holly Sugar Corporation	600	600	......
106	.....do	Fort Lupton	1920	Industrial Sugar Co	600	600	......

During the past 50 years 5 other mills have been built, but 3 of them have burned, 1 has been dismantled, and 1 has been utilized for some purpose other than that of making beet sugar. Of the 106 beet-sugar mills now standing (fig. 1), 26 were erected at some

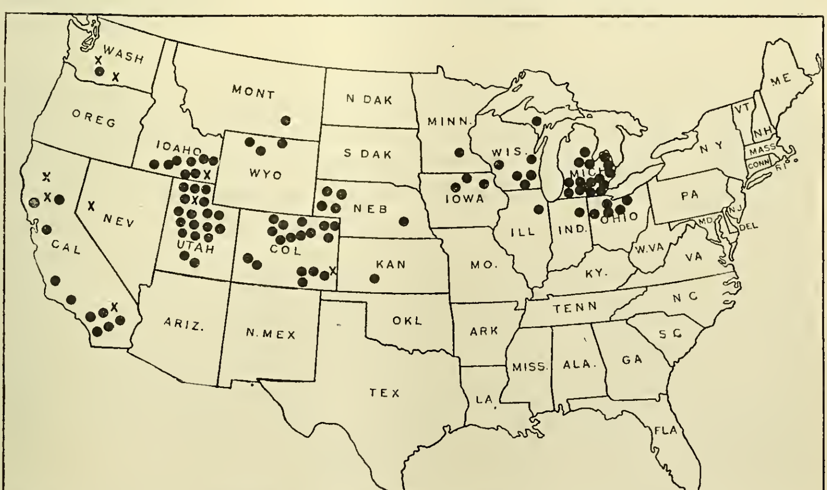

FIG. 1.—Outline map showing by black dots the locations of beet-sugar mills that were in operation during the 1920–21 campaign. Mills that were standing idle during the 1920–21 campaign are indicated by an × mark.

point other than the place where they are now located, but owing to certain limiting factors in beet-sugar production these 26 mills were removed to other locations (fig. 2 and Table II); 2 of these were built in Canada and removed to the United States and 1 was built in this country and removed to Canada.

TABLE II.—*Original and present locations of the removed beet-sugar mills.*

No.	Date of erection.	Where built.		Date removed.	Present location.		Capacity (tons).	Original owners.
		State.	Town.		State.	Town.		
1	1891	Nebr.	Norfolk	1905	Colo.	Lamar	350-500	Norfolk Beet Sugar Co.
2	1897	N. Y.	Rome	1906	Calif.	Visalia	200	First New York Beet Sugar Co.
3	1898	do	Binghamton	1904	Idaho	Blackfoot	350-900	Binghamton Beet Sugar Co.
4	1898	Oreg.	La Grande	1912	do	Burley	350-600	Oregon Sugar Co.
5	1898	Calif.	Crockett	1908	Calif.	Corcoran	500-1,000	California Beet Sugar & Refining Co.
6	1898	Mich.	Bay City	1907	Iowa	Waverly	350-500	Michigan Sugar Co.
7	1899	do	Benton Harbor	1902	Ontario	Berlin	350	Wolverine Sugar Co.
8	1899	do	Rochester	1905	Wis.	Madison	500-600	Detroit Sugar Co.
9	1899	do	Kalamazoo	1904	do	Chippewa Falls	500-600	Kalamazoo Sugar Co.
10	1899	Nebr.	Leavitt	1910	Nebr.	Scotts Bluff	500-2,000	Standard Beet Sugar Co.
11	1899	Wash.	Waverly	1918	Utah	Centerfield	350-500	Washington State Sugar Co.
12	1900	N. Y.	Lyons	1911	Calif.	Anaheim	600-1,200	Empire State Sugar Co.
13	1901	Mich.	Saginaw	1905	Colo.	Sterling	600-1,050	Saginaw Sugar Co.
14	1902	Ont.	Dresden	1904	Wis.	Janesville	600-700	Dresden Sugar Co.
15	1902	do	Wiarton	1908	Calif.	Santa Ana	350-600	Colonial Sugar Co.
16	1903	Mich.	East Tawas	1906	Minn.	Chaska	600-800	Tawas Sugar Co.
17	1905	Colo.	Holly	1915	Wyo.	Sheridan	600-900	Holly Sugar Co.
18	1905	Ariz.	Glendale	1920	Colo.	Delta	600	Western Sugar & Land Co.
19	1906	Idaho.	Nampa	1916	Utah	Spanish Fork	750-1,000	Western Idaho Sugar Co.
20	1906	Mich.	Charlevoix	1912	Ohio	Ottawa	600-700	West Michigan Sugar Co.
21	1906	Calif.	Visalia	1919	Utah	Hooper	400	San Joaquin Valley Sugar Co.
22	1908	do	Corcoran	1920	Idaho	Whitney	600	Pingree Sugar Co.
23	1911	Colo.	Monte Vista	1916	Wyo.	Lovell	600	San Luis Valley Beet Sugar Co.
24	1916	Oreg.	Grant's Pass	1919	Wash.	Toppenish	500	Utah-Idaho Sugar Co.
25	1917	Mont.	Missoula	1920	Nebr.	Mitchell	1,000	Great Western Sugar Co.
26	1918	do	Whitehall	1920	Utah	Honeyville	600	Amalgamated Sugar Co.

Of the three mills that were burned, little is known about the actual working of the one at Staunton, Va., or the one at Eddy, N. Mex. The former operated for two years and the latter for three years, but evidently they were not sufficiently successful to warrant rebuilding. They were of small capacity and constructed from second-hand material. The mill formerly at St. Louis Park, Minn., which was burned in 1905, operated with fair success during each of the seven years of its existence. The mill at Watsonville, Calif., which was erected in 1888, was closed in 1899 and has since been dismantled. The mill at Pekin, Ill., erected in 1899, was closed in 1900 and has since been transformed into a glucose plant. Further data regarding these five mills are given in Table III.

TABLE III.—*Beet-sugar mills destroyed or used for other purposes than making sugar.*

No.	Location.		Date erected.	Name of company.	Capacity (tons).	Present status.
	State.	Town.				
1	California	Watsonville	1888	Western Beet Sugar Co	1,000	Dismantled.
2	Virginia	Staunton	1892	O. K. Lapham	(a)	Burned, 1894.
3	New Mexico	Eddy	1896	Pecos Valley Beet Sugar Co	200	Burned, 1903.
4	Minnesota	St. Louis Park	1898	Minnesota Sugar Co	350	Burned, 1905.
5	Illinois	Pekin	1899	Illinois Sugar-Refining Co	700	Glucose plant, 1902.

[a] Not known.

The 106 mills now standing are for the most part favorably situated for extracting and refining beet sugar under present conditions. In many instances certain limiting factors will need careful

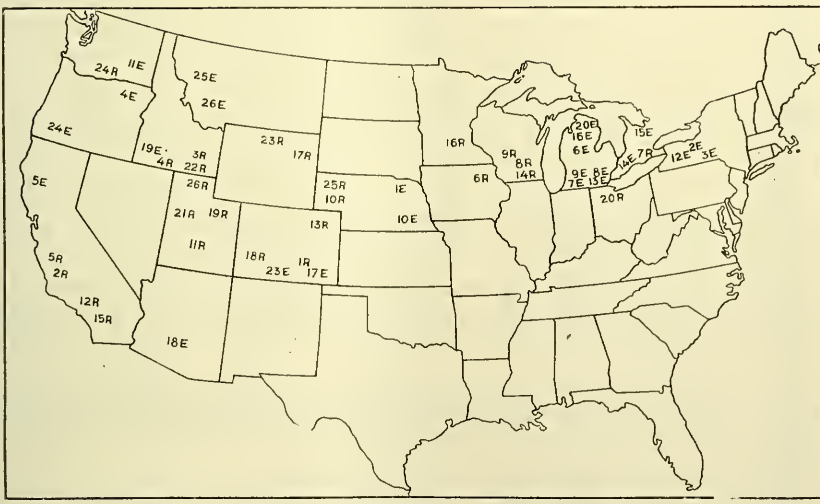

FIG. 2.—Outline map showing the original location of 26 beet-sugar mills (E) and the points to which they were removed (R). For example, 1E shows the original location of mill No. 1 and 1R the point to which that mill was removed; 2E the original location of mill No. 2 and 2R the point to which it was removed; and so on for each mill listed in Table II. Factories 21E and 22E are in the same locations as those designated by 2R and 5R.

consideration and readjustment before a sufficient quantity of raw material can be assured annually to make all of them permanently successful. In many areas beet-sugar mills have been crowded in too rapidly, so that it has not been possible to readjust the farming operations and install the required drainage, irrigation, and other improvements with sufficient rapidity to provide the necessary well-prepared acreage to supply enough sugar beets to insure a normal mill run. Consequently neither the mill owners nor the growers have received under these conditions a maximum return for the money and labor invested

TABLE IV.—*Beet-sugar production, 1916 to 1920.*

Location and year.	Number of sugar mills.	Days operating.	Beets harvested.	Beets produced.		Average.			Sugar made.	Price paid for beets.	
				Average per acre.	Total.	Extraction.	Sugar in the beets.	Coefficient of purity.		Average per ton.	Total.
			Acres.	*Tons.*	*Tons.*	*P. ct.*	*P. ct.*		*Tons.*		
California:											
1916....	11	108	141,097	10.47	1,477,426	16.15	18.35	84.13	236,322	$6.30	$9,311,000
1917....	14	92	161,909	8.22	1,331,548	15.84	18.48	82.91	209,325	7.60	10,125,000
1918....	13	81	100,684	8.52	858,028	14.52	17.03	81.50	122,795	9.95	8,534,000
1919....	10	76	107,174	7.61	815,896	16.30	17.87	82.02	131,172	14.17	11,561,000
1920....	10	90	122,813	8.74	1,073,828	15.97	17.66	81.44	167,997	13.13	14,096,000
Colorado:											
1916....	14	102	188,568	10.70	2,018,298	13.04	15.00	85.79	252,147	6.06	12,236,000
1917....	15	91	161,476	11.50	1,857,649	13.39	15.40	85.16	234,303	7.28	13,525,000
1918....	14	76	125,882	11.47	1,443,846	14.07	16.10	85.96	191,880	10.02	14,474,000
1919....	15	87	182,616	9.66	1,764,772	11.71	13.62	83.85	193,890	10.85	19,143,000
1920....	17	98	219,847	10.58	2,325,003	13.60	15.81	85.15	294,482	11.88	27,627,000
Idaho:											
1916....	5	86	42,135	8.48	357,137	13.84	16.95	86.39	45,874	6.16	2,199,000
1917....	7	70	37,745	8.27	312,067	13.40	16.74	84.84	38,376	7.06	2,203,000
1918....	7	87	32,306	10.66	344,334	13.66	16.57	86.46	44,682	10.00	3,443,000
1919....	6	50	30,331	6.70	203,168	13.29	15.48	86.15	26,159	11.00	2,235,000
1920....	8	72	45,810	8.82	404,078	13.94	16.26	86.41	57,603	12.10	4,889,000
Michigan:											
1916....	15	49	99,619	5.46	543,766	13.79	16.37	85.22	69,341	6.14	3,337,000
1917....	14	53	82,151	6.38	524,195	13.91	16.28	86.57	64,247	8.04	4,215,000
1918....	16	75	114,976	8.40	966,676	14.37	16.61	85.49	127,979	10.08	9,741,000
1919....	16	84	123,375	9.82	1,211,018	12.63	14.57	81.78	130,385	12.52	15,158,000
1920....	17	87	149,559	8.78	1,312,883	13.34	15.79	84.04	165,899	10.08	13,236,000
Nebraska:											
1916....	3	160	41,083	10.34	424,913	12.86	15.51	81.12	51,945	6.17	2,622,000
1917....	4	97	51,337	9.22	473,494	12.16	14.91	80.71	53,893	7.22	3,417,000
1918....	4	99	42,746	11.35	485,070	14.01	16.05	86.14	63,494	9.96	4,833,000
1919....	4	112	59,113	10.16	600,730	10.99	13.14	82.80	60,870	10.90	6,546,000
1920....	5	110	72,296	9.93	717,956	13.37	15.74	83.94	89,518	11.96	8,587,000
Ohio:											
1916....	4	45	24,767	5.96	147,718	13.24	15.89	83.36	18,234	6.83	1,608,000
1917....	5	70	24,234	9.08	219,931	12.68	16.24	86.25	24,467	7.18	1,580,000
1918....	5	91	32,547	9.69	315,371	12.19	15.74	84.23	35,476	10.03	3,162,000
1919....	5	79	30,909	10.58	326,962	10.93	14.15	82.73	31,864	12.75	4,168,000
1920....	5	100	49,199	8.86	435,928	12.31	15.44	82.45	47,073	9.89	4,313,000
Utah:											
1916....	11	95	68,211	11.70	798,119	12.75	16.05	84.79	90,277	5.73	4,577,000
1917....	15	82	80,289	7.49	762,028	12.01	15.61	82.27	83,662	7.04	5,368,000
1918....	16	98	81,717	12.27	1,003,013	11.69	15.29	84.21	105,794	10.01	10,041,000
1919....	18	84	103,247	9.84	1,015,873	11.12	13.87	82.39	101,025	10.97	11,148,000
1920....	18	102	112,567	12.35	1,389,843	12.89	15.62	84.27	162,588	12.03	16,713,000
Wisconsin:											
1916....	3	48	7,000	8.79	61,500	11.58	14.90	....	6,800	6.06	373,000
1917....	4	53	9,800	8.10	79,372	11.34	15.03	....	8,032	8.81	699,000
1918....	4	61	12,400	8.05	99,777	14.29	16.29	82.40	13,358	10.00	998,000
1919....	4	60	12,100	9.71	117,443	10.07	13.16	81.73	10,636	12.02	1,411,000
1920....	5	80	20,686	9.19	190,203	12.40	15.86	82.53	20,943	10.20	1,940,000
Other States:											
1916....	8	57	52,828	7.56	399,379	13.07	15.69	82.67	49,717	6.20	2,476,000
1917....	13	51	55,856	7.52	420,093	12.46	15.17	81.87	48,902	7.28	3,059,000
1918....	10	64	50,752	8.53	432,683	13.59	15.95	84.31	55,492	9.86	4,268,000
1919....	11	52	43,590	8.39	365,616	11.95	14.27	83.14	40,450	11.08	4,050,000
1920....	12	70	79,599	8.75	696,471	13.06	15.46	83.12	83,918	11.52	8,025,000
All States:											
1916....	74	80	665,308	9.36	6,228,256	13.86	16.30	84.74	820,657	6.12	38,139,000
1917....	91	74	664,797	9.00	5,980,377	13.60	16.28	83.89	765,207	7.39	44,192,000
1918....	89	81	594,010	10.01	5,948,798	13.64	16.18	84.70	760,950	10.00	59,494,000
1919....	89	78	692,455	9.27	6,421,478	12.34	14.48	82.84	726,451	11.74	75,420,000
1920....	97	91	872,376	9.80	8,546,193	13.63	15.99	83.97	1,090,021	11.63	99,426,000

For several years the Office of Sugar-Plant Investigations, jointly with the Office of Farm Management and Farm Economics and independently, has been studying the agronomic conditions found in each of the existing and in some of the prospective sugar-beet centers. This bulletin discusses the conditions which have been brought out in these studies and points out in a general way the factors that are favorable and those that are unfavorable for the production of sugar beets. The primary object of this bulletin is to give a general survey of the beet-sugar industry, to encourage the more general application of those principles and practices which make for better returns to the grower, and to discourage those practices which tend to reduce the yields and quality of sugar beets and of other crops and also to unbalance the relation between crop production and the kind, number, and quality of the live stock on the beet farms. The general effect aimed at is the production of more sugar and a more nearly perfect stabilization of the beet-sugar industry in the United States.

The production of sugar from beets in the United States for the five-year period from 1916 to 1920, inclusive, is shown in Table IV.

SOIL.

Almost any fertile soil capable of producing good yields of other crops will, if properly handled, produce good sugar beets. More depends upon the physical condition of the soil and the way in which it is handled than upon the so-called kind or type of soil. Extremely sandy soil or soil of a decidedly gravelly type is not usually satisfactory for sugar-beet growing.

Raw soil.—Generally speaking, raw soil or new soil does not produce as large yields of sugar beets as may be obtained from soil that has been under cultivation for some time. In recent years much new soil has been brought under cultivation through the use of sugar beets; this in a measure has had a tendency to reduce the average yield of sugar beets in this country. The argument in favor of growing sugar beets on new soil is that this crop will bring the raw soil under control and place it in good tilth for other crops more quickly than almost any other crop now produced on a large scale on American farms. It must be expected, therefore, that so long as new sugar-beet territories are being opened in the partially developed sections of the United States this factor, tending to keep down the average yield of beet roots, will be effective. Also in many of the older sugar-beet sections in which the growing of sugar beets is being extended from year to year, whereby new lands are being brought under cultivation, this factor will be more or less effective in holding down the average yield. In those sections where sugar beets have been grown for many years (as, for example, in Utah) and in which a minimum acreage of new soil is being used for sugar-beet culture from year to year, the average yield of beets per acre is strikingly above the average for the entire country. Usually the grower who utilizes new soil for sugar-beet production expects a comparatively low yield and is generally satisfied, for the reason stated above, if the crop pays the cost of production. Though this is one of the causes of the low average yield of beets per acre in this country, it is by no means the only one.

Worn soil.—In those sections where sugar beets have been grown for a number of years without proper attention to the maintenance of soil fertility and an adequate supply of humus, the yield has been reduced. There are few sugar-beet areas in which the soil fertility has been maintained or improved to the limit of possibilities. It is apparent, therefore, that by proper attention to soil conditions from the standpoint of fertility the average yield of beets per acre may be greatly increased. The worn condition of the soil is not peculiar to the growing of sugar beets, but occurs in the growing of other farm crops, when attention is not given to increasing the supply of available plant food in the soil or to maintaining its humus content.

Quality of the soil.—Soils vary widely in their original qualities, both physical and chemical. All agricultural soils are supplied in varying proportions with the necessary plant foods for crop production. Soils that have plant food present in great abundance may be said to be rich. They are not fertile, however, unless these plant foods are in soluble form or unless they are rendered soluble as rapidly as the various materials are required by the plant in the process of growth. The quality of the soil from the standpoint of fertility may be greatly improved by proper cultivation, crop rotation, and the addition of humus, as well as by the application of lime or other material that will improve its physical condition. At times special treatments, such as subsoiling and drainage, are needed to make the soil highly productive.

SUBSOIL.

In the growing of sugar beets the subsoil is often of equal importance with the surface soil.

Hardpan.—Frequently the surface soil is underlain by a hardpan which it is impossible for the beet roots to penetrate. The hardpan may be of natural formation or it may be induced by improper tillage. If it is close to the surface and of such material that it can not be broken up successfully, the profitable growing of sugar beets is impossible. Beets produced under such conditions will be short, with a resulting low tonnage, or they will be pushed out of the ground and consequently will be low in sugar and purity. The nature of the hardpan is of considerable importance in this connection. If it is of rock and near the surface, little can be done to improve its condition for sugar-beet culture, but if it is simply a close and compact form of soil it may be broken up with a subsoil plow. Sometimes local areas of extremely hard subsoil are found in the sugar-beet sections, and this condition constitutes a limiting factor in the production of this crop in those areas as a whole or on certain farms or fields, depending upon the location and distribution of the hardpan. If the hardpan is level it may hold too much moisture in the surface soil, thereby rendering the conditions unfavorable for sugar-beet production without artificial drainage. If the hardpan is several feet below the surface and has slope sufficient to carry off the excess water, no unfavorable condition will result from it.

Porous soil.—The reverse of the preceding condition is sometimes found in sugar-beet sections in which the subsoil is of such a nature and of such a depth that it is very difficult to keep the soil supplied with moisture during the growing season. Rain or irrigation water passes rapidly through porous subsoils, and is soon out of reach of the growing plant. If the porous subsoil is very deep and extremely porous the ground is unsuited for sugar-beet culture. Frequently this condition can be relieved somewhat by proper cultivation and by supplying the surface soil with sufficient humus to enable it to retain enough moisture to produce a fair crop. A heavy crop of beets can not be expected on a thin surface soil underlain by an extremely porous subsoil.

TOPOGRAPHY.

The unfavorable topography of an area is frequently the limiting factor in the production of sugar beets. Mountainous areas can not be utilized for the development of the beet-sugar industry unless the valleys are sufficiently large to support a mill or are favorably located with reference to an existing mill and are composed of sufficient fertile, tillable soil so that beets of proper quality and in sufficient quantity can be produced at a reasonable cost. Many small valleys, especially in the western United States, might be utilized in the growing of sugar beets were it not for the fact that they are too small to support a sugar mill and too far from existing mills to permit the beet roots to be transported at a sufficiently low cost. This problem may be solved by utilizing some practical means of drying the beet roots. It is possible to slice and dry the roots, thereby reducing the weight of the beets by about 75 per cent without changing the quality or lessening the quantity of sugar present. If this can be done with sufficient rapidity and at a sufficiently low cost it will be possible to handle to advantage the product of many small valleys and other limited areas. A sugar mill should be able to handle not less than 500 tons of beet roots per day of 24 hours, and it can not be financially successful under normal conditions unless it is supplied with a sufficient quantity of raw material to produce a run of approximately 100 days each year. It is desirable that a considerable part of the supply be within wagon haul of the mill. Any factor which reduces the working capacity or the operating time of a sugar mill increases the cost of production of the sugar. The small valleys mentioned above are sometimes used to supplement the beet crop produced in other sections provided the hauling distance by wagon or rail is not too great.

Hills.—Generally a hilly country is not satisfactory for sugar-beet culture, especially if the hills are inclined to wash. The nature of the soil of the hills is an important factor in determining whether sugar beets can be grown. Hauling heavy loads in a hilly country is also a matter of serious consideration. Usually from 3 to 5 tons of beets are hauled at each load and if hills must be climbed the loads must necessarily be reduced and the cost of hauling consequently increased. This in itself may be a limiting factor in the production of sugar beets in some otherwise favorable sugar-beet areas.

Level land.—In irrigated countries it is desirable that the surface of the soil be sufficiently level to permit uniform irrigation. A perfectly level area, however, is objectionable because of the difficulty in spreading the water over the entire field with sufficient rapidity. This is especially objectionable in the case of sugar beets, which should be watered between the rows only, as shown in Plate I, figure 2. Again, when the land, especially in irrigated sections, is very level and poorly drained alkali frequently appears on the surface after repeated irrigations. Sugar beets will tolerate a small amount of alkali, but all crops are injured by excessive quantities of alkali in the soil, especially when the plants are young and tender.

Rolling land.—Other things being equal, moderately rolling land is more desirable for sugar-beet culture than either extremely hilly or very level areas. This is especially true in those sections where sugar beets are produced under rainfall conditions. In irrigated sections rolling land is not so desirable unless the topography of the country is such that the area under cultivation can not be irrigated readily. Under irrigation conditions it is desirable that the land have an even surface with a gentle slope of at least 7 feet to the mile. If the slope is too marked the irrigation water passes over it too rapidly unless special care is taken in applying the water.

CLIMATE.

One of the most important factors in determining the suitability of a given area for sugar-beet culture is the climate. Frequently all other conditions are favorable, but some climatic factor renders sugar-beet growing unprofitable.

Temperature.—Successful sugar-beet growing has been confined to the temperate region in practically all beet-sugar producing countries. Frequently sugar beets will produce a satisfactory tonnage of roots in warmer areas, but for some reason they generally are not sufficiently rich in sugar to make them profitable in sugar making.

FIG. 1.—PLANTING SUGAR-BEET SEED WITH 4-ROW DRILLS, WHEREBY THE SEED SHOULD BE PLACED AT A UNIFORM DEPTH, IN STRAIGHT ROWS, AND IN A FIRM SEED BED.

FIG. 2.—A FIELD OF SUGAR BEETS, SHOWING FURROW IRRIGATION; EACH ALTERNATE ROW FURROWED.

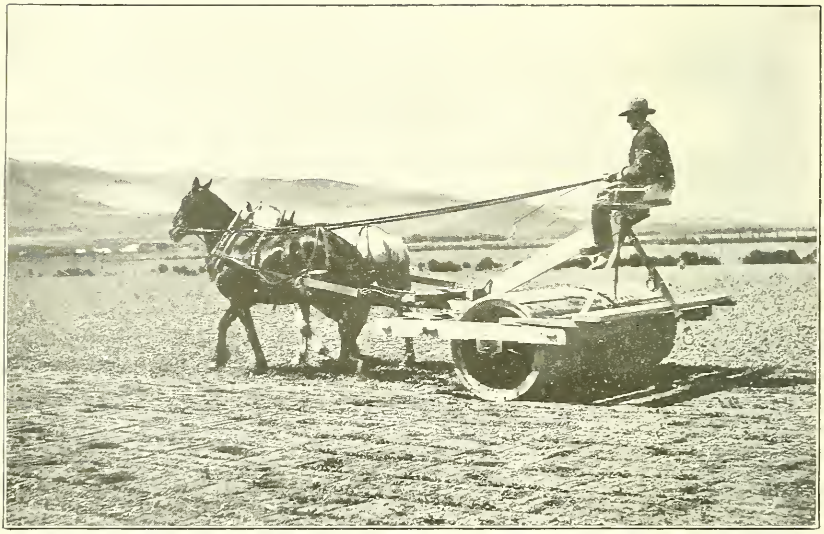

FIG. 1.—THE SMOOTH ROLLER, A USEFUL IMPLEMENT IN PACKING THE SEED BED BEFORE AND AFTER PLANTING.

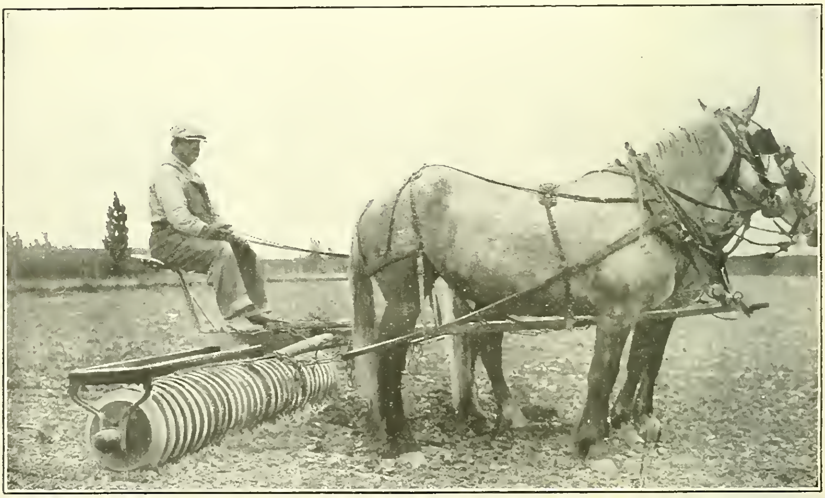

FIG. 2.—THE CORRUGATED ROLLER, AN IMPLEMENT WHICH BREAKS THE CRUST AND RIDGES THE GROUND AGAINST WIND EFFECT.

This is notably the case in nearly all parts of the southern United States. Occasionally areas are found in these warmer zones where sugar beets may be grown successfully. This is true in southern California and in some parts of Arizona and New Mexico, where the adverse condition of temperature is overcome by growing the beets during the so-called winter months, or at least by getting the plants started in the winter or early spring. In some sections the elevation and the temperature of the prevailing wind are sufficient to modify the climate so that sugar beets may be produced with profit. If the winter months are too cold for the production of beets and the summers too warm for the proper storage of sugar in the roots, a limiting factor is established which renders profitable sugar-beet growing impossible with any known varieties. Should it become desirable to extend the culture of sugar beets into the warmer sections of the country, it is possible that suitable varieties could be developed that would be profitable from the standpoint of both tonnage and quality.

Another important consideration is the fact that high temperatures tend to increase spoilage. This may be overcome by passing the beets through the mill as rapidly as they are harvested and by harvesting the roots as soon as they are matured. Regarding the lower temperatures, sugar beets have been successfully grown in practically all of our Northern States, and several beet-sugar mills are operated successfully in Canada. It is apparent, therefore, that the lower temperatures do not constitute a limiting factor in sugar-beet growing in any of our agricultural sections. It would seem that a short growing season would render sugar-beet production unprofitable in many northern areas, but the sugar beet readily adapts itself to many adverse conditions, and usually in those sections where the growing season is short the sugar beet grows rapidly and stores sugar in great abundance. In fact, some of our most satisfactory sugar-beet sections are to be found in the more northern States.

During the period just preceding the beet harvest the difference in temperature between day and night is one of the important conditions in the development and storage of sugar in the beet root. The young beet plant begins very early to store sugar, but its maximum activity along this line is reached in the fall, when in most of the beet-growing areas the difference in temperature between night and day is most apparent. This difference is apparently one of the conditions necessary for the proper elaboration and storage of sugar and is a limiting factor in the production of sugar-beet roots sufficiently rich in sugar to make them profitable for sugar-making purposes. It is probable that the absence of cool nights at the end of the growing season permits the continued growth and development of the beets, thereby using up the sugar in plant growth instead of storing it.

Moisture.—Moisture is necessary for the production of profitable crops of sugar beets. This reaches the soil in the form of rain or snow, or it may be applied artificially. Our present sugar-beet area extends over a portion of the humid and the irrigated sections of the country, as shown in figure 1.

In the humid sections the moisture falls largely during the winter months, although rains usually are frequent during the spring and summer. Occasionally some parts of the humid portion of our sugar-beet area are visited by heavy rains in the early spring, which greatly delay the planting of the beets as well as of other crops. This is sometimes followed about midsummer by a severe drought, which greatly retards crop growth. If these conditions were of frequent occurrence over wide areas, they would constitute a limiting factor in sugar-beet growing in the humid sections: but they have occurred in this country only in limited areas and at long intervals. Occasionally rainfall is large at harvesting time, and sometimes injures the sugar-beet crop by producing a second growth of the plants, which greatly reduces the sugar content. The extent of this injury depends upon the condition of the beets and the duration of the rainy period. If this is followed by a period of favorable weather, the sugar content will be restored wholly or in part, depending upon the duration and nature of the weather. It sometimes happens that the beets must be harvested before the lost sugar is fully restored, either to prevent the roots from freezing in the ground or to avoid a temporary shutdown of the mill. Consequently a second growth due to late rains may cause serious losses to the grower and to the sugar company. A season in the humid region in which the rainfall is just sufficient to maintain a steady growth until near harvesting time, followed by continuous fair weather accompanied by cool nights and warm days, makes conditions most favorable for the production of sugar beets so far as the humid area is concerned. These conditions prevail generally in the humid sections where sugar beets are grown.

In the irrigated sugar-beet areas usually less than 20 inches of moisture falls during the entire year, and frequently many of the showers are so light that they are of no practical benefit in crop production. Sugar-beet growers in those sections depend largely upon irrigation. Frequently the showers that fall in irrigated areas are detrimental rather than helpful in the production of sugar beets, since they frequently cause the soil to crust. If this crusting occurs shortly after the seed is sown the young plants have great difficulty in breaking through to the light, with the result that the stands are very seriously injured and replantings are necessary. If the showers occur soon after the beets are up and the ground crusts around the young plants the air is cut off from the roots and growth is interfered with. This may sometimes be remedied by prompt cultivation, although the plants are often so firmly embedded in the crust that cultivation is difficult without serious injury to the plants. Sometimes a moderately heavy roller of one of the types shown in Plate II will produce the desired result in breaking the crust. In irrigated sections every effort should be made to retain the fall or winter moisture in the soil, and if the ground is dry in the fall, irrigation is generally desirable. The soil should be sufficiently moist when the seed is planted to produce prompt and complete germination, and there should be sufficient moisture in the soil to maintain a steady growth for several weeks. As soon as the plants indicate that they are suffering from lack of moisture they should be irrigated. When beets wilt during the day and fail to revive at night they should be watered without delay. Usually from one to three irrigations during the growing season are sufficient to produce a crop in most of the irrigated sections where sugar beets are grown. When beets are irrigated the soil should be thoroughly wet, and every effort should then be made to retain the moisture as long as possible by frequent cultivation.

Sunshine.—The third element of climate which has a marked effect on the quality of sugar beets is light, over which man has little control except in the selection of locality. It is generally believed that direct sunshine is an important factor in the production and storage of sugar in the beet; observation indicates, however, that diffused light is almost, if not quite, as effective in producing and storing sugar. The importance of light should not be overlooked, however, since without it the leaves could not manufacture sugar. Beet sugar is all made in the beet leaves by the action of light upon the leaf green when moisture and carbonic-acid gas are present. Without light this action in the leaf can not take place, no matter how favorable may be all other conditions for growth and sugar production.

SUGAR-BEET STAND.

One of the most important factors in sugar-beet production is the stand at harvest time. A perfect stand of beets with the usual width of row and the proper distance of spacing would consist of 25,000 to 40,000 plants to the acre. If each of the beet roots harvested weighed 1 pound, which is below the average in most fields, there should be 12½ to 20 tons of roots per acre. As a matter of fact the sugar-beet stands are only from 50 per cent to 80 per cent perfect, and the average yield of beets in the United States is about 10 tons. Absolutely perfect stands are not to be expected, considering the many factors influencing the stand and the large area annually in sugar beets, now approximately 1,000,000 acres. However, there should be no difficulty in greatly raising the percentage of stand, thereby increasing the yield per acre. Careful attention has been given to the factor of stand during the last few years, and by actual count in many fields in all parts of the sugar-beet area it has been found that the stand at harvest time very frequently is as low as 50 or 60 per cent of a possible 100. It is very seldom that a field has more than 80 per cent of a perfect stand at harvest time. Many factors influence the stand, some of the most important of which have been carefully studied and are discussed below.

Seed.—The quality of the seed is one of the primary factors in producing a stand of sugar beets. All beet seed imported from foreign countries must be up to a certain standard of germination and purity; otherwise it need not be accepted. As a rule sugar-beet seed stored under proper conditions will retain its vitality six or seven years. Usually we have no means of knowing the age of the seed that is shipped to this country, and it is entirely possible that seed imported is sometimes near the limit of its vitality and if held over for one or two years may deteriorate in germinating power. It is customary for sugar companies to retain a part of their seed from year to year to provide for replanting or to take care of belated contracts. All reserved seed, as well as new lots, should be carefully tested for germination before it is given to the growers. If the germination of the seed is too low to produce a good stand of beets at the usual rate of planting, either the seed should be discarded entirely or a sufficient quantity of seed should be planted to insure a good stand.

With American grown sugar-beet seed no difficulty should be met in ascertaining its age; in fact, all American grown sugar-beet seed is utilized within a year or two following its production, so that at present there is no danger of the home-grown seed losing its germinating power before it is planted. In general, domestic sugar-beet seed shows a higher germinability than is shown by the imported seed. All American seed, however, should be tested carefully for germination, because certain conditions during the process of growth, development, and storage of the seed may render it weak or nongerminable. One of the most important factors affecting beet seed adversely during its development is the false chinch bug, which occasionally appears in some beet-seed growing localities. This insect infests the beet-seed balls and the tender leaves and stalks and by sucking the juice from the plant may prevent the seed from developing and maturing.[1] The health and vitality of the beet root when planted for seed is another important factor influencing the quality of the seed. Beet roots that have been weakened by Phoma rot or other diseases of the root will sometimes produce seed stalks, and fre-

[1] For control measures, see p. 49.

quently the seed balls will begin to form; but the plants often die before the seed is mature. If the seed stalks bearing the nonmatured seed are harvested and the seed balls from these stalks are mixed with the matured seed, it is evident that the percentage of germination will be materially reduced. Hot dry winds at the time the seed is forming interfere with pollination and tend to prevent the seed balls from filling and producing viable seed.

The water supply during the growing season has also a marked effect upon the quality of the seed. If the supply of moisture in the soil is too low, especially at the time when the seed is forming, the seed balls will not fill, and the yield of viable seed will be reduced. In the humid sections where seed is grown we have no direct control over the moisture supply except in so far as we are able to retain the moisture in the soil by proper methods of cultivation. In the irrigated sections, wherever water is constantly available, the moisture supply is under the control of the grower. It is not advisable to undertake the growing of sugar-beet seed in those irrigated sections where an abundant supply of water is not available for irrigation when needed.

The seed bed.—The condition of the seed bed as a factor influencing sugar-beet stands is of an importance equal to the quality of the seed. In general, the seed bed should be firm and moist and capable of retaining its moisture under all conditions for a considerable period. To produce such a seed bed the soil should be thoroughly supplied with humus. The ground should be plowed in the fall, in order that it may catch the winter rain and snow, and the surface should be harrowed as early as possible in the spring, so as to retain as fully as possible the moisture in the soil at that time. The seed bed should be worked from time to time to destroy the weeds that may appear, as they rob the soil of moisture as well as of fertility. Just before planting, the seed bed should be thoroughly worked down and firmed, so that the surface will be uniform in texture and in firmness. If the bed is not uniformly firmed, the drill wheels will sink deeper in some places in the field than in others, with the result that some of the seed will be so deeply covered that the plants will not reach the light, or they will be more or less retarded, producing a spotted or uneven stand. The seed should be drilled into the firm seed bed, so that it will be constantly in contact with the moist soil. (Pl. I, fig. 1.) Poor stands are probably produced oftener by too deep and uneven planting, due to a poorly prepared seed bed, than by any other cause.

Date of planting.—No specific date for planting beet seed can be given, since much depends upon local soil and weather conditions. In general, however, it has been found that the soil should be warm and uniformly moist before the seed is planted, as beet seed will not germinate satisfactorily in a cold or unevenly moistened bed. A few of the stronger plants may come up in the moist spots if the seed bed is not too cold, but the stand will be uneven and far from perfect. It is advisable, therefore, to see that the soil conditions are right before planting. Generally there is a planting period of several weeks during which the seed may be placed in the ground with good results. It has been observed that late plantings will frequently give better results than very early plantings. It is not advisable to plant in soil that is too dry or too wet. If the soil is too dry and irrigating water is available it is best to irrigate before planting; if irrigating water is not available and the indications are favorable for rain it will usually be advisable to wait until rain has fallen. If the ground is too wet when the seed is planted, there is danger of the seed rotting and thereby failing to produce a stand.

Winds.—In some localities wind is an important factor affecting the stand of sugar beets. Aside from the effect of wind upon seed formation, as previously noted, wind is effective in two ways in injuring the stand of beets. If the soil is sandy, strong winds may shift the sand so that the seed is covered too deeply and the young plants can not get through to the light, and if the beet seedlings are up the wind may carry the fine particles of sand against the tender plants with such force that they are destroyed or severely injured. This frequently occurs in level areas where strong winds prevail in early spring. The destructive effect of winds may be overcome, in part at least, by drilling in the seed at right angles to the direction of the prevailing winds and by ridging the ground slightly between the rows.

Crust.—In many sugar-beet localities the soil has a strong tendency to crust if it is moistened and then quickly dried. Showers sometimes fall shortly after the seed is planted, followed by sunshine and drying winds, and in cases where the soil has a tendency to bake a very hard crust will frequently form, which will either prevent the young plants from coming through to the light or will cause a very uneven stand. The crust formed will vary in thickness, depending upon the nature of the soil and the conditions of the weather. If the crust is thin and the young plants have not been caught in it, a light harrow or a roller will sometimes put the surface in shape so that the plants will break through. If the crust is thick and the plants are embedded in it, there is frequently no remedy except to harrow the ground and replant. A crust may be prevented or greatly retarded by an application of lime before or immediately after plowing and by keeping the ground well supplied with humus.

FIG. 1.—BLOCKING AND THINNING SUGAR BEETS, AN OPERATION THAT MUST BE PERFORMED BY HAND AS SOON AS THE BEETS ARE LARGE ENOUGH.

FIG. 2.—FLOODING A FIELD OF SUGAR BEETS, A POOR METHOD OF IRRIGATION, SINCE IT REDUCES THE STAND OF BEETS, WASTES THE WATER, AND INJURES THE SOIL.

FIG. 1.—A 4-ROW CULTIVATOR, WHICH IF NOT CAREFULLY USED MAY DESTROY A GOOD STAND OF BEETS.

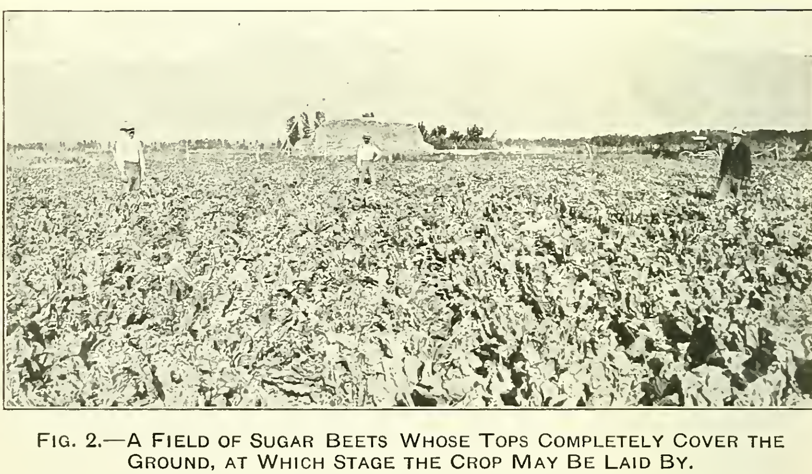

FIG. 2.—A FIELD OF SUGAR BEETS WHOSE TOPS COMPLETELY COVER THE GROUND, AT WHICH STAGE THE CROP MAY BE LAID BY.

Blocking and thinning.—A good stand of beets very largely depends upon careful blocking and thinning. Blocking consists in cutting out a portion of the beets by means of a hoe or other suitable implement (Pl. III, fig. 1), usually operated at right angles to the row, leaving the remaining beets in tufts from 8 to 10 inches apart. This should be done while the beets are very small. It is very easy for the careless workman to strike the row at an angle, making the distance between the tufts very much greater. Frequently the tufts themselves are destroyed by careless use of the blocking implement. When the plants have been destroyed, practically nothing can be done to replace them. Transplanting sugar beets to the vacant spaces has not been found practicable on a commercial scale.

The thinning is done by hand and consists in pulling out from each tuft all the plants but one. Careless workers will often destroy or pull out all the plants from the tuft, thereby reducing the stand. Frequently in thinning the dirt is removed so that the young plants are left with their tender stems subject to the influence of the rays of the sun, the heat of which sometimes destroys them. The dirt should be brought close around the plant that is left so as to protect it from injury.

Cultivating.—Many otherwise good stands of beets are seriously injured by the cultivators either covering the young plants with dirt or tearing them out. This injury is frequently due to carelessness and sometimes to accident. Sugar beets are usually cultivated by means of a 4-row cultivator (Pl. IV, fig. 1). If by accident or otherwise the cultivator is permitted to shift so that several plants are injured or destroyed in one row, the same number of plants will be injured or removed from each of the four rows. This is a common cause of poor stands in many fields. A few beets cut out of four rows here and there in the field each time the beets are cultivated will have a marked effect upon the final stand and will greatly reduce the yield of beets harvested. Success in operating the cultivator depends upon the condition of the seed bed, upon the animals, the driver, and the adjustment of the implement. By careful attention on the part of the driver, nearly all the injury due to cultivation may be avoided, provided the seed bed is in good condition and the drill rows are straight. When the beet leaves cover the ground, as shown in Plate IV, figure 2, the crop is laid by, and no further work is done until the harvest begins.

Diseases affecting the stand.—One of the common agencies affecting the stand of sugar beets is disease. Nearly all sugar-beet diseases are due to parasitic organisms. One of the most serious affecting the stand is the damping-off of the young beets. Later in the season root-rot does considerable damage in some localities. Leaf-spot frequently injures the beets and reduces the tonnage, but does not often destroy the stand. All fungous diseases may be greatly reduced or entirely controlled by proper cultural methods, including the proper rotation of crops.

There are several diseases which sometimes destroy entire fields. The disease known as curly-top belongs to this group. This is an obscure disease, the cause of which is not definitely known. The Office of Sugar-Plant Investigations in cooperation with the Bureau of Entomology is making an earnest effort to determine the cause of this disease and to find a practical means for its control. Another serious pest affecting the stand of beets is the sugar-beet nematode. The nematode first appears in a field here and there, destroying a few beets. From year to year this area becomes more marked if beets are grown continuously in the infested fields, and eventually the whole field is affected and the crop is worthless. The Office of Sugar-Plant Investigations in cooperation with the Office of Agricultural Technology is carrying on extensive experiments in all areas infested with the sugar-beet nematode, with a view to controlling this pest in a practical way, so that profitable crops of beets may be grown in spite of the nematode. For a further discussion of sugar-beet diseases, see pages 45 to 48.

Insects affecting stand.—There are several insects affecting the stand of sugar beets. The most common during the early stages of the beet are wireworms and cutworms. The latter usually cut off the root at some distance below the ground. As a result the plant dies or produces a very short root. Sometimes the cutworms destroy beets here and there in the field, but when the pests are numerous the entire stand may be destroyed, necessitating replanting in order to produce a crop. White grubs also are serious pests. They are the larvæ of the May and June beetles. They occur frequently in sod ground and are to be expected in beet fields where beets follow sod. Later in the season army worms and related pests frequently do considerable damage. Even if the stand is not seriously injured by the pests the tonnage is greatly reduced. For a further discussion of insect pests affecting sugar beets, see pages 48 and 49. For a list of publications relating to sugar-beet diseases and insects, see pages 57 and 58.

Rodents affecting stand.—In some localities ground squirrels and other rodents are a serious menace to the sugar-beet crop. They feed upon the beets from the seedling to the mature stage, but do most of their damage when the beets are about half grown. They sometimes make serious inroads upon the stand of beets. These pests may be destroyed by the use of poison or by trapping.

WATER.

Excess or deficiency of water may be a limiting factor in sugar-beet production.

Precipitation.—In the humid sections of the sugar-beet area beet growers depend upon rainfall and snow for the necessary supply of soil moisture. Usually the snow and the spring rains put the soil in good condition for planting, and the summer rains keep the crops growing until the end of the season. Whether the precipitation will furnish an excessive amount of moisture for the soil will depend upon soil conditions, as well as upon the amount of precipitation. For uniform soil conditions, however, the right amount of precipitation is of vital importance in the growing of sugar beets. Excessive precipitation may be detrimental in two ways: (1) By preventing a proper preparation of the seed bed, and (2) by saturating the soil to such an extent that the air is excluded from the plant roots and the proper growth of the plants thereby prevented. A deficiency of precipitation may make a proper preparation of the seed bed impossible, or it may put the seed bed in such condition that the germination of the seed or the subsequent growth of the plants may be impaired. Excessive precipitation may be remedied under certain conditions by a proper system of drainage. (See pages 22 to 24.) The lack of moisture may be remedied in part (1) by putting the proposed seed bed in a proper condition to catch and hold the fall and winter moisture; (2) by subsequent cultivation whereby a mulch is formed on the surface of the field, thereby retarding evaporation; and (3) by supplying the soil with a suitable amount of humus.

Irrigation.—The use of irrigating water is theoretically simple, but its practical application is very complex, calling for a knowledge of plant growth and soil requirements based upon experience and good judgment. It is one of the most important factors in sugar-beet production in the semiarid regions. Good crops are sometimes ruined by a lack of knowledge of the water requirements of plants and by want of experience in applying the water.

There are four sources from which irrigating water may be obtained, namely, from reservoirs, direct from streams, from flowing wells, and by pumping. A reservoir is a storage place in which an excess of water due to melting snows or from other sources may be stored for future use. Stream irrigation implies either a continuous or an intermittent flow of water in a river bed which may be drawn upon when needed. Pump irrigation is practicable when the subsurface water is present in sufficient quantity and at a depth shallow enough to supply the necessary water for crop production at a reasonable cost.

Reservoirs are either individual storage places which supply moisture for a single farm or part of a farm or they may be community enterprises operated by the landowners or by an irrigating company. Community reservoirs are sometimes filled directly from permanent streams and sometimes they are filled during freshets, while individual reservoirs are frequently supplied with water by pumping: in this manner pump irrigation may be direct or indirect. By direct irrigation the water is pumped into the ditches or laterals and spread at once upon the fields; by indirect irrigation the water is pumped into a reservoir, from which it is distributed upon the field when needed. There are difficulties to overcome in each of the methods of irrigation mentioned. In utilizing water from a community reservoir it is necessary for all farmers under the ditch from this reservoir to use the water at a time agreed upon by the majority of users, regardless of the requirements of all the crops to be watered. In case the water is not used by one or more farmers when the reservoir is open, they must await the next opening of the reservoir, which may be several weeks later, regardless of the injury that the lack of water may cause to their crops. The reservoir can not be opened at the will and pleasure of each water user. To do so would cause a great waste of water, which is often of greater value than the land itself.

Water from a community reservoir is usually prorated and measured to each farmer so that he is able to obtain only his share; likewise, in using water from a stream in which the supply is limited it is prorated and measured, and irrigation must cease when the allotted number of acre-feet have passed through the gate, regardless of the crop requirements. If the pumping plant is a community plant, practically the same regulations obtain as in the case of the community reservoir; that is, each farmer entitled to water must use it at a definite time agreed upon by a majority of the users or forfeit his right to the use of the water until the next irrigating period arrives. It would, of course, be too expensive to operate the pumping plant for a limited number of farmers whose crops were not in need of water at the regular irrigating period. The individual plant is usually more satisfactory from the standpoint that water may be available when needed. The expense, however, of installing and operating an individual pumping plant has frequently been beyond the farmer's means. It is apparent, therefore, that the water supply for irrigating a sufficiently large area to insure the growing of the necessary acreage of beets to enable a sugar mill to operate successfully is frequently the deciding factor in the growing of sugar beets. The problem of water supply should be considered carefully before any large sum of money is expended in the erection of a sugar mill

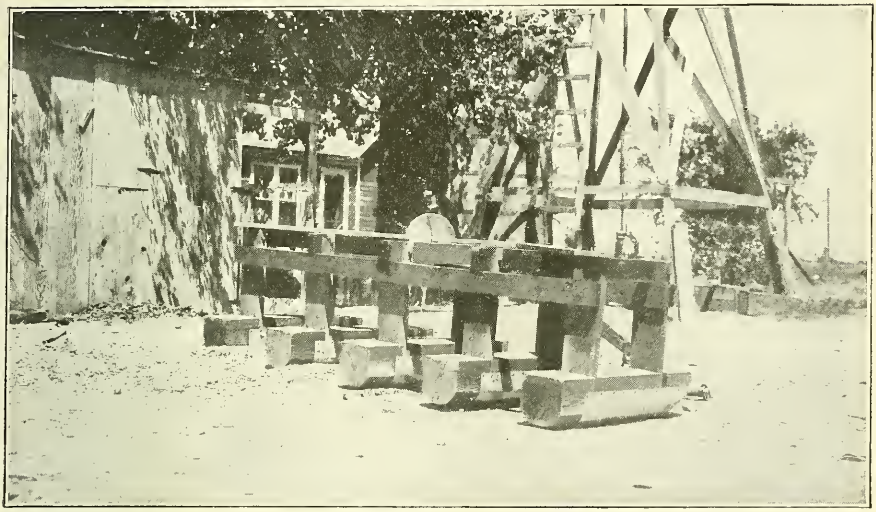

FIG. 1.—A SLEDDING IMPLEMENT USED IN SMOOTHING IRRIGATING FURROWS IN SUGAR-BEET FIELDS, BEING SOMETIMES HELPFUL IN DISTRIBUTING THE WATER.

FIG. 2.—A FLOAT USED IN LEVELING THE SEED BED FOR SUGAR BEETS.

FIG. 1.—PREPARING LAND FOR SUGAR BEETS BY PLOWING UNDER A CROP OF ALFALFA, ONE OF THE BEST GREEN FERTILIZERS WHEN THUS TREATED IN THE FALL.

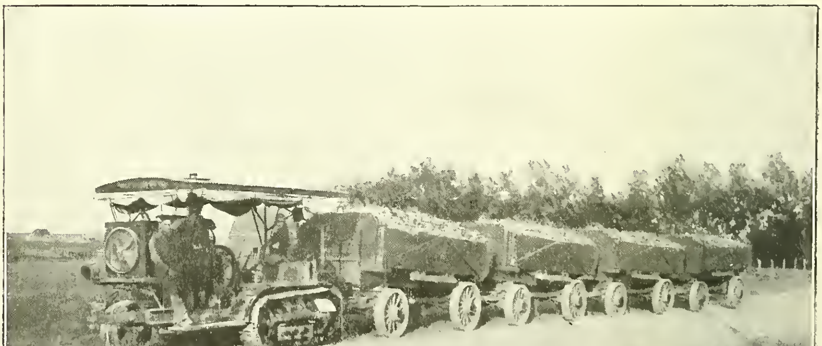

FIG. 2.—HAULING SUGAR BEETS TO THE MILL, THE COST BEING GREATLY REDUCED BY GOOD ROADS.

in any locality in which irrigation is necessary to grow satisfactory crops of beets.

If the water supply in a given area will insure the growing of only 5,000 acres of sugar beets annually under proper crop rotation and under other conditions favorable to sugar-beet culture, it would not be advisable to build a mill having a capacity greater than 500 tons per day. It frequently happens that a large part of the water used for irrigating purposes is wasted either by badly constructed ditches or by improper methods of irrigating. Ditches are improperly constructed when they allow an excessive amount of seepage or when they are so easily clogged that they overflow. Under the methods in practice it is sometimes impossible to avoid using water on certain fields when it is really not needed. Occasionally the water is turned on from the reservoir, or the community pumping plant is put in operation before the water is actually needed by any of the growers. Much can be done to delay the first irrigation and to extend the time between irrigations by proper preparation of the seed bed and by proper cultivation. In most irrigated areas the actual water supply is limited, and in order to meet the crop requirements as nearly as practicable there should be no waste of water beyond the unavoidable losses due to seepage and evaporation.

Methods of irrigation.—There are two general methods of irrigating sugar beets, namely, by flooding, as shown in Plate III, figure 2, and by the furrow method, as shown in Plate I, figure 2. The first method is generally detrimental to sugar-beet production and is wasteful of water. In flooding the entire surface of the field more water is used than would be used by the furrow method. There is a much larger surface for evaporation. The air supply is cut off from the beet roots, and frequently as the ground begins to dry after a flood irrigation the surface forms a crust which further cuts off the air supply, promotes evaporation, and incases the beet plants in such a way that it is very difficult to cultivate or otherwise work the plants without doing some damage. It is argued that flood irrigation is necessary in certain sections where the slope of the land is slight, but it is seldom the case that the slope is not sufficient to enable the careful irrigator to use the furrow method, especially if proper laterals and cross ditches are used. In using the furrow method of irrigation a furrow is made between the rows of beets or between each alternate row and the next, as shown in Plate I, figure 2, and frequently this furrow is smooth or sledded out by an implement, as shown in Plate V, figure 1, which is drawn lengthwise through the furrow, leaving its surface smooth and well adapted to carrying the water. The water should be turned into these furrows, should be confined to them entirely without flooding the surface around the beets, and should be allowed to flow until the soil is thoroughly wet. The head of water which is used in furrow irrigation must not be too large, as shown in Plate III, figure 2. The size of the head must be governed by the slope of the land, by the nature of the soil, and by the number of furrows that can be irrigated at one time.

Leveling.—In order that irrigation may be properly done the field must be carefully leveled, as shown in Plate V, figure 2. This is frequently a limiting factor on many fields and occasionally in an entire community. The lack of success in at least one sugar-beet area is due primarily to the failure of the growers to level the ground properly. It usually requires several years to level a field properly for furrow irrigation, for the reason that the depressions that are filled during the first effort to level the field will usually settle and still leave slight depressions, while the higher points from which the soil was removed to make the fills do not settle, and an unevenness results. If the leveling process is repeated for two or three years the ground generally becomes sufficiently level to admit of furrow irrigation. If the ground is very uneven the Fresno scraper may often be used to good advantage. In some localities the surface of the soil is by nature sufficiently level to admit of proper irrigation. In other sections the slopes are sufficiently long and the source of the water supply so high that it can be carried to the highest point and distributed over large areas without the expense of leveling the ground. In the process of leveling, the better surface soil is removed from the high point and carried to the depression. It is then necessary to improve the areas from which the better soil has been removed, either by the use of stable manure or a leguminous crop. Sometimes several years are required to make a leveled field uniform in fertility as well as in firmness of surface.

A very coarse soil, especially if it has a porous subsoil, is irrigated with great difficulty, and frequently much time and money are wasted in leveling such lands, as they are not adapted to the growing of sugar beets or other intensively cultivated crops.

DRAINAGE.

Drainage has an important bearing upon sugar-beet growing in general, as well as upon the production of other farm crops. Large areas of land that are now too wet to be cultivated could be put under tillage and would produce good crops if properly drained. Other large areas now under cultivation are in many instances becoming water-logged, especially in the irrigated sections, and will soon be unfit for crop production unless they are drained. In some instances the further expansion of the sugar-beet acreage is limited to the bringing in of areas through drainage.

Natural drainage.—Fortunately a large part of the tillable area now devoted to sugar-beet culture has a natural drainage. This may be due to one of several conditions.

(1) The surface of the ground may be sufficiently rolling to drain naturally. In some instances the slope is so great that the water passes off too quickly, and consequently the land is unproductive because of excessive surface drainage.

(2) Certain areas have a natural drainage due to a sloping subsoil. As previously noted, some areas have a subsoil that is more or less impervious to water. If the impervious subsoil is sloping, the water falling upon the surface soil will pass through to the subsoil and gradually disappear along the sloping subsoil. In this case natural drainage is satisfactory and needs no particular attention, provided the impervious subsoil is not too near or too far from the surface, and provided further that there is a natural outlet, so that the water will not eventually back up along the slope or incline of the subsoil.

(3) The natural drainage accomplished by means of a porous subsoil has been already noted. There are localities in which the subsoil is so porous that it is almost impossible to hold sufficient water in the seed and root beds to produce a crop of beets. There are therefore localities in which the natural drainage is of such a nature, either through a lack of moisture or through an excess of water, that natural drainage constitutes a limiting factor in sugar-beet production.

(4) On the other hand, there are areas and fields in which artificial drainage must be practiced in order to put the soil in condition for sugar-beet production. Several systems of artificial drainage are in general use.

The open ditch.—An open ditch constitutes one of the methods by which this limiting factor of excessive moisture is removed. It is the least expensive method of providing artificial drainage, especially from the standpoint of labor and material involved. However, considerable tillable ground is lost through the construction of open ditches. This loss is due to the space occupied by the ditch and by the ditch bank. In constructing an open ditch these points should be kept in mind, so that the least possible loss of tillable area will result. The open ditch constitutes a barrier which can not readily be crossed in the usual farming operations. It is advisable, wherever practicable, to construct these ditches along the edges of the field, along roadsides, and in places where they will interfere least with the farming operations. Sometimes it is necessary to cross the fields with ditches in order to drain the soil properly; in such cases the fields and ditches should be so laid out that the ditches will run lengthwise of the field, thereby avoiding the crossing of the ditch in the usual farming operations. The size and depth of the open ditch will depend upon the length and fall of the ditch, the location of the subsoil, the amount of water to be carried, and the position of the outlet. The drainage ditch should always be deep enough to prevent any interference of the water table with the crop to be grown.

The blind ditch.—The most satisfactory method of artificial drainage is the blind ditch. In the construction of this ditch tile is used most commonly. Many fields that otherwise would not yield profitable crops have been reclaimed by the blind ditch. These ditches should be laid out very carefully with reference to direction, depth, and slope, so that the entire area under consideration will be drained thoroughly. The size of the tile is very important. Tiles that are too small must never be used. This is false economy, and it frequently results in added expense in that the small tiles must be taken up and replaced with larger ones. The tile should be large enough to carry off the water quickly in times of excessive rainfall, deep enough not to be disturbed by the plow or other implements, and laid so carefully that the ends will fit against each other evenly and a gentle and continuous fall should be provided, without depression or elevation. The outlet of the blind ditch should be kept open, that the water may flow freely.

SEEPAGE.

Seepage is closely related to drainage. Many fields or areas that otherwise might be profitable for crop production are rendered useless by seepage. This is especially noticeable in those areas where irrigation is practiced. Seepage is detrimental to the soil in several ways: (1) As a loss of water, especially in cases where water has been stored for irrigating purposes, and (2) through a loss of the use of the land, either because the soil is too wet for crop production or because of the accumulation of soluble minerals which are brought to the surface through seepage. The injurious soluble minerals usually are known as alkali.

Seepage from streams.—Some streams are so located naturally that a portion of the water seeps into the adjacent soil, forming marshes or waste places due to excessive moisture; this is especially true where the fields adjacent to the stream are low, level, or underlain with an impervious subsoil. The nature of the bank of the stream is of importance in this connection. If the overflow at flood time is prevented by the construction of dikes the land may be made productive by drainage. Usually these marshlands when drained are very fertile and produce good crops, though they are not always the best for sugar-beet production, since they sometimes produce large roots low in sugar.

Seepage from ditches.—It is sometimes necessary to construct irrigating ditches higher than the surrounding area, to carry the water across low places or to carry it long distances. It is very common for the water to seep through the ditch bank in such cases and to saturate the surrounding fields, especially if the soil in those fields has a high water-holding capacity. Ditches constructed of clay or other close-textured material allow less seepage than ditches constructed of sandy or other porous material. In the case of sandy ditches the holding capacity may be increased very greatly by oiling the surface of the ditch with crude oil; this can be applied economically only in those localities not far removed from the source of oil supply. Where the oil is available it may be spread over the inner surface of the ditch when the ditch is empty and should be allowed to soak into the soil before the water is turned into the ditch. A second or even a third application of the oil will improve the condition of the ditch. Ditches treated in this manner will carry water with almost no seepage, and when the work is done properly the oiled surface will frequently last for several years. If the oil is spread over the ditch bank, weed growth will be prevented, or at least decidedly retarded. There is always some seepage from the ordinary untreated earth ditch, and the amount of damage done by this seepage will depend upon the nature of the ditch and the soil of the adjacent fields. The seeped areas may sometimes be rendered tillable by drainage.

Seepage from earth reservoirs.—The area of land damaged by seepage from earth reservoirs is less than that from ditches, but the total is considerable and is usually progressive; that is, a small area first appears to be water-logged and this gradually increases from year to year until large areas involving fields and sometimes entire farms are destroyed. Seepage from reservoirs depends upon the construction of the reservoir and upon the nature of the surrounding country. Reservoirs are sometimes constructed in mountainous areas for the purpose of catching and storing flood waters due to melting snows. Generally the location of these reservoirs is such that no tillable soil is injured through seepage; the only loss in such cases is caused by the quantity of water which seeps away and becomes unavailable for irrigation purposes. In other instances reservoirs are constructed of cement, which is nearly impervious to water, and consequently little or no loss from seepage results. The serious injury due to seepage from reservoirs takes place in those localities in which the reservoirs are constructed entirely or in part of earth and in which the surrounding country is composed of tillable land; in such cases the loss due to seepage is sometimes of considerable importance.

Alkali.—As already indicated, one of the serious results of seepage is the accumulation of alkali in the surface soil. In such cases there must be more or less alkali dissolved in the water. As this water rises to the surface of the soil it brings with it the salts held in solution. After the water evaporates from the surface of the soil the alkali remains, and it may eventually accumulate to such an extent that crop production is greatly reduced or rendered entirely impossible. This condition is a limiting factor in the production of sugar beets as well as other crops in certain portions of the sugar-beet area. The sugar beet is one of the most alkali resistant of our farm crops, but even with this plant the limit of endurance is sometimes reached or exceeded, and beet growing becomes unprofitable. Alkali in the seed bed is especially troublesome, since the young plants are very tender and therefore susceptible to this and other adverse conditions. If the beet plants are well started before the alkali accumulates in the surface soil, much less damage will be done, as the subsequent growth of the plants is less affected by the same amount of alkali. The alkalinity of a soil may be reduced by the use of irrigation water, provided the irrigating water is comparatively free from alkali and a satisfactory drainage system has been established.

SOIL FERTILITY.

Elements of plant growth.—By fertility is meant the ability of the soil to produce a good crop. The difference between a rich soil and a fertile soil should be kept in mind—that is, a soil is rich if it contains a considerable quantity of each of the elements required by the plant in the process of growth. Unless, however, these elements are available to the plant and the physical conditions of the soil are such as to promote plant growth, the soil cannot be said to be fertile. If a single element required by the plant, though present, is not soluble, this condition will render the soil infertile. In order that an element may be available to the plant, it must be soluble, and it must dissolve rapidly enough to supply the plant with that particular element as rapidly as the plant requires it. Certain elements are always available when present; other elements must be acted upon by certain substances under certain conditions in order to become available or soluble. It is apparent, therefore, that fertility is one of the limiting factors in the production of sugar beets as well as of other crops.

The sugar beet requires the same elements of plant food that are required by other field crops, but in slightly different proportions; for example, a 10-ton crop of sugar beets (which is approximately the average yield for the United States) will require about 30 pounds of nitrogen, 14 pounds of phosphoric acid, and 71 pounds of potash; a wheat crop, yielding 20 bushels per acre, will require 41 pounds of nitrogen, about 13 pounds of phosphoric acid, and 17 pounds of potash; a corn crop, yielding 40 bushels of ears to the acre, will require 56 pounds of nitrogen, 21 pounds of phosphoric acid, and 23 pounds of potash; clover yielding 2 tons of hay per acre requires 83 pounds of nitrogen, 18 pounds of phosphoric acid, and 88 pounds of potash. These elements are required by all field crops, and, in addition to these, seven other elements are required in much smaller quantities. These elements are always present in agricultural soils in larger or smaller quantities. The two questions, therefore, with regard to soil fertility, so far as the composition of the soil is concerned, are whether the required elements are present in sufficient quantity to produce the desired crop and whether the elements are available or soluble in such quantity and at such time during the growing season as the plant requires. In addition to the presence of these elements, as indicated above, the soil must be in proper physical condition to promote plant growth in order to be fertile. In the production of sugar beets a moderately fertile soil is required. If the soil is lacking in fertility the roots may be too small to produce sufficient tonnage to make the crop profitable to the grower.

Under ordinary farm conditions there is little danger of the soil being too fertile for satisfactory beet growing. Occasionally spots are so fertile that large roots low in sugar are produced, as, for example, an old feed lot, a barnyard which has been turned into a portion of the field, or a spot where an old straw stack has been left to decay. These areas are small and insignificant when compared with the total sugar-beet acreage in the United States, but they sometimes have an important bearing upon the results on an individual farm, especially where the sugar-beet acreage on that particular farm is small. The greatest danger from the standpoint of fertility arises from the lack of those physical conditions or the absence of available plant foods to produce large yields. The principal problem, therefore, in this connection lies in the improvement of the fertility of the soil. Soils may be rendered infertile through natural causes, such as leaching, and through artificial causes, such as single cropping, improper crop rotation, and the improper proportion of live stock to crop production. One of the principal methods that may be employed to increase soil fertility is the addition of humus to the soil, either in the form of stable manure or of green crops plowed under.

Stable manure.—One of the most satisfactory methods of supplying humus to the soil is the proper use of stable manure. A close relation should exist between the number of live stock on the sugar-beet farm and the acreage under cultivation. Studies in practically all parts of the sugar-beet area indicate that the number of live stock on most farms is too small for the most profitable production of crops and is usually below the possibilities in both live stock and crop production when we consider the number of acres under cultivation and the satisfactory crops that the tillable area is capable of producing when properly fertilized and tilled. Furthermore, a considerable portion of the stable manure produced on most sugar-beet farms is wasted or rendered only partially effective either by not giving it proper care or by the method in which it is handled in connection with crop production. In addition to the humus contained in stable manure, considerable quantities of plant food are present, which, if properly handled, add to the fertility of the soil. This plant food is largely soluble; consequently the leaching process to which the stable manure is in most cases subjected, owing to the fact that it is usually exposed to rains and snows, frequently causes much of the fertility to be lost. Again, stable manure is often spread upon the fields and left exposed to the weather, until a large part of the volatile plant foods has passed off into the atmosphere. Much of the nitrogen is often lost in this manner. The best results in utilizing stable manure in connection with sugar-beet production are obtained by applying the manure to the crop preceding the beet crop; this allows the manure to be thoroughly worked into the soil. It is a common practice in many localities where manure spreaders are not used to haul the manure from the feed yard or stable at times when there is no urgent work to be done and to dump it in piles, to be spread at some convenient time before the ground is plowed. This is a wasteful method, especially if the piles are left for some days or weeks without spreading, often resulting in much loss of valuable material through leaching. However, this method is preferable to spreading the manure and leaving it on the surface of the ground exposed to the action of the sun and wind. If the manure is spread and the ground can not be plowed immediately, it should be disked whenever practicable; that is, if the ground is not frozen. Fortunately, the manure spreader is becoming more and more common, and where the number of live stock on the farm warrants it there is probably no other implement of greater value to the farmer. The full value of the spreader is not realized, however, unless the manure is plowed under or worked into the soil immediately after spreading.

Green crops.—Green crops plowed under provide another source of humus for soil improvement. Any vegetable matter plowed under and worked into the soil will add humus, though certain crops are more valuable for this purpose than others, because of the plant food as well as the vegetable matter which they contain. Such crops as peas, beans, clover, and alfalfa, are among the best for supplying humus to the soil. These crops should be plowed under in the fall so that they will have abundant opportunity to decay before the growing season begins the following year. In irrigated sections the ground should be irrigated thoroughly, if necessary, before plowing, so that there will be sufficient moisture in the soil to bring about the desired change in the crop plowed under. In the case of such crops as clover and alfalfa, usually one or more cuttings are made for hay, and the later growth is plowed under when it has attained the height of 1 to 1½ feet, as shown in Plate VI, figure 1. If cowpeas are used for green manure they are usually planted in midsummer and plowed under when they have attained their normal growth in the fall. All crops when used for this purpose should be plowed under while they are still green.

If for any reason a leguminous crop can not be grown for green manure, other crops, such as oats, rye, barley, or even sorghum, may be used. Maintaining the humus in the soil is more difficult in the irrigated than in the humid sections of the country. The climatic conditions, especially the hot winds, seem to have a decidedly reducing effect upon the quantity of humus in the soil. Humus in irrigated sections is doubly important, since it is necessary not only in maintaining and improving soil fertility, but it also has a decided advantage in increasing the water-holding capacity of the soil.

The green crops will add little material not already in the soil. They may, however, bring up the elements required for plant growth from considerable depths and when plowed under deposit them in soluble form in the surface soil. For this reason deep-rooted crops are to be preferred for soil improvement to those more shallow rooted. At any rate some deep-rooted crops should be included in each rotation system. The legumes may increase to some extent the nitrogen content of the soil, and stable manure, if applied in sufficient quantity, will supply at least a part of the necessary plant foods besides adding some humus to the soil.

Commercial fertilizers.—If the required elements are not present in the soil, or if present are not readily available, they should be supplied in the form of so-called commercial fertilizers. The composition of the fertilizer used will depend upon the requirements of the crop to be grown and upon the condition of the soil which is to be used for crop production. From the figures given above it is apparent that a sugar-beet or clover crop should have an abundant supply of potash, while for a wheat or corn crop special attention should be given to the nitrogen supply. A complete fertilizer consists of nitrogen, phosphoric acid, and potash. Compounds containing these elements are mixed in different proportions for different crops and for different soil requirements. It frequently appears that a complete fertilizer is not required. For example, there may be present in the soil an abundant supply of available potash, but the supply of nitrogen and phosphoric acid may be deficient. In that case a fertilizer containing the required amount of nitrogen and phosphoric acid only should be applied. Under certain conditions commercial fertilizers do not seem to be effective. This may be due to the fact that the fertilizer elements are not used in the proper proportions, or it may be due to the physical condition of the soil. The greatest benefits are obtained from commercial fertilizers when the soil is well supplied with humus. There should, of course, be a sufficient supply of moisture in the soil to dissolve and hold in solution the plant foods that are already present or that may be supplied in the form of a commercial fertilizer. The benefits arising from the use of fertilizers, whether stable manure, green crops, or mineral compounds, are frequently noticeable over a period of several years; hence, in estimating the value of a fertilizer the results of several seasons' crops should be taken into account.

CROP ROTATION.

Occasionally a farm is found on which beets are grown on the same field year after year. While this seems to give satisfactory results for a time in some instances, it is in general a poor method and one that can not be recommended, since it tends to encourage the development of certain sugar-beet pests which eventually render the crop unprofitable. The rotation practiced in the various sugar-beet areas must necessarily depend upon the crops that do best or are most profitable in these several localities, as well as upon the crop and live-stock requirements of the farm. In some areas, for example, the Irish potato is a profitable crop and forms an important link in a system of rotation with sugar beets. In other areas the Irish potato is not successful, and in such sections it would be a waste of time and money to undertake to utilize it in rotation with sugar beets. Again, there are areas in which the muskmelon is very satisfactory and rotates well with sugar beets or other crops; in other parts of the sugar-beet territory the muskmelon can not be grown with success. In planning the rotation, therefore, one must have in mind not only the crops that will rotate well with sugar beets, but also the success of those crops independently. The grower must also consider the practicability of handling such crops from the standpoint of his returns; for example, in some sugar-beet areas alfalfa gives good yields, but because the hauls are so long the value of the alfalfa under normal conditions is not sufficient to pay the transportation charges and leave a reasonable profit. Therefore, unless there is an abundance of live stock to utilize the alfalfa locally or unless it is needed as a soil improver, it is not a satisfactory rotation crop in certain localities in spite of the fact that it produces satisfactory yields. Our studies of the various sugar-beet sections indicate that live stock is an important factor in crop rotation on the sugar-beet farms. As already indicated, certain crops can be grown to advantage if there is an abundance of live stock to utilize them. Even if certain crops could be sold from the farm at a reasonable return above the cost of production, it would be poor policy to sell them, for the reason that by so doing a large amount of plant food would be shipped away. Live stock, if properly handled, enable the farmer to keep a larger proportion of the plant foods on the farm than could be done if the crops themselves were removed. Feeding the crops on the farm is the best practice and will generally yield the largest returns per unit of land and per unit of labor, especially if the proper relations between crops, live stock, land area, and labor are established. It is apparent, therefore, that several objects may be accomplished by proper crop rotation, all of which must be kept in mind in order to reap the greatest returns from the sugar-beet farm.

Effect on the soil.—As has been previously noted, all plants require certain plant foods, and these elements are utilized by different plants in different proportions. The rotation of crops insures a better utilization of these plant foods than can be obtained by growing a single crop. Certain crops are deep rooted, while others are more shallow. The deep-rooted crops tend to stir the soil to a greater depth and in this way make the plant foods more readily available for the shallow-feeding crops. Certain crops aid in the production of certain plant foods, as, for example, the leguminous crops store nitrogen, which is rendered available to the other crops grown in rotation with the legumes. Again, certain crops require more or less cultivation, as is the case with sugar beets. This stirring of the soil tends to expose the plant foods to the action of the elements, thereby rendering the mineral material available for the use of the beet plants and the plants of succeeding crops.

Relation of pests to crop rotation.—The rotation of crops tends to reduce or to destroy those pests which depend upon certain plants for their existence. As is well known, some plant pests live and thrive only on certain plants. If these plants are grown year after year in the same field, they furnish favorable breeding conditions for the propagation and increase of these pests. By changing to other crops, plants upon which the pests can not live or upon which they do not thrive may be grown and the pests thereby destroyed or reduced to a minimum. Frequently the pests have resistant forms or stages in which they can exist in a dormant condition for several years, as is notably true of the brown-cyst stage of the sugar-beet nematode and the resting-spore stage of certain fungi. In such cases it is necessary to plan the rotations with a view to starving out these pests. To do this the rotations must be of such a length that crops upon which these pests can not thrive may be grown for several years in succession. In some cases other methods must be resorted to in order to control the destructive pests, but a large number of the sugar-beet pests, including some of the fungi and bacteria as well as insect pests, may be controlled by crop rotation.

Effect of sugar beets upon other crops.—As a rule, the effect of sugar beets upon succeeding crops is beneficial. This is especially true of the small grains; that is, small grains grown after sugar beets will almost invariably produce larger yields than when these grains follow other crops. The sugar beet does not gather nitrogen from the air and transform it into plant food, but, owing to its long main root and its uneven feeding rootlets, it gathers a considerable quantity of several soluble mineral salts and stores them in the beet crown, and when the beet tops are fed to live stock and the manure returned to the soil considerable fertility is added. In addition to this improved fertility of the soil the methods of cultivation employed in growing and harvesting the beet crop put the soil in splendid tilth, thereby forming good seed and root beds for the crops that follow the beets. Although sugar beets are grown primarily for the cash value of the roots as a source of sugar, the feeds obtained from the beet tops, molasses, and pulp, and the increased fertility and improved tilth of the soil are recognized as indirect benefits to the beet growers, and are important factors in considering the advisability of growing sugar beets. These indirect benefits due to sugar-beet growing have only a remote bearing upon the price paid for beets and upon the price of sugar. They should, however, be considered in figuring the profits derived from sugar-beet culture.

COMPETING CROPS.

Crops grown in competition with sugar beets may or may not be suitable for rotation with sugar beets. By competing crops is meant those crops grown in sugar-beet areas which appear to be more profitable or more easily produced, or for some reason are so favored by the farmer that he may possibly prefer them to sugar beets. Some of the competing crops do not lend themselves readily to a rotation with sugar beets. In such cases the competing crops may be a limiting factor in sugar-beet production on an individual farm, or if the crop is a general one it may be a limiting factor in sugar-beet production in a given community. A crop may compete with sugar beets because of its market price, because of the small amount of labor involved in its production, because of the peculiar fitness of the soil for the growing of that crop, because of local market conditions, or because it fits more closely the requirements of the individual farms than any other crop. The competing crops in the sugar-beet sections are beans, tobacco, potatoes, muskmelons, alfalfa, and grains. Other crops may temporarily be competing with sugar beets, and some of those mentioned may for local or other reasons temporarily cease to be competing crops. Most of the competing crops may form a satisfactory crop-rotation system with sugar beets in one or more of the recognized sugar-beet areas.

Beans.—In the farm-to-farm survey of the Office of Sugar-Plant Investigations beans have been found as a competing crop in several localities, and under certain conditions it is one of the strongest competitors. This crop is easily produced and brings a fair return to the farmer for the labor and money invested. In some of the areas studied beans have ceased to be a competing crop because of local conditions, chief of which is the presence of certain bean diseases. It was believed that beans could follow beans profitably in the same field for a number of years, but this, like all other crops, is more satisfactory in the long run when grown in proper rotation with other crops. As in the case of sugar beets, continuous cropping with beans has enabled certain diseases of the bean to be propagated from year to year, thereby becoming more widespread and more destructive, until bean production in certain areas is no longer profitable. If properly handled, beans should be a good crop to rotate with sugar beets. They should not compete with the sugar beet to the exclusion of the latter, for the reasons above stated. The diseases affecting sugar beets and beans are for the most part very different, and for this reason these crops rotate well together. Again, the sugar beet leaves the ground in good condition for the production of the bean crop. If the beet crop has been properly handled the weeds are eliminated, and in this respect the field is left in a good condition for beans. Furthermore, sugar beets leave the ground in good physical condition for a bean crop; on the other hand, if beans precede beets they will leave the ground in good condition for the sugar beets. The order of rotation, therefore, with these crops is not particularly important.

Tobacco.—Tobacco is not generally grown in the sugar-beet areas, but there are a few localities in which both tobacco and sugar beets are produced. Though the tobacco crop is expensive to handle, the returns under favorable conditions make it a strong competitor. The methods used in growing tobacco do not usually lend themselves well to crop rotation; for example, tobacco fields are usually heavily fertilized with commercial fertilizer. Part of the results to be expected from these fertilizers should be apparent during the second or even the third year after they are applied. Owing to this large expense growers usually expect to use the same field for the tobacco crop for a series of years, consequently it does not admit of ordinary crop rotation. Again, the tobacco crop requires a large amount of labor, some of which conflicts with the labor necessary for sugar-beet production. If, however, a farmer can obtain sufficient labor to handle both crops there should be no serious difficulty in producing both sugar beets and tobacco, especially if these crops are produced on comparatively small areas on the individual farm. It may be found, also, that these crops will rotate one with the other to the advantage of both.

Potatoes.—In certain areas studied, the potato under present conditions is one of the strongest competing crops with sugar beets. Where these crops are grown in rotation, however, the results, from the standpoint of yield, are satisfactory. Unfortunately, certain diseases affecting potatoes attack sugar beets also: this is notably true of the scab. When the price of potatoes is high the tendency in the especially good potato areas is to increase the potato acreage and to diminish the sugar-beet acreage correspondingly. The chief danger is that when an extra-large potato crop is harvested the price usually drops, and the results are somewhat disappointing. It should be noted in this connection that the prices paid for sugar beets are fixed in practically all cases before the seed is planted. The returns from this crop depend not only upon the yield, but upon the quality of the beets produced and upon the wholesale price of sugar. As already indicated, sugar beets and potatoes form a part of a satisfactory rotation, but neither of these crops should immediately succeed or follow the other, because of the diseases that are common to both plants. There should be one or two years of intervening crops, such as small grains or alfalfa.

Alfalfa.—In some localities studied, alfalfa has appeared to be a strong competing crop with sugar beets. This is true in part because of the tendency to leave alfalfa sod without breaking for a number of years, thereby making a very long rotation or, in some cases, what amounts to no rotation; for example, certain areas have been found in which alfalfa has remained undisturbed in some fields for upward of 20 years. Alfalfa is an inexpensive crop to produce, provided a good stand is obtained. This is not difficult if the ground is well prepared and properly handled at seeding time. After the alfalfa has become established the expense of maintaining the crop is slight, and the chief expense in connection with alfalfa production consists in irrigating in certain sections and in harvesting and marketing the crop.

In some sections where alfalfa grows well it is not a competing crop with sugar beets, because of the remoteness of these areas from the market or because it is not fed locally to advantage: but in cases where the alfalfa is used locally to advantage or where the markets are accessible it may compete strongly with the sugar beet and may exclude the latter to such an extent that the beet acreage will be so small that the profitable operation of a sugar mill is not possible; for a sugar mill should have a sufficient quantity of beets to insure a run of at least 100 days each year, though the average run for 1920 was only 91 days. (Table IV, p. 6.)

Sugar beets may be grown in rotation with alfalfa to good advantage under certain conditions, and our studies have shown the advantage of these conditions in several instances. This is especially true if the farmer looks upon the alfalfa crop as a soil-improving crop as well as a crop from which direct satisfactory returns may be expected. In such cases alfalfa may be grown two or three years, and at the end of this period the last crop of alfalfa is plowed under for the improvement of the soil, thus putting it in good condition for one or two crops of sugar beets. It is not desirable to grow sugar beets immediately after old alfalfa, because the old alfalfa roots are large and woody and interfere seriously with cultivation. It is better to follow old alfalfa with a noncultivated crop, such as small grain, which in turn may be followed by sugar beets.

Fruit.—In several sugar-beet areas fruit has been found to be a competing crop. In several instances the sugar beet has been eliminated or shifted to other areas, or reduced in area below the point of a profitable mill run. It is sometimes possible to grow considerable areas of beets in orchards when the trees are small, but as the orchards get older and the trees increase in spread of branches and roots the vacant space between them must necessarily become smaller and smaller until finally the sugar beet is excluded. When fruit growing has become general in a sugar-beet area, as has been the case in several instances in certain localities, sugar-beet growing and diversified farming in general have been practically eliminated. Occasionally some misfortune overtakes the fruit industry, and the area again returns to general farming, including sugar beets. In one locality studied the entire cycle has been passed through, and the fruit growers are now removing their trees and returning to general farm practice, including the growing of sugar beets.

FARM EQUIPMENT.

The equipment on the sugar-beet farm is a matter of vital importance. It covers a wide range but may be grouped under four general heads, namely, soil and water, implements, live stock, and labor. If a farm is lacking in any of the essential parts of the equipment, and if these parts can not be supplied, successful sugar-beet growing is not possible. The equipment differs to some extent in different localities, especially between the humid and irrigated sections. Soil and water are not usually listed as a part of the farm equipment, but are included here in order to emphasize their importance in crop production.

SUITABLE SOIL.

As previously noted, a suitable soil, together with a satisfactory subsoil, is one of the first requisites in the production of sugar beets. Although soil is not usually classed as a part of the farming equipment, it is in fact a very essential part. If the soil is very sandy or extremely rocky, it is not probable that it would pay to undertake the growing of sugar beets. Certain conditions of soil may be changed or modified by proper cultural methods, so that an otherwise unfavorable soil condition may be changed to a sufficiently favorable condition to enable the farmer to produce a satisfactory crop of beets: for example, a hard subsoil may sometimes be broken up in such a manner that a sufficiently deep soil for the production of beets is produced. Again, an infertile soil due to lack of humus, to a scarcity of lime, or to improper crop rotation, may be remedied at a small cost and an otherwise unproductive soil rendered productive. As already noted, a soil containing an excess of moisture or one in which the water table is too near the surface may be made productive by proper drainage. It is apparent, therefore, that soil, from the standpoint of equipment, may be a permanent limiting factor, which in some cases can not be overcome sufficiently to enable the farmer to produce a satisfactory crop of beets, while, on the other hand, this part of the farmer's equipment may be modified in many cases by proper treatment and the barrier to sugar-beet production removed. This part of the farm equipment, however, like work stock, implements, and labor, is just as essential for the production of other crops as for the production of sugar beets.

IMPLEMENTS.

Many of the implements used in sugar-beet growing are the same as those used in the production of other crops, though some special implements are necessary in order to grow sugar beets successfully; this is especially true of the drill shown in Plate I, figure 1, and the cultivator, Plate IV, figure 1.

Drills and cultivators.—Sugar beets are grown in rows about 20 inches apart, and there is a special drill for the planting of sugar-beet seed. There are several sugar-beet drills on the market which seem to be fairly satisfactory. In some localities the farmers own their beet drills, and in others they are owned by the sugar companies and rented to the farmers at a small charge per acre. Most of the drills made for planting sugar-beet seed are so constructed that they will plant four rows at a time, as shown in Plate I, figure 1. Likewise, the cultivator is especially adapted to sugar-beet work, and will cultivate four rows corresponding to the drill. This is very important, as will be noted by those who have had experience in using a cultivator in such narrow rows. In planting four rows at a time many deviations from a straight line will occur in each of the four rows, which can, therefore, be followed more readily with a 4-row cultivator with less damage to the plants. The beet cultivators are usually equipped with various implements for stirring the soil, destroying weeds, and forming a mulch, depending upon the soil conditions and the size of the beets.

Plows.—The ordinary walking or riding plow can be used in turning the soil in the preparation of the seed bed. The 2-way plow is well adapted to the sugar-beet crop, for the reason that it produces neither back furrow nor dead furrows. This is especially important in the irrigated areas. In some localities the disk plow is frequently used, although the ordinary moldboard plow is in most common use in sugar-beet areas. The advantage of the disk plow for deep plowing is that it enables one to stir the soil to a good depth if the plow is properly constructed and adjusted, without bringing too much raw soil to the surface. The plows in use vary from the walking moldboard plow through various types of sulky plows to the disk plow with its numerous variations. In some types of soil it is especially desirable to give an occasional deep plowing.

Best results are generally obtained by fall plowing for sugar beets. The farm-to-farm survey as well as the experience and observation of the Office of Sugar-Plant Investigations indicates that fair results may be obtained by spring plowing, provided the soil has been previously in good tilth.

Harrows.—In preparing a seed bed for any crop the disk harrow is a valuable implement. It is frequently used to advantage before the ground is plowed. When so used it puts the surface of the ground in such condition that holes or spaces are nowhere left when the ground is turned with the plow. The disk harrow is used sometimes in breaking up lumps or clods after the plowing has been done; however, if the ground has been plowed when in good condition and has been properly treated after plowing there will be no large lumps or clods for the disk harrow to break. In case weeds start before the time for planting the sugar-beet seed the disk harrow is sometimes useful in destroying them. In some instances in which beets have been followed by beets good results have been obtained by omitting the plowing and simply disking and harrowing in the preparation of the seed bed in the early spring. The proper preparation after the ground is plowed consists in harrowing, preferably with a spike-tooth harrow or other form of this implement, which simply stirs the surface of the ground and makes a moderately fine mulch. It is a more or less common practice to harrow at the end of each half day or, at the latest, at the end of each day the ground just plowed. This is a practice to be especially recommended in cases of spring plowing, since it has a tendency to hold the moisture in the soil, thereby leaving it in good condition to form a satisfactory seed bed. In case of fall or winter plowing it is better to leave the ground rough, in order that it may catch or hold the winter snows and rains.

The scraper and float.—In the irrigated sections leveling is sometimes necessary to put the ground in condition to be irrigated. As pointed out on page 10, ground which is not level or nearly so can not be satisfactorily irrigated. This is especially true with a crop like sugar beets, which must be irrigated by the furrow method. If the ground is leveled before the plowing is done, a scraper is commonly used. If the leveling is left until after the ground is plowed, an implement called a float is frequently used; this consists of two planks placed on edge and so framed together, about 6 or 8 feet apart, that they can be dragged sideways over the field as shown in Plate V, figure 2. This has the advantage of not only leveling the ground, but it tends to break up the small clods and puts the ground in good condition for further preparation of the seed bed. Frequently the Fresno scraper is used before plowing if the surface is very uneven, and the float is used after plowing in the same field. The two operations are quite distinct; the former is usually called scraping and the latter leveling. The scraping is necessary only when inequalities in the surface of the field are very marked. The time and labor spent in leveling will be repaid in the production of sugar beets, both from the standpoint of yield and from that of labor saved in irrigating.

The roller.—Another implement of considerable importance in sugar-beet growing is the roller. There are two types of this implement, as shown in Plate II, figures 1 and 2, namely, the smooth roller and the so-called corrugated roller. The latter is desirable in those localities where there are high winds, since the corrugations tend to prevent the soil from shifting under the influence of the wind. The chief advantage of the roller is its surface-packing effect. If the root bed is inclined to be loose the subsurface packer should be used immediately after plowing. As previously noted, the seed bed for sugar beets should be decidedly firm, for the two reasons, at least, that the firmness of the seed bed tends to hold the moisture, and at the same time prevents the sinking of the drill wheels, which would frequently result in planting the seed too deep. The seed bed that is unevenly firm or in which there are soft spots or areas is always unsatisfactory, as it results in an uneven start of the beet plants, which interferes with the handling of the crop.

Harvesting tools.—At harvest time the beet lifter, a special implement not required in harvesting other crops, is necessary. (Pl. VII, fig. 1.) There are two forms of this implement, namely, the double-pointed lifter and the side lifter. In the former, one point

FIG. 1.—LIFTING THE BEETS, THE FIRST OPERATION IN HARVESTING THE CROP BY HAND.

The lifter is sometimes provided with a riding attachment.

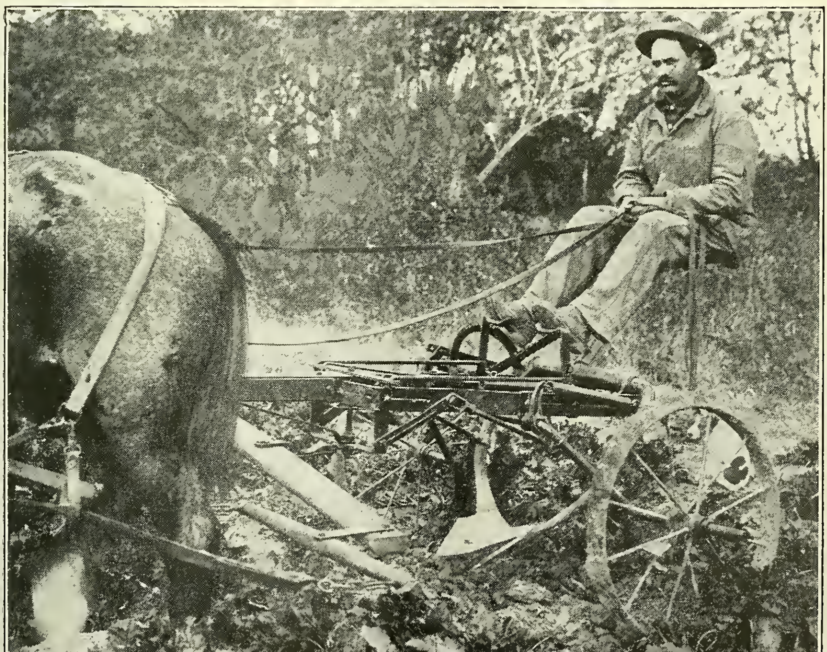

FIG. 2.—ONE TYPE OF SUGAR-BEET LIFTER USED IN SOME LOCALITIES.

This illustration shows the construction of the lifting parts, which are raised out of the ground in turning at the end of the row.

FIG. 1.—TOPPING AND PILING A CROP OF SUGAR BEETS BY HAND.

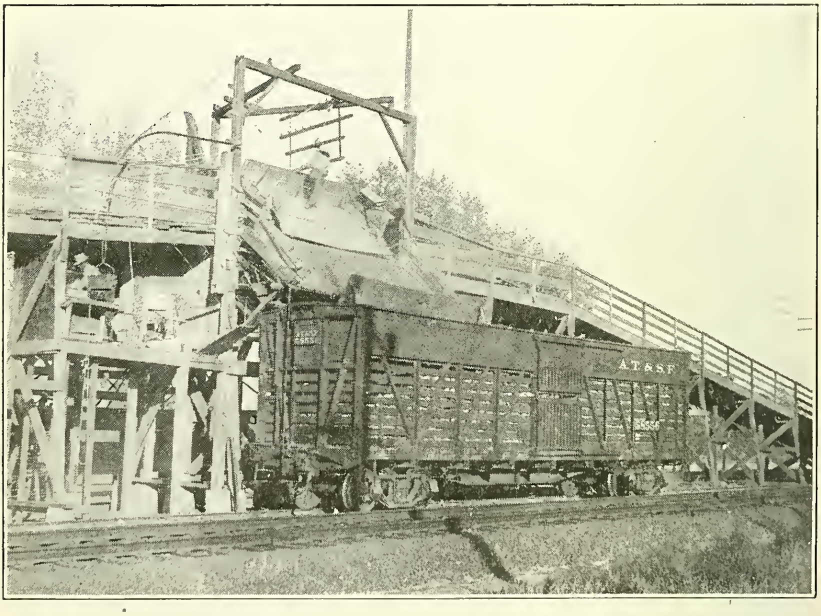

FIG. 2.—ONE FORM OF DUMP USED IN UNLOADING BEETS FROM A BEET WAGON.

The load has just been dumped into a freight car and the wagon is still tilted.

passes along each side of the beet root at a depth of several inches below the surface and is so constructed that the beets are loosened and slightly lifted. (Pl. VII, fig. 2.) The side lifter passes along one side of the beet row and loosens the beet, usually without lifting it; in either case the roots, after they have been loosened, can readily be pulled and thrown into piles. Care should be taken in using these lifters to see that the beet roots are not broken, as considerable loss frequently results to the grower from the breaking of the roots, causing the lower part of the beet to be left in the ground.

In topping beets by hand, heavy knives closely resembling large butcher knives are used; in some localities sickles are used for the purpose. This work, now done by hand, as shown in Plate VIII, figure 1, may be done by machinery. (Pl. IX.) In loading the beets on the wagons, forks specially constructed with a knob of metal on the end of each tine should be used, so that the beets may not be punctured when they are forked onto the wagon. Special beet racks, as shown in Plate VI, figure 2, and Plate VIII, figure 2, are commonly used in hauling the beets to the factory or dump. These special racks are necessary in facilitating the unloading of the beets at the dumps, where the beets are emptied from the wagons onto the cars. (Pl. VIII, fig. 2.) If the beets are forked from the wagon the ordinary wagon box may be used, but generally the beets are dumped, in which case racks with hinged sides are necessary. Furthermore, the special rack holds more roots than the ordinary wagon bed, thereby reducing the cost of delivering the crop.

Sugar-beet harvester.—Heretofore the most laborious operation connected with beet culture has been the harvesting. This operation consists of three parts, lifting, pulling, and topping, as described above. The pulling and topping have been done entirely by hand at a cost of $7 to $9 per acre. Many attempts have been made in this country and in Europe to construct a mechanical harvester. Recently several types of this implement have been improved, and it is expected that they will be available to harvest at least a part of the 1921 acreage. One type of harvester, as shown in Plate IX, figure 1, is a motor-driven device which lifts the beets entirely out of the ground and tops and piles the roots. Another type of harvester, as shown in Plate IX, figure 2, is a horse-drawn implement which tops the beet and then lifts the root. Each implement is operated by one man; hence, the saving in labor and in labor cost are considerations that appeal to the beet grower.

LIVE STOCK.

The live stock on the sugar-beet farm should consist of work stock and other animals. One of the most important parts of the necessary equipment on a beet farm is the work stock, which should be sufficient in number, size, and quality to handle the work readily. For the heavy work, such as deep plowing, lifting, and hauling the beets, heavy work animals, similar to those shown in Plates II, V, and VI, are desirable. Work stock of proper size and quality, therefore, are an essential part of the equipment. The horses should be trained to follow rows when cultivating. Large animals, properly trained and handled, will do this work without injury to the beets and may be used unless small animals are available for this purpose.

Apparently the tractor is taking the place of work animals in some localities for many of the operations on sugar-beet farms. A farm tractor should be of simple and durable construction, moderate in price, easily and cheaply operated, and capable of making fair speed when required.

Animals, in addition to work stock, are essential on the sugar-beet farm in order to utilize to the best advantage the beet tops and pulp, as well as the feeds grown in rotation with the beets, and also to furnish the necessary farmyard manure required to keep up and improve the fertility of the soil. The particular kind of stock, whether dairy cows, beef cattle, sheep, hogs, or poultry, will depend upon the locality, especially with reference to the markets, upon the kind of labor obtainable for handling the stock, and upon the other farm crops adapted to that particular locality.

LABOR.

The question of labor on a beet farm is of vital importance, and the lack of labor to handle beets at the proper time will constitute a limiting factor in sugar-beet production. Other things being equal, the beet grower with sufficient dependable labor of good quality at his command will handle the crop to the best advantage. For those growers who have not a sufficient amount of labor available for the production of sugar beets in addition to the other farm work, the sugar companies will usually undertake to obtain laborers. These laborers usually are transient, coming into an area at the beginning of the growing season, caring for a given acreage of beets during that season, and returning to their homes after the beets are harvested. In some instances they go out year after year to work in the same locality and for the same farmers. Frequently they rent land after a few years of experience and remain in the community throughout the year; such workers sometimes purchase land, thereby becoming landowners and employers of labor. The labor imported into an area for work in connection with sugar beets is handled under contract at a fixed price per acre. Before he leaves his home the laborer demands a contract stipulating the acreage that he will be

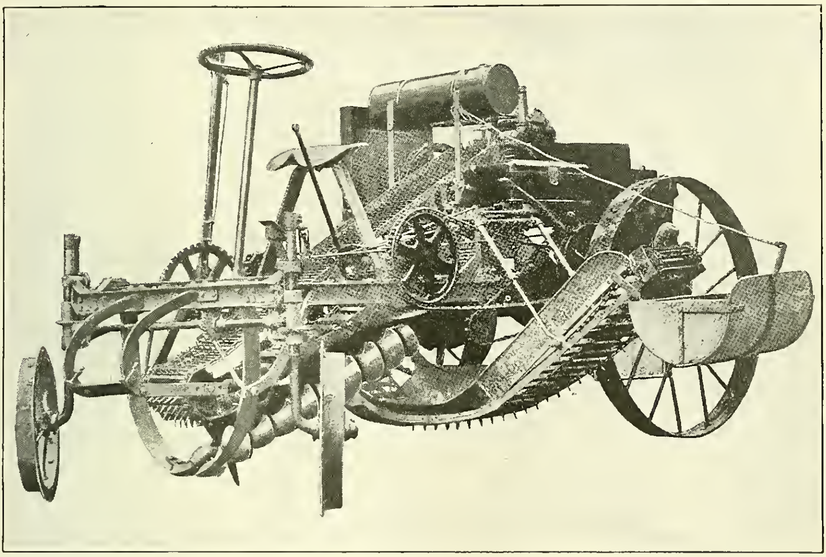

FIG. 1.—A MOTOR-DRIVEN BEET-HARVESTING MACHINE.

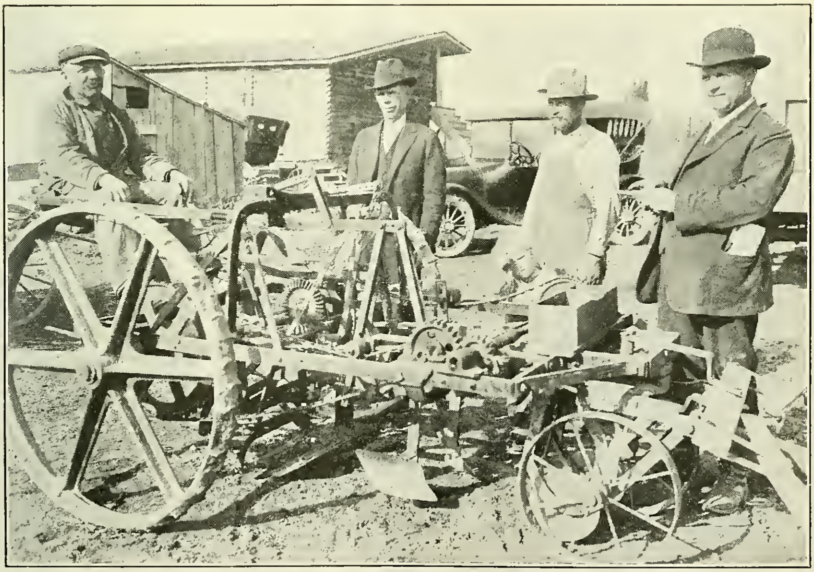

FIG. 2.—ONE TYPE OF HORSE-DRIVEN BEET HARVESTER.

FIG. 1.—PASTURING BEET TOPS AFTER THE ROOTS HAVE BEEN HAULED AWAY

FIG. 2.—FEEDING BEET TOPS AND BEET-TOP SILAGE IN RACKS.

This is the most economical method of handling this class of feeds.

allowed to handle and the price per acre that he will receive for the labor. Labor problems are more fully treated on pages 42 to 44.

BEET BY-PRODUCTS AND LIVE STOCK.

Live stock constitutes an important factor in the success of beet growing from two standpoints: (1) The utilization of beet tops and pulp and (2) the production of stable or barnyard manure.

Kind of live stock to feed.—Sugar-beet tops and pulp are good feed for all kinds of live stock, including chickens, hogs, sheep, cattle, and, to some extent, horses. Generally the tops and pulp are fed to sheep and cattle. There are several methods by which the beet tops may be utilized for feed. They may be pastured off, a process which consists in turning the live stock into the beet field after the beets have been harvested and the roots removed, as shown in Plate X, figure 1. The tops are left scattered over the ground, and this method of feeding results in the ground being more or less trampled. Sheep especially are inclined to travel more generally in paths, thereby trampling the ground unevenly. In no case should the pasturing of the tops be permitted when the ground is wet, since the ground itself would be seriously injured by trampling in that condition and many of the tops would be wasted by being trampled into the ground. While live stock thrives on beet tops and pulp, other feed must be used in finishing the animals for the market. Beet tops, especially the crowns, contain considerable mineral matter which is beneficial to live stock, but it should not be fed in too large quantities.

The tops are sometimes allowed to cure partly and are then gathered into piles, hauled to the feed yard, and fed in racks, one form of which is shown in Plate X, figure 2. This is a much more economical method of utilizing the tops, but it involves the additional expense of gathering and hauling. The tops may also be used as ensilage. When chopped with straw, cornstalks, or other roughage excellent silage is produced. Both the tops and the pulp are excellent for dairy cows, since they act as a tonic upon the animals as well as a food and increase the flow of milk. Pulp is used either fresh or dried. It is dried artificially, either by itself or in combination with molasses. When dried by itself it contains the same substances as when fresh; when dried with molasses it, of course, contains the added sugar and mineral matter. The object in drying the pulp is to make it easier to handle. About 80 per cent of the weight is lost in drying and when dried it can be shipped long distances. It should be soaked for several hours before it is fed to stock.

Number of live stock to keep.—It is apparent that there should be a suitable ratio between the number of live stock and the available tops, pulp, and other feed on the farm. As stated above, animals can not be finished for the market on the beet by-products, and unless other feed is available it will not be advisable to purchase animals for feeding purposes with a view to turning them on the market later. If the farmer is provided with dairy cows, it is advisable to furnish them with one or two feeds of tops or pulp each day. The tops, when cured or pitted, will keep for several months; the pulp when left in a large pile will not spoil for feeding purposes, except in a thin layer on the surface. If the tops or the pulp are fed heavily to dairy cows, a distinct increase in the flow of milk marks the top and pulp feeding period, and there will generally be a marked falling off in the flow of milk when this feed is discontinued. Since the supply of tops and pulp is limited, it is better to continue the feeding over a longer period, giving a smaller amount to each of the animals daily. The tops and pulp should always be fed in combination with other feeds in order to make a balanced ration.

LABOR PROBLEMS.

One of the most serious problems on many of the beet farms is that of labor. The difficulties in connection with the labor question as related to sugar-beet culture are due to the fact that a part of the work must be done by hand and is tedious; furthermore, the labor in connection with this crop is not continuous. For example, there is a period in the spring when considerable labor is required for the blocking and thinning of the beets, as shown in Plate III, figure 1. The work during midsummer is light, consisting of a little hoeing. In the fall there is another increase in the labor requirement, due to the harvest, followed by the winter months, when little or no field work in connection with this crop is done. The need for labor at harvest time is apparent, as the beets must be harvested promptly when they are mature. The reasons for pushing the beet harvest are several: Fall rains may set in and cause the roots to deteriorate in quality, the roots may be frozen in the ground if harvest is delayed, the mill must have sufficient roots to operate continuously, and the farmer must get the beet crop out of the way in order to do his other fall work. The question of obtaining and holding the necessary labor for the handling of this crop has been one of the serious problems in sugar-beet growing in this country. Beet labor may be classified under three heads—family labor, community labor, and hired labor, the latter being divided again into general labor, regular and transient, and into contract labor.

Family labor.—By this term is meant the labor furnished by the family which has contracted with the sugar company to grow the beets. It may be the family of the landowner or the family of the tenant. Usually the most successful operations in sugar-beet growing are in those localities where the labor is handled by the family of the grower. In those localities the beet acreage per farm is usually small and the beet labor is not burdensome. This class of labor is usually more vitally interested in the success of the crop than other kinds of labor, and therefore greater pains are taken to produce and maintain good stands.

Community labor.—By community labor is meant the exchange of labor between the beet-growing families in a given community. Usually not all the beets in a given community are ready to be thinned or harvested at the same time, and since both of these operations must be done as promptly as possible when the beets are ready, it has been found advantageous for families in the same community to use the exchange-labor method in handling this crop. This exchange system is not confined to the beet crop, but is a common practice in many localities in carrying on all kinds of farm work which needs to be done quickly, such as haying and grain harvesting.

General labor.—By general labor is meant that labor which is employed by the day, month, or year for the general farm work. Transient labor is that part of this labor that comes and goes without any certainty as to its permanency and with little responsibility as to the results of the work. It is seldom used in handling the sugar-beet crop, as it is not sufficiently dependable. All farming communities are familiar with this kind of labor to a greater or less extent. It is unreliable and unsatisfactory, but sometimes enables a farmer to get through a temporary rush period without serious damage to his crop. On many farms there are monthly or annual laborers who take part in all of the farming operations, including the sugar-beet work. Usually this class of labor is very satisfactory in the beet fields, and the farmers are fortunate if by the aid of their general helpers they are able to care for the beet crop in addition to the other work.

Contract labor.—This is the most common class of labor employed to do the handwork in caring for the sugar-beet crop, and, as the term implies, the work is done under contract. The term "contract labor" as used in this connection is often misunderstood. It is thought by some who are not familiar with beet-growing conditions that the so-called beet-labor contracts are decidedly to the advantage of the landowner or of the sugar company and that such labor is compelled to work under contract. Usually the sugar company has no interest in the contract labor except in helping the grower to get his work done at the proper time and in the best possible manner. The landowner or beet grower desires a contract, so that he will be sure of the necessary help in handling his crop at the proper time, but above all the laborers themselves desire a contract which specifies the number of acres of beets that a given individual, family, or other group of workers will be permitted to handle and the price that they will receive per acre for their labor. These contracts are usually made with so-called labor families, although individuals and groups of individuals sometimes enter into the contracts. The labor families are usually in the cities during the winter, employed in mills or factories, and in the summer they go out and work in the beet fields. For their own protection they must have a contract before they can afford to leave their employment to take up a new line of work. Many of these families return from year to year to work for the same beet growers.

The contract labor usually covers all of the handwork used in growing the beet crop: namely, the blocking, thinning, hoeing, pulling, and topping. The landowner and tenant do all the teamwork, from the plowing of the land to the hauling of the beets to the sugar mill or loading station.

The hand laborers usually work for a specified rate per acre, a part of which amount is furnished them after each operation. Occasionally they receive a specified bonus for each ton above a yield agreed upon. The object of this bonus is to encourage the laborers to maintain the best possible stands and to produce the highest possible yield per acre.

THE SUCCESSFUL GROWER.

The successful production of sugar beets on any farm depends to a great extent upon the temperament of the farmer and upon his attitude toward the production of this crop. As in other lines of business, the man's ability to conduct his business successfully is largely a matter of individual temperament, judgment, and ability to do the right thing in the right way and at the right time. There are many farmers, as there are many men in other lines of business, who are not adapted to the kind of work upon which they are engaged. It is not to be expected that these men would have any more success in the growing of sugar beets than in other lines of agriculture. Again, there are farmers well adapted by temperament to the particular line of farming which they are following, but who would not be successful in some other line of agriculture; for example, a man might grow grain on a large scale and do it very successfully; he might not at all be adapted to dairying or to the feeding of live stock. Some people can not handle live stock successfully even though they have right ideas in regard to the handling of crops; likewise, the grain farmer may not be adapted to the growing of sugar beets. Frequently grain production is extensive rather than intensive, while sugar beets should be handled intensively rather than extensively. At any rate intensive methods should be employed in growing this crop. Some growers of the extensively grown crops, like grains and forage, sometimes become very successful growers of sugar beets, but generally they prefer the line of agriculture which they have followed and from which they do not like to depart. The same is true of the live-stock man, although the man who handles live stock, especially dairy cows, is more inclined to take up the growing of such an intensive crop as sugar beets and is more apt to succeed in this line of agriculture than the grain or forage crop man. This does not apply, however, to the live-stock man who grows for the market, and especially the man who produces or handles large herds of cattle. The point to be made in regard to the grower is that he must have the natural qualifications for intensive agriculture and must be fitted by training and experience for the growing and handling of crops requiring intensive cultivation.

DISEASES.

Diseases are among the most apparent limiting factors in sugar-beet production. A crop of beets that might otherwise be very profitable is frequently turned to a loss by some disease. The sugar beet, like all other plants, is subject to disease from the time it begins its growth until it is harvested; and even after the plants are harvested, if stored under certain conditions, the beets may decay to a greater or less extent, impairing or destroying their value for sugar-making purposes. Some of the diseases are well known and easily controlled; others, while known, are handled with difficulty; and still others are obscure as to their causes. The losses produced by diseases may be brought about by a destruction of the plant itself or by some injury which reduces the size or quality of the beet root.

Damping-off.—Among the diseases which attack the beet during the early stages of its growth is the so-called damping-off. There are several forms of this disease, due, apparently, to different organisms. Frequently the young beet plants turn black just at the surface of the gound, fall over, and die. Sometimes the entire root turns black and softens, and sometimes the blackening is confined to the outer layer or epidermis. In the latter case the beets frequently recover. This disease is caused either by a fungus or a bacterium which is in the soil or on the seed when planted. If the disease is widespread, so that the stand is seriously injured, the field should be disked and replanted. Damping-off is more common in the early spring, when the ground is damp and not thoroughly warm, but the disease will not occur unless one of the damping-off organisms is present.

Nematodes.[2]—The sugar-beet nematode is a minute wormlike organism, sometimes called an eelworm, which attaches itself to the

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[2] See list of publications on p. 57.

root and when present in sufficiently large numbers retards the growth of the beet. There are several species of the nematode which attack the sugar beet, but only one is considered especially serious; hence, this species is known as the sugar-beet nematode (*Heterodera schachtii*). This pest has been known for many years in Europe and has existed in isolated localities in this country for more than a decade. It is spreading, both by its own activity in certain stages of its existence and by being carried from the present infested areas by various agencies. The pest lives in the soil from year to year and travels slowly, so that the infested area is gradually increased, until frequently an entire field or even a group of fields may become useless from the standpoint of beet production. Unfortunately, this pest will attack many plants besides the sugar beet. This makes it extremely difficult to control by crop rotation, which is one of the best methods known for the control of many of our plant pests. However, there are numerous plants that the nematode attacks to a very slight extent or not at all. Again, the nematode passes through several stages of development; one of these is known as the brown-cyst stage. In this stage the nematode is very resistant to unfavorable conditions and will remain alive in the soil for a number of years; the exact length of time is not known. The Office of Sugar-Plant Investigations is making every effort to determine the crops that are resistant to the nematode under the local soil and climatic conditions where the nematode exists and also to determine the proper length of the rotation with these resistant crops, so that the nematodes will be reduced to such a small number that sugar beets may be grown with profit in spite of the pests. Various soil treatments also are being tested on nematode-infested areas. Some of these tests are very promising but will need to be repeated before anything definite can be said regarding their beneficial effects. Careful surveys have been made in some of the infested areas, and all fields or spots in fields containing nematodes have been listed and marked, either for study or for the purpose of growing crops other than sugar beets on them. A similar campaign is planned in the other infested areas where the sugar-beet nematode has gained a foothold, while a careful watch is being kept over all sugar-beet areas in order to detect and combat the pest on its first appearance.

Curly-top.—The curly-top is confined to the western part of the United States. So far as is known, it has not been seen in the eastern portion of the sugar-beet area or in any of the beet fields of foreign countries. It has appeared in practically all States west of Minnesota and Iowa where sugar beets are grown commercially, although it has not been seen in all of the sugar-beet areas of the West. It is not due to unfavorable climatic or soil conditions: nor is it due to the kind or quality of seed used. It is connected in some way with a so-called leafhopper, which appears to be only a carrier and not the real cause of this disease. A further study of curly-top has been undertaken by the Office of Sugar-Plant Investigations in cooperation with the Bureau of Entomology, in the hope of being able to determine the exact cause of the disease, and especially for the purpose of finding some practical means of control. Curly-top does not usually occur to any serious extent two years in succession in the same field, although there are some exceptions to this rule. Frequently it will occur over a given area, destroying or stunting to a worthless size practically all of the beets for a season and then almost entirely disappear, so that the next year beets of good tonnage and quality may be grown on the same fields. It is possible that there are other carriers besides the leafhopper and that certain soil and climatic conditions favor the development of this disease. The real cause, however, is undoubtedly organic in nature; it is probably either an organism or an organic compound; but until this cause is known little progress can be made in finding a reliable method of control. Curly-top has played an important part in closing at least two beet-sugar mills and has caused losses of hundreds of thousands of dollars in other localities.

Root-rot.—There are several destructive diseases of the sugar beet known as root-rot. One of these is due to a fungus called Phoma and another is due to a fungus known as Rhizoctonia. Other root rots less extensive or little known are due to other fungi or to bacteria. The Phoma rot seems to be more prevalent and more destructive than the Rhizoctonia. These fungi attack the beets in the field, usually in midsummer. Sometimes they destroy the plants before they are harvested, causing a serious loss to the grower. In other cases they make only a slight attack on the beet in the field, but develop more or less rapidly when the beet has been placed in storage, either for sugar-making purposes or for seed production. The Phoma fungus causes more loss to stored roots than any other agency, especially if the temperature favors the development of the fungus. These diseases are found in all parts of the sugar-beet area in this country and in Europe. The most successful means of combating the root-rot of beets in the field is crop rotation, and if it does not get started in the field there is little danger of its developing in storage.

Leaf-spot.—Two fungi which produce spots on the leaves of beets are more or less general throughout the United States and Europe. One of these is known as Cercospora and the other as Phoma; the latter is the same fungus that produces the root-rot. When the spores of either of these fungi fall upon the beet leaves and the conditions are favorable the fungus growth attacks the tissue of the leaf, producing distinct and characteristic spots. The Cercospora fungus does not generally attack any part of the beet plant except the leaf blade and the petiole, while the Phoma may attack leaf and root. If these fungi are present in large numbers they may do considerable damage to the beet crop. If the attacks are severe early in the season the growth of the beets is retarded, and consequently the yield is reduced. If the attacks do not occur until late in the season, after the beets have practically reached their normal growth the disease will reduce the sugar without appreciably affecting the tonnage. If these fungi attack the beets in midsummer both the yield and the quality will be generally reduced. These diseases may best be controlled by deep fall plowing and by crop rotation. Crop rotation is especially recommended where it can be practiced, but in cases where it is necessary to follow beets with beets after these diseases have appeared, the ground should be plowed in the fall to a good depth, not less than 12 to 14 inches. In fact, all plant-pathological problems, from a practical standpoint, are closely connected with the cultural phases of crop production. Production can not be successfully studied without a knowledge of the diseases affecting that particular crop, nor can the disease of a crop be intelligently considered with reference to control measures except in conjunction with the cultural practices and with a knowledge of the conditions under which that crop is grown.

INSECTS.

The principal insects affecting sugar beets have been treated in various publications of the Bureau of Entomology. A list of these publications is given at the end of this bulletin. Among the important forms which affect the leaves are webworms and the beet army worm. In some localities blister beetles, leaf beetles, and local pests do considerable damage, mainly by destroying the foliage. They also have a retarding effect on the growth of the beet, but the principal injury is due to the destruction of the foliage and the consequent expenditure of energy and food required by the plant to produce a new set of leaves. Usually these insects start in small areas on one side or a corner of a field and spread rapidly. Of some species there are several generations in a season, and if weather conditions favor their development much damage is frequently done. In the case of insects working early in the season the tonnage of the beets may be greatly reduced, and if the insects continue until late in the season the sugar content also will be lowered considerably. Sugar-beet insects as a general rule are more or less local and are seldom very destructive for more than one or two years in succession.

All biting or chewing forms of insects are susceptible to poisons and may be controlled by the use of arsenate of lead, Paris green, or other arsenicals.

The leafhopper, previously mentioned as a carrier of curly-top, is frequently very destructive indirectly. After feeding upon diseased plants it punctures the leaf blades or leaf stems of healthy beets with its slender beak and injects into the plant some substance or organism which exerts a decidedly unfavorable effect upon its growth.

Among insects working in or near the roots are cutworms, wireworms, and white grubs, all of which are very destructive. White grubs are abundant in sod land; therefore such lands should not be selected for growing sugar beets. Wireworms and cutworms as a rule are more destructive early in the season while the beets are small. They frequently destroy the stand to such an extent that replanting is necessary. Cutworms come from the surface of the ground and cut off the plants during the night. Poisoned baits, prepared and applied according to directions which will be furnished by the Bureau of Entomology, are practically perfect remedies. Wireworms usually follow the row of young beets when they have begun their work of destruction, and since they usually remain in a row a second planting should be made in the same direction, so that the rows are parallel and several inches from the original planting, without harrowing or disking. If this method is pursued the second planting will often become so large that little wireworm damage will be done. Other remedies, however, are necessary.[3]

The false chinch bug is a serious enemy to seed beets, frequently appearing in immense numbers and working on the growing tender seed stalks and leaves. When present in large numbers it frequently absorbs by suction so much of the vital juices of the plant that either the seed stalks are destroyed or the seed fails to mature. This insect may be controlled in limited areas by the use of contact sprays, such as nicotine sulphate, 40 per cent, or fish-oil soap. The false chinch bug usually makes its first appearance on a small number of plants. Gathering the bugs from these plants and destroying them is very helpful in controlling this pest.

BY-PRODUCTS.

The principal by-products connected with sugar-beet growing and beet-sugar production are the beet tops, pulp, and lime. The first two of these have already been considered under live stock. The lime is an important by-product of the mill used in purifying the juice in the process of separating the sugar from the nonsugars in solution. For this purpose limestone is obtained and burned. The limestone should be as pure as it is possible to find it and should be thoroughly

[3] See Bulletin 123, Bureau of Entomology, U. S. Dept. Agr., "A preliminary report on the sugar-beet wireworm," 68 p., 23 pls., 9 figs. 1914. (Superintendent of Documents, Washington, D. C., price 25 cents.)

and evenly burned. The beet juice is treated with this burned limestone, and a large part of the mineral matter taken up by the beet plants in the process of growth combines with the lime and is removed by filtering. The lime is then washed out or otherwise removed from the mill and is known as waste lime or lime sludge. Large quantities of this material accumulate at the various mills and may be used as a soil improver and as a fertilizer. It is beneficial chiefly because of the lime, which tends to improve the physical condition of the soil, and slightly because of the mineral matter that the lime has removed from the beet juice. The use of this material as a fertilizer has not become general in this country. In some of the beet-sugar countries in Europe this by-product is all used in making commercial fertilizers. It is used in part as a filler in the manufacture of fertilizer and in part as a soil improver just as it comes from the sugar mill. It therefore has in this country two possibilities: First, it may be used just as it comes from the mill, and, second, it may be used in the manufacture of commercial fertilizers. When first removed from the mill it is wet and can be handled with difficulty, but it soon dries sufficiently to be handled readily, is friable and easily incorporated with the soil, and should all be used in improving farm lands. In some localities where the value of this material has been realized it is washed out and carried in ditches or flumes to the fields, where it is spread by the irrigating water. In this way it may be handled quickly at a minimum cost, and if care is taken it may be evenly spread. As soon as the ground on which the lime has been spread is sufficiently dry it should be plowed and the lime thoroughly mixed with the soil.

For sugar-beet culture there is very little danger of getting too much lime in the soil. Beets not only thrive well on limed soil, but the lime seems to have a beneficial effect under some conditions in retarding the development of certain plant diseases.

ROADS.

One of the most important factors in developing a beet-sugar industry is that of roads. Certain localities otherwise adapted to sugar-beet growing have been found in which this crop can not be recommended or encouraged because of the condition of the roads. Fortunately the interest in roads during the past few years has greatly reduced the number of such localities. Road building and sugar-beet culture have been mutually helpful. It is only by having good roads that crops which must be hauled to market in numerous heavy loads can be handled successfully; likewise, the demand that these crops have made for good roads has stimulated their building and improvement, as shown in Plate VI, figure 2.

There are three points to be considered in connection with roads as related to sugar-beet culture: (1) The length of the haul, (2) the topography of the country, and (3) the nature of the roadbed. In general it has been found that 4 or 5 miles is the maximum distance that sugar beets can be hauled profitably. It is apparent that the distance depends to a great extent upon the topography and the nature of the roadbed. If the country is hilly, and especially if the hills are steep, it frequently is unprofitable to haul sugar beets.

Unless at least 3 tons of beets can be hauled per load the conditions must be very favorable to make the handling of this crop profitable. In the survey by the Office of Sugar-Plant Investigations, cooperating with the Office of Farm Management and Farm Economics, it has been found that, other things being equal, the cost of delivering beet roots increases directly with the distance. In this survey the topography and the care of the roadbed were practically the same for all cases compared. It is apparent that it would be more expensive to haul a short distance over a poor or hilly road than several times that distance over a level stone road (Pl. VI, fig. 2.) In speaking of the hauling distance, reference is made not to the distance from the factory, but to the loading station or point of delivery. In this respect the grower near the sugar mill has no advantage over the grower many miles away, provided the latter is near a beet dump.

The railroad haul is another point to be considered. As a rule, beets can not be transported more than 100 miles with profit, at least under normal conditions. There are, of course, circumstances under which longer hauls are permissible and profitable. Frequently in trying out a new sugar-beet section it is necessary to haul the roots several hundred miles, but in such cases it is not expected that any considerable profit will be obtained from these beets, and, in fact, they sometimes are transported long distances at a loss in order to determine whether beets of sufficient yield and quality to make beet growing profitable can be grown in a given locality. The length of the railroad haul depends to some extent upon the local conditions, the returns that may be obtained, and whether the haul is over a single road or over two or more lines.

CONTRACTS.

All sugar beets grown commercially for sugar-making purposes are grown under contract. These contracts are issued by the sugar company and are signed by some official or agent of the company and also by the beet grower. The principal points covered in the contracts include the acreage to be planted, the price to be paid for the beets, the methods of handling the crop, the time of harvest, and the regulation of delivery. Contracts are necessary because a definite acreage of sugar beets is required in order to make a successful mill run. Each mill should have enough raw material for at least a 100-day run, although the average operating period for 1920 was only 91 days, as shown by Table IV. It would be a source of loss to the sugar company to undertake to operate a mill with beets enough for only 50 days, or at half capacity. Knowing the average yield of beets per acre in a given locality, it is comparatively simple to determine approximately the number of acres that will be required to produce a satisfactory run under normal conditions. Furthermore, it is important that the sugar company shall have a written agreement or contract setting forth the time of delivery of the beets. Beet roots must be delivered in sufficient quantity to supply the mill from day to day. It is very expensive to close a mill and let it remain idle even for a few hours during the sugar-making period; hence, there must be some understanding with regard to the delivery of the beets. On the other hand, the beets must not be delivered too rapidly, since they might deteriorate in quality if stored too long, especially in certain localities or under certain climatic conditions where the spoiling of the beets before they could be put through the mill might be a matter of considerable magnitude.

The growers require a contract because they must be insured a market for the beets at a fixed price. This is one of the few crops grown on a commercial scale in which the market price or at least the basis for fixing the price is known even before the seed is planted and for which there is no market of any importance except for sugar-making purposes.

There are three general forms of contract so far as the price to be paid for beet roots is concerned, namely, the flat rate, the sliding scale, and the profit-sharing plan. This feature of the contract relating to the price of beets differs with different companies and in different localities.

Flat rate.—The flat-rate contract fixes a definite price which the farmers are to receive for the beets regardless of the quality of the roots. It is usually stipulated in the contract that the roots must possess a specified sugar content and purity in order to be accepted, but in all of the beet-growing areas there is no record that any sound sugar beets have been rejected because of poor quality. The advantage in this clause in the contract lies in the fact that the fields that are not testing as high in sugar and purity as is required by the contract can be held until a later date before harvesting. Usually the sugar content of the roots increases rapidly in the fall, so that a delay of a few days at or near harvesting time frequently means a decided increase in the sugar content and an improvement in the purity of the roots. The flat rate is the price per ton for the clean and properly topped roots. It differs in different localities and varies from year to year in the same locality. The direction and extent of the variation depend upon labor conditions and upon the wholesale price of sugar.

Sliding scale.—The second form of contract so far as the price of the beet roots is concerned is the so-called sliding scale. The other features in the contract, aside from the price to be paid for the beets, are usually the same as in the flat-rate contract. The sliding scale of beet prices is based either upon the percentage of sugar in the beet or upon the market price of sugar at a given time and place, or it is based upon a combination of the sugar in the beet and the price of sugar. In those contracts in which the scale of prices for beets depends upon the sugar content of the beet root there is a minimum price per ton for a beet of a given quality and an increased price per ton for each unit or fraction of 1 per cent of sugar in the beet above the minimum. The minimum price and the minimum quality of the root agreed upon differ in different localities, but are definitely stated in the contract. The rate of increase also varies in different localities; for example, one sugar company may agree to pay a minimum price of $5 per ton for beets testing 12 per cent sugar, while another company may agree to pay a minimum price of $6 per ton for a minimum of 14 per cent sugar content. They may also agree to increase the price 25 cents or 33⅓ cents per ton for each per cent of sugar above the minimum.

The price scale for beets, based upon the market price of sugar, was in use in several localities for the first time in 1917. Since that date the price of sugar has played an important part in the price of beet roots in all sugar-beet areas. In these contracts the price of sugar at a given time and for a definite stated period is taken as the basis. If the price of sugar at the place and for the time specified is $6 per hundred, for example, the price paid for the beets will be $6 per ton or $7 per ton, as may be agreed upon and specified in the contract. Usually a minimum price to be paid for the roots is stated in the contract with a stated increase for each unit of increase in the price of sugar. This would seem to be an equitable arrangement, since the greatest profit to the grower and to the sugar company would result when the price of sugar is high, and both would share the smaller profit or the loss when the price of sugar is low.

Profit sharing.—In the profit-sharing contract the grower is guaranteed a fixed minimum price for beets, the sugar companies to accept a minimum price for sugar, which presumably will give the grower and the sugar company approximately the same profit per ton of beets. It is further agreed that all profits in excess of the amounts above mentioned shall be divided equally between the grower and the sugar company. In areas where this contract or the sliding scale contract is offered the grower, a flat-rate contract is available, if desired.

Tare.—One of the important factors in handling sugar beets is that of tare, and it forms an important clause in the contract. Tare consists of two distinct parts, one of which is the dirt which clings to the beet roots when delivered, and the other is the part of the crown that is sometimes left on the beet when the beet is topped. Tare is obtained by taking a sample from a load of beets and weighing it carefully. The dirt is then removed from this sample, usually by means of a stiff brush, and the beets, if not properly topped, are correctly topped and the cleaned, topped roots again weighed. The difference between the original weight of the sample and the clean, properly topped beets is the tare. This is usually reduced to a percentage, and the entire load is tared on the basis of the sample tared. Most sugar-beet tare houses are provided with scales that give a direct reading of the percentage of tare for each sample as it is weighed.

AREA COMPETITION.

Competition for acreage between adjacent sugar-beet areas secured by different sugar companies may or may not be of advantage to the beet-sugar industry as a whole, and consequently may or may not be beneficial to beet growers residing within those areas. If the acreage in a given area is sufficient to support two mills, for example, the competition in securing acreage for each of these mills may, if properly handled, stimulate the development of the industry in that area. If, on the other hand, a sugar mill is established in a given area having a limited sugar-beet acreage, due regard being had for proper crop rotation, and a second mill is built in the same area, the results may be disastrous to both of the mills and may result in retarding or preventing the development of the beet-sugar industry in that locality.

In all lines of business, competition is desirable under certain conditions, but in the beet-sugar industry a certain acreage of beets is necessary to enable a sugar mill to operate on a profitable basis. If a competing mill draws upon the beet acreage in a given locality to such an extent that the raw material is not sufficient to provide a satisfactory and profitable run for either of the mills, one or both of them must necessarily suspend operations. This result must lead to disappointment and financial loss on the part of those who have invested in the mills, and it deprives the growers of the benefits of sugar-beet production, inasmuch as the closing of the mills must necessarily leave the growers without a market for their product.

Sugar-beet producing areas may sometimes be extended by bringing in lands not previously under cultivation, by the development or extension of suitable means of irrigation, or by instituting or extending a suitable drainage system which will reclaim lands not now under cultivation. In this manner areas that are now capable of supplying but one mill with raw material may eventually be made to supply two or more mills. In all cases the necessary acreage for the maintenance of a mill should be in sight, without injury to existing mills or to local growers, before any money is expended in the erection of another mill. If this point is kept in mind, some of the financial losses and disappointments which investors have experienced in the past will be avoided.

SUGAR-BEET SEED.

One of the most important factors influencing beet-sugar production is that of seed. Not only must there be an adequate supply of seed to plant the necessary acreage for each sugar factory, but the seed must be of high grade; that is, it must be capable of germinating so that a good stand will be produced, and it must be capable of producing beets of satisfactory yield and quality. The present varieties of sugar-beet seed are apparently very much mixed, as indicated by commercial fields in all parts of the beet area. Efforts are being made at each of the beet-seed stations of the Office of Sugar-Plant Investigations to produce distinct strains of sugar beets of high quality for commercial planting. An endeavor is being made to increase the yield and quality of the seed and to establish an American beet-seed industry capable of meeting all domestic requirements.

Imported seed.—Until within recent years practically all sugar-beet seed planted in the United States was imported from Europe. This imported seed consisted of more than 20 so-called varieties, many of these varieties being simply strains bearing the name of the growers or the locality where the seed was produced. There appears to be little difference in results between the varieties imported. More seems to depend upon soil and climatic conditions and the cultural methods used in growing the crop than upon the particular variety of seed used.

Home-grown seed.—In recent years efforts have been made to produce American strains of sugar-beet seed and to produce them in commercial quantities in this country. In 1917 about 5,000 acres of beet seed were grown, yielding about 55,000 sacks of seed, and a still larger crop of American-grown seed has been produced with each succeeding year. In 1920 about one-third of the sugar-beet seed required by American growers was produced in the United States. Even with an increased home production, we must continue for some time to look to foreign countries for a considerable part of our beet-seed supply. To make our beet-sugar industry safe and to insure American growers of sugar beets an adequate supply of high-grade seed free from the seed of stock beets we should produce annually from 16,000 to 20,000 acres of beet seed. This acreage must necessarily be increased from year to year to care for the constantly increasing acreage of sugar beets if the American beet-sugar industry is to be made safe and permanent.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE RELATING TO SUGAR AND ITS PRODUCTION.

PUBLICATIONS AVAILABLE FOR FREE DISTRIBUTION.

Sugar and Its Value as Food. (Farmers' Bulletin 535.)

Sugar-Beet Growing under Irrigation. (Farmers' Bulletin 567, second revision.)

Sugar-Beet Growing under Humid Conditions. (Farmers' Bulletin 568, second revision.)

Leaf-Spot: A Disease of the Sugar Beet. (Farmers' Bulletin 618.)

Grasshoppers and Their Control on Sugar Beets and Truck Crops. (Farmers' Bulletin 691.)

The False Chinch Bug and Measures for Controlling It. (Farmers' Bulletin 762.)

Control of the Sugar-Beet Nematode. (Farmers' Bulletin 772.)

Sugar-Beet Sirup. (Farmers' Bulletin 823.)

Rodent Pests of the Farm. (Farmers' Bulletin 932.)

Saving Man Labor in Sugar-Beet Fields. (Farmers' Bulletin 1042.)

Beet-Top Silage and Other By-Products of the Sugar Beet. (Farmers' Bulletin 1095.)

Sugar-Beet Seed Growing in the Rocky Mountain States. (Farmers' Bulletin 1152.)

The Sugar-Beet Nematode in the Western United States. (Farmers' Bulletin 1248.)

Loss in Tonnage of Sugar Beets by Drying. (Department Bulletin No. 199.)

Conditions Influencing the Production of Sugar-Beet Seed in the United States. (Separate 503 from Yearbook for 1909.)

The Present Status of the Sugar-Beet Seed Industry in the United States. (Separate 695 from Yearbook for 1916.)

Destroying Rodent Pests on the Farm. (Separate 708 from Yearbook for 1916.)

Statistics of Crops Other than Grain Crops. (Separate 720 from Yearbook for 1916.)

Sugar Supply of the United States. (Separate 756 from Yearbook for 1917.)

Thrips as Pollinators of Beet Flowers. (Department Bulletin No. 104.)

Farm Practice in Growing Sugar Beets for Three Districts in Utah and Idaho, 1914–15. (Department Bulletin No. 693.)

Farm Practice in Growing Sugar Beets for Three Districts in Colorado, 1914–15. (Department Bulletin No. 726.)

Farm Practice in Growing Sugar Beets in the Billings Region of Montana. (Department Bulletin No. 735.)

Farm Practice in Growing Sugar Beets in Michigan and Ohio. (Department Bulletin No. 748.)

Farm Practice in Growing Sugar Beets in Three California Districts. (Department Bulletin No. 760.)

Farm Practice in Growing Field Crops in Three Sugar-Beet Districts of Colorado. (Department Bulletin No. 917.)

The Agricultural Situation for 1918. Pt. III, Sugar. (Secretary Circular No. 86.)

Sugar Supply of the United States; Its Extent and Distribution on August 31, 1917. (Secretary Circular No. 96.)

PUBLICATIONS FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C.

The Sugar Beet: Culture, Seed Development, Manufacture, and Statistics. (Farmers' Bulletin 52.) Price, 5 cents.

Irrigation of Sugar Beets. (Farmers' Bulletin 392.) Price, 5 cents.

Statistics of Sugar in the United States and Its Insular Possessions, 1881–1912. (Department Bulletin No. 66.) Price, 5 cents.

Field Studies of the Crown-Gall of Sugar Beets. (Department Bulletin No. 203.) Price, 5 cents.

The Sugar-Beet Thrips. (Department Bulletin No. 421.) Price, 5 cents.

Production of Sugar in the United States and Foreign Countries. (Department Bulletin No. 473.) Price, 10 cents.

The Beet Leaf-Beetle. (Department Bulletin No. 892.) Price, 15 cents.

Curly-Top, a Disease of the Sugar Beet. (Bureau of Plant Industry Bulletin No. 122.) Price, 15 cents.

The Curly-Top of Beets. (Bureau of Plant Industry Bulletin No. 181.) Price, 15 cents.

A Biochemical Study of the Curly-Top of Sugar Beets. (Bureau of Plant Industry Bulletin No. 277.) Price, 5 cents.

Experiments with Sugar Beets in 1893. (Bureau of Chemistry Bulletin No. 39.) Price, 5 cents.

The Influence of Environment upon the Composition of the Sugar Beet, 1902, Including a Study of Irrigated Sections. (Bureau of Chemistry Bulletin No. 78.) Price, 5 cents.

Analyses of Sugar Beets, 1905 to 1910, together with Methods of Sugar Determination. (Bureau of Chemistry Bulletin No. 146.) Price, 10 cents.

[The Beet Army Worm.] *In* Proceedings of the Twelfth Annual Meeting of the Association of Economic Entomologists. (Bureau of Entomology Bulletin No. 26, p. 79.) Price, 10 cents.

A Brief Account of the Principal Insect Enemies of the Sugar Beet. (Bureau of Entomology Bulletin No. 43.) Price, 5 cents.

The Sugar-Beet Crown-Borer. *In* Some Miscellaneous Results of the Work of the Bureau of Entomology. (Bureau of Entomology Bulletin No. 54, pp. 34–40.) Price, 10 cents.

The Beet Army Worm. *In* Report on Miscellaneous Cotton Insects in Texas. (Bureau of Entomology Bulletin No. 57, pp. 35–36.) Price, 5 cents.

The Leafhoppers of the Sugar Beet and Their Relation to the "Curly-Leaf" Condition. (Bureau of Entomology Bulletin No. 66, part 4.) Price, 10 cents.

The Hawaiian Beet Webworm. (Bureau of Entomology Bulletin No. 109, part 1.) Price, 5 cents.

The Southern Beet Webworm. (Bureau of Entomology Bulletin No. 109, part 2.) Price, 5 cents.

The Sugar-Beet Webworm. (Bureau of Entomology Bulletin No. 109, part 6.) Price, 5 cents.

A Preliminary Report on the Sugar-Beet Wireworm. (Bureau of Entomology Bulletin No. 123.) Price, 25 cents.

Utilization of Residues from Beet-Sugar Manufacture in Cattle Feeding. (Separate 137 from Yearbook for 1898.) Price, 5 cents.

Relation of Sugar Beets to General Farming. (Separate 320 from Yearbook for 1903.) Price, 5 cents.

Progress of the Beet-Sugar Industry in the United States in 1909. (Report No. 92.) Price, 10 cents.

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 996

Contribution from the Bureau of Animal Industry
JOHN R. MOHLER, Chief

Washington, D. C. ▲ October 12, 1921

FLUSHING AND OTHER MEANS OF INCREASING LAMB YIELDS.[1]

By F. R. Marshall and C. G. Potts, *Animal Husbandry Division.*

CONTENTS.

EXTENT TO WHICH FLUSHING IS PRACTICED IN THE UNITED STATES.

THE BELIEF that extra feeding of ewes at the time they were bred would result in larger yields of lambs has long been held by students of sheep husbandry. Feeding for this purpose is commonly called "flushing." Though flushing has been practiced by a few breeders of purebred sheep, it has not been generally or seriously considered by flock owners producing market lambs. Practically no figures or results of experiments have been obtainable as to the extent of increase in the lamb crop that could be obtained by flushing the ewes.

This bulletin presents the results of five years' experiments in flushing ewes, covering a total of 302 matings. These experiments were conducted on that portion of the Bureau of Animal Industry farm at Beltsville, Md., known as "Sheep Acres," and at the United States Morgan Horse Farm, Middlebury, Vt. There is added a discussion of other matters to be considered in endeavoring to obtain maximum yields of lambs.

[1] R. B. Millin, now of the Montana Agricultural College, assisted in the early development of the experiments reported in this bulletin.

FACTORS INFLUENCING SIZE OF LAMB CROP.

The size of the lamb crop is dependent upon two things—the number of dry ewes (those not having lambs) and the number of twins and triplets. Under ordinary farm-flock conditions the proportion of dry ewes is insignificant. In range flocks, however, it is a principal cause of lower lamb yields, and it is often impossible to furnish the feed necessary to put the ewes into condition to make sure of their getting in lamb.

The advantages of flushing are to be obtained principally through an increased number of twins. It has not been proved that the sire influences the number of twins occurring among his offspring. The production of twins or triplets is determined chiefly, if not entirely, by the ewe. Twins may result in either of two ways. First, two developed ova (eggs) may be discharged from the ovaries during the period of heat. Second, a single fertilized ovum may become divided at an early stage and each part develop a fetus. The first is believed to be the more common cause of twins. The production of a second or third ovum is thought to be largely influenced by the condition of the ewe and on this basis the connection between flushing and twin births is rendered very clear.

To show the connection between production of twin lambs and maturing of extra ova, Marshall[2] slaughtered 55 Black-faced Highland sheep shortly after breeding and examined the ovaries to learn the number of ova that were produced. His findings were as follows:

1 ruptured follicle in one ovary—1 ovum produced	42 cases.
1 ruptured follicle in each ovary—2 ova produced	7 cases.
2 ruptured follicles in one ovary—2 ova produced	5 cases.
2 ruptured follicles in one ovary and one in the other—3 ova produced	1 case.

In this case if the ewes had been kept and if all the ova had been fertilized and all developed normally, the result would have been 42 single lambs, 12 pairs of twins, and one set of triplets, a total lamb crop equal to 125.4 per cent of the number of ewes bred. The report of this experiment states that this is higher than the ordinary returns from flocks of the breed and that apparently under ordinary conditions some of the ova do not produce lambs.

It is a common observation that the twin lambs in a flock are produced chiefly in the early part of the lambing season. In 302 cases of lambing in purebred Southdown ewes used in experiments conducted by the Bureau of Animal Industry and extending over five years, 78 per cent of the ewes dropping twins lambed during the first half of the lambing period.

The explanation of these facts must be found in one of two things, either of which has an important relation to management for maxi-

[2] The Œstrous Cycle and the Formation of Corpus Luteum in Sheep. In Philosophical Transactions of the Royal Society, Series B, No. 196.

mum lamb yields: (1) The ewes that are in the best nourished condition and therefore more likely to produce two ova are also those first to come in heat and get in lamb, or, (2) the feed and pasturage are more nutritious early in the season and cause production of more ova by the ewes bred at that time.

In the Bureau of Animal Industry experiments the use of rams began about September 7 to September 10, but in most cases only one or two ewes were bred during the first 10 days. It therefore seems that the ewes ordinarily bred first are those that owing to their better physical condition first come in heat at the beginning of the breeding season, and that their condition is at once the cause of their showing heat earlier and their producing twins.

An overfat condition may derange the normal action of the ovaries even more seriously than a thin condition. It seldom occurs except in stock fitted for show or in ewes that have missed getting in lamb and grown fat while running dry. In our experiments there have been some rather fat dry ewes which got in lamb as readily as other ewes. They were not allowed grain, however, and had plenty of exercise.

RESULTS OF EXPERIMENTS IN FLUSHING EWES.

GENERAL PLAN OF THE EXPERIMENTS.

The experiments were made with purebred Southdown ewes, all of which had been bred in the Bureau of Animal Industry flocks. The number of animals was 302, divided into 17 lots, of which Lots 1, 2, 5, and 6 were at the Morgan Horse Farm, Middlebury, Vt., and Lots 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17 at the bureau farm, Beltsville, Md. The ewes were usually in good condition compared with general farm flocks, which it is thought would tend to lessen the effect of flushing.

In all the tests the lots of ewes were divided with careful regard to age, number of lambs dropped in previous years, gain in weight prior to experiment, and the rams to which bred. As it was necessary to use a number of different rams in each flock, hand breeding[3] was followed, which with the use of teasers[4] made it possible to record the date of each service and at the same time mate each ewe to the ram desired. Approximately the same number of ewes in each lot were bred to each of the rams used that season. In one case the proportion was disturbed because one of the rams was not a sure breeder and some of the ewes booked to him did not get in lamb. Such cases were eliminated from the experiment. The data given are in all cases for ewes having lambs. The matter of dry ewes and the influence of rams upon the lamb yield are discussed separately.

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[3] "Hand breeding" is a term applied to the individual mating of a ram and ewe outside the flock.

[4] "Teaser" applies to a ram used in a flock for the purpose of indicating the ewes which are in heat. Copulation is prevented by an apron tied around the ram's body.

The amount of grain fed was never less than one-half pound per ewe daily; in a few cases it was as much as three-fourths of a pound. The grain mixture used is given in Table 1. The gains shown are the averages for each lot, each ewe's gain covering the period from one to two weeks prior to the dates the rams were first used up to the date of the service to which she lambed.

It was planned to hold the unflushed lots without making any gains in weight during the breeding season. Except in the case of Lots 11 and 14, the pasturage was the same for the flushed and unflushed lots. There was considerable irregularity in the gains of individual ewes. Some of those in the unflushed lots made quite large gains, while some in the flushed lots made little or no gain. However, the fact of having grain feed may be considered to result in a more highly nourished body condition, even if not reflected in gains in weight.

In all the Vermont flock tests, all lots were run on blue-grass pastures. All the lots in the Maryland flock were grazed on forage crops, soy beans being chiefly used during the breeding season.

NUMBER OF LAMBS DROPPED.

An average increase of 18.1 per cent in the number of lambs dropped was obtained as a result of flushing in the experiments here reported. This figure applies to 302 lambings of 143 different ewes used in the fall breeding seasons of 1916 to 1920, inclusive, and includes the total number of lambs dropped, living or dead, the percentage being based on the number of ewes having lambs.

As shown in Table 1, the smallest result from flushing obtained in any one of the separate trials was 3.2 per cent. This was in the case of Lots 5 and 6, bred at the Morgan Horse Farm, Middlebury, Vt., in the fall of 1917. Both lots of ewes were in very good condition and ran on similar grass pastures. Although fed grain (14 parts corn, 5 parts bran, 1 part linseed-oil meal) at the rate of one-half pound each daily, the flushed lot made an average gain of only 6.3 pounds per head from September 10 until they were in lamb, while in the corresponding time the ewes not fed grain gained 4.6 pounds per head.

The most pronounced effects of flushing are seen by comparing Lot 3 with Lot 4 and Lot 9 with Lots 10 and 11. In the case of Lots 3 and 4, both of which were in quite low condition when breeding commenced, there was an increased gain of 12.38 pounds in weight in the flushed over the unflushed lot and an increase of 30 per cent in lambs dropped. In the second instance the 15 unflushed ewes (Lot 9) gained 3.03 pounds each from September 10 to the time of getting in lamb, the average date of which was October 5. This lot produced 120 per cent of lambs. During the same time 150 per cent of lambs was yielded from a lot of 14 ewes (Lot 10) receiving grain, and 145.5 per cent for 11 ewes (Lot 11) kept on sufficiently good pasture to cause them to gain 10.96 pounds each from September 10 until in lamb, the average date being October 14.

TABLE 1.—*Effect of flushing on yield of lambs from Southdown ewes.*[1]

Unflushed lots.							Flushed lots.								
Lot No.	Number in lot.	Date breeding started.	Average date of first service.[2]	Average date of conception.[3]	Average gain in weight.[4]	Lambs dropped.	Lot No.	Number in lot.	Feed given.	Date breeding started.	Average date of first service.[2]	Average date of conception.[3]	Average gain in weight.[4]	Lambs dropped.
					Pounds.	*Per cent.*							*Pounds.*	*Per cent.*
1	15	Sept. 9, 1916	Sept. 28, 1916	Oct. 8, 1916	2.58	126.7	2	25	Corn and oats	Sept. 9, 1916	Sept. 27, 1916	Oct. 17, 1916	4.32	140
3	10	Sept. 1, 1916	Oct. 1, 1916	Nov. 2, 1916	4.75	110	4	15	Corn, 14 parts; bran, 5 parts; linseed-oil meal, 1 part.	Sept. 1, 1916	Sept. 23, 1916	Oct. 24, 1916	17.13	140
5	19	Sept. 10, 1917	Sept. 28, 1917	Oct. 12, 1917	4.58	136.8	6	20	do	Sept. 10, 1917	Sept. 28, 1917	Oct. 10, 1917	6.3	140
7	17	Sept. 1, 1917	Sept. 21, 1917	Oct. 6, 1917	1.03	129.4	8	13	do	Sept. 1, 1917	Sept. 24, 1917	Oct. 8, 1917	2.85	161.5
9	15	Sept. 10, 1918	Oct. 4, 1918	Oct. 5, 1918	3.03	120	10	14	Oats	Sept. 10, 1918	Oct. 1, 1918	Oct. 6, 1918	12.31	150
							11	11	Extra pasture	do	Oct. 2, 1918	Oct. 14, 1918	10.96	145.5
12	25	Sept. 10, 1919	Sept. 17, 1919	Oct. 9, 1919	.76	136	13	21	Corn, 4 parts; oats, 4 parts; bran, 2 parts; linseed-oil meal, 1 part.	Sept. 10, 1919	Sept. 30, 1919	Oct. 20, 1919	10.8	147.6
							14	21	Extra pasture	do	Sept. 25, 1919	Oct. 7, 1919	3.76	152.4
15	24	Sept. 10, 1920	Sept. 25, 1920	Oct. 2, 1920	−1.46	129.16	16	20	Corn, 4 parts; oats, 4 parts; bran, 2 parts; linseed-oil meal, 1 part.	Sept. 10, 1920	Sept. 23, 1920	Oct. 3, 1920	5.80	150
							17	17	Extra pasture	do	Sept. 28, 1920	Oct. 9, 1920	10.00	147.05
Average.	18		Sept. 26	Oct. 11	1.76	128.8		25			Sept. 27	Oct. 12	7.98	146.9

[1] This table includes only ewes dropping lambs. The small number of ewes not getting in lamb in no case appeared to be due either to flushing or not being flushed.
[2] The dates of first service show the effect of flushing upon bringing ewes into heat earlier.
[3] The date of conception is considered to be that of recorded date of service nearest to 147 days prior to lambing.
[4] From date breeding started to date of conception.

Breeds having a larger proportion of twin births than the Southdowns can be expected to give larger returns from flushing. Also, most farm ewes should show larger increases in lamb yields as a result of flushing than were obtained in these experiments because of the fact that ordinarily they are thinner at the time of breeding.

RELATION OF WEIGHT GAINS TO NUMBER OF TWINS.

Individual weights of the ewes were kept, and these permit an analysis of the relation between actual gains and numbers of twins produced.

Of 30 cases in which ewes lost 1 to 7 pounds during the breeding season, twins were produced by 11, or 37 per cent.

Of 133 cases in which ewes gained up to 7 pounds during the breeding season, twins were produced by 45, or 34 per cent.

Of 74 cases in which ewes gained 7 to 30 pounds during the breeding season, twins were produced by 33, or 44 per cent.

These results suggest that in order to produce the largest number of twins, ewes should gain 7 pounds or more.

FEED FOR FLUSHING.

With regard to kinds of feed most effective and most economical for use in flushing, no data have been obtained except in the cases of Lots 11 and 14. These lots had first access to good growths of soy beans, while the grain-fed lots and the unflushed lots followed on the same grazing after the pasture-flushed lots were moved forward. The difference in the grazing so obtained caused Lot 11 to gain 3 pounds more than Lot 9 in 1918 and Lot 14 to gain 4 pounds more than Lot 12 in 1919. In 1918 the pasture-flushed Lot No. 11 produced 4.5 per cent fewer lambs than the grain-flushed Lot No. 10, while in 1919 the pasture-flushed Lot No. 14 produced 4.8 per cent more lambs than the grain-flushed Lot No. 13.

This would indicate that there is no decided advantage in the kind of feed used in flushing other than the saving in labor and more expensive grain feed when pasture flushing is practiced. There are times, however, owing to unfavorable weather, when good pasture is not available and pastures are too short even to hold ewes at their initial weight. In such cases grain could no doubt be economically used.

EARLINESS OF LAMBING.

In addition to the increase in the number of lambs from flushed ewes, it has been believed that the extra nourishment brought the ewes in heat earlier and thereby resulted in earlier lambs. This is a reasonable expectation when the rams are in service at the beginning of the breeding season.

In all but two cases flushed ewes came to the first service earlier than those unflushed, the time ranging from one-half day to 8 days.

UNIFORMITY OF LAMBS' AGES.

Having all the lambs of about the same age is a great advantage in marketing and flock management. Since flushing brings ewes to service earlier, it should be a great aid in preventing late lambs. This expectation was not realized, however, in the experiments. More of the cases of not getting in lamb until the second or third service occurred among the flushed ewes and was of course followed by a larger proportion of late lambs.

The number of ewes lambing to each successive service in each year is shown in the following table; the ewes which were bred after being interchanged between lots are not included:

TABLE 2.—*Number and per cent of ewes getting in lamb at each service.*

Year.	Unflushed lots.							Flushed lots.						
	Lot No.	Ewes in lot.	Service.					Lot No.	Ewes in lot.	Service.				
			1st.	2d.	3d.	4th.	5th.			1st.	2d.	3d.	4th.	5th.
1916	1	15	8	5	2	0	0	2	25	10	10	3	1	1
	3	10	0	4	5	1	0	4	15	7	7	1	0	0
1917	5	19	15	3	1	0	0	6	20	15	3	2	0	0
	7	17	7	4	5	1	0	8	13	6	3	3	1	0
1918	9	15	14	1	0	0	0	10	14	11	3	0	0	0
	......	......	......	......	......	......	......	11	11	7	2	1	1	0
1919	12	25	13	9	2	1	0	13	21	6	7	6	2	0
	......	......	......	......	......	......	......	14	21	12	3	6	0	0
1920	15	20	11	8	0	1	0	16	20	13	4	2	1	0
	......	......	......	......	......	......	......	17	16	9	4	1	1	1
Total	......	121	68	34	15	4	0	......	176	96	46	25	7	2
Per cent.	......	......	56	28	13	3	0	......	......	55	26	14	4	1

TWIN PRODUCTION AS AFFECTED BY AGE OF EWE.

Flock records of the Bureau of Animal Industry show a gradual rise in the proportion of twins born until the ewes are 5 and 6 years old. There is a possibility that this is due in part to elimination of ewes not dropping twins. In our experimental flocks, however, ewes have never been discarded on that account, although some ewes have been kept to advanced age that might have been disposed of one or two seasons earlier if it had not been for their marked prolificacy. The figures given in Table 3 for ewes over 6 years old may, therefore, have been to a slight extent affected by selection. The data given include nine years' records. The ages are those at time of lambing and not at time bred.

TABLE 3.—*Effect of age of ewes on per cent of lambs dropped in experimental flocks.*

Age of ewes.	Cases of lambing.	Lambs dropped.	Age of ewes.	Cases of lambing.	Lambs dropped.
Years.		*Per cent.*	*Years.*		*Per cent.*
2	79	111.4	6	49	161.2
3	63	123.8	7	35	142.8
4	67	143.3	8	22	113.6
5	62	143.5	9	8	162.5

TWIN PRODUCTION AS AFFECTED BY BREED OF EWE.

Evidence as to inheritance of fertility makes it appear that various breeds or strains have each an inherited limit of fertility and that the obtaining of the full possibility in any one season will be determined by the extent to which the conditions and management favor the full utilization of the inherited capacity.

Records of actual returns from 189 flocks representing 9 breeds for the seasons of 1919 and 1920 were obtained by the Animal Husbandry Division through the kindness of breeders who reported. The average per cent of lambs in proportion to ewes, lambing in the spring, is shown below, also the separate record of the 2-year-old ewes (dropping lambs the first time) and the highest flock average reported for each breed. The table gives the average of the two seasons' reports. The high return for the breed is for a single season.

TABLE 4.—*Record of lamb crops, by breeds, from 189 flocks.*

[Average of seasons 1919 and 1920.]

Breed.	Flocks.	2-year-old ewes.		Aged ewes.		Total ewes.		Highest flock.	
		Ewes.	Lambs dropped.	Ewes.	Lambs dropped.	Ewes.	Lambs dropped.	Ewes.	Lambs dropped.
	Number.	*Number.*	*Per cent.*	*Number.*	*Per cent.*	*Number.*	*Per cent.*	*Number.*	*Per cent.*
Dorset	26	215	146	566	163	781	158	6	200
Lincoln	11	40	145	106	161	146	157	11	191
Oxford	18	96	144	214	156	310	152	6	200
Southdown	27	138	143	378	153	516	151	6	200
Hampshire	26	549	139	857	148	1,406	144	6	200
Cotswold	16	91	135	190	148	281	144	23	200
Shropshire	25	167	134	402	154	566	149	6	183
Tunis	16	84	123	184	149	268	141	8	200
Rambouillet	24	186	111	667	125	853	122	9	177

TWIN PRODUCTION AS AFFECTED BY SIRE.

A study of 334 cases of lambing from the services of 5 rams, none of which were used less than three seasons or on less than 20 ewes, does not indicate any important variation in proportions of twins that can be attributed to the sire. Such differences as were shown in the average number of lambs per service for each sire appeared to be due to differences in the ewes to which they were bred. Records of 380 lambings from services of 8 different sires were studied in relation to the ages of the rams at the time of service. The results did not show any connection between age of sire and number of twins among his "get."

Overworked or run-down condition of a ram may result in a smaller lamb crop through a lack of numbers or of vitality of the sperm cells in the seminal fluid. Such a lack is most likely to occur in the case of ram lambs running in a flock with the ewes, and it would be more likely to result in ewes not getting in lamb than in a decreased number of twins. Though improbable, it is possible that a ewe might produce two ova and have one of them fail to become fertilized because of a lack in the number or vitality of the sperm cells.

BREEDING FOR TWIN LAMBS.

It appears quite logical to suppose that the proportion of twin births in a flock can be increased by selecting, for breeders, rams and ewes themselves born as twins. However, the facts do not bear out such a supposition. This does not preclude the possibility of increasing lamb yields by breeding, but selection for this purpose should be based on average yields of different strains rather than on records of individuals.

The fact that a ram was born as a single or as a twin can not reasonably be expected to have any relation to the number of twins among his offspring. The function of the sperm cells of the male is to fertilize the ova produced by the female, and under ordinary conditions the number and strength of the sperm cells is many times greater than actually needed.

It is reasonable, however, to expect a son of a ewe that is a regular producer of twins to transmit some or all of his dam's capacity to his daughters. Any ewe's inheritance of capacity for bearing twins must therefore be traced through the prolificacy records of her female ancestors.

In the breeding of the bureau's purebred Southdown flock, records have been obtained of 458 cases of lambing which include only ewes that have dropped lambs at least three times. A few of the ewes had eight or nine lambing records. The relation of the production of these ewes, the fact of their having been born as single or twin lambs, and also whether their sires and dams were born as singles or twins are shown in Table 5. It must be remembered that the fact of a ram or a ewe having been born as a single or twin is in itself an incomplete record of the dam's productive capacity.

As shown in the table twin-born ewes were found to be 4.7 per cent more prolific than those born singles. The highest record, however, is from ewes born as singles with both parents twins, and the second-highest record is for single-born ewes by single sires from twin dams.

There does not appear to be any connection between lamb production and the fact of sires and dams having been singles or twins.

TABLE 5.—*Effect of breeding on twin production of Southdown ewes in Government flock.*

Ewes' breeding.	Number of ewes.	Number of lambings.	Lambs dropped.
Born twins:			*Per cent.*
Sires twins, dams twins	3	12	133
Sires singles, dams twins	18	84	142.9
Sires twins, dams singles	3	12	116.6
Sires singles, dams singles	27	134	142.5
Average for twin ewes			140.9
Born singles:			
Sires twins, dams twins	4	14	157.1
Sires singles, dams twins	12	70	145.7
Sires twins, dams singles	4	21	109.5
Sires singles, dams singles	24	111	132.7
Average for single ewes			136.2

A safer way of appraising the possibility of increasing twin production by selection is to take into account the full records of female ancestors rather than a single birth in which the particular sire or particular dam was produced.

VALUE OF TWIN LAMBS IN COMPARISON WITH SINGLES.

Sheep raisers differ in their ideas of the desirable size of the lamb crop. At one extreme are ranchmen chiefly interested in wool production who consider twins as undesirable because feed conditions are unfavorable to a ewe's furnishing more than sufficient milk for one lamb. Even in such cases, however, it is always likely that a number of ewes will lose their lambs and a corresponding number of pairs of twins would allow transferring one from each pair of twins to a ewe in milk and without a lamb. This would render possible the rearing of 100 per cent of lambs.

There are, also, a few breeders of registered sheep who believe that there is no gain in obtaining twin lambs. Their position is based upon the fact that some twin lambs do not develop so fully as singles. Since a good individual animal sold for breeding purposes may bring as much as or more than two inferior ones, single lambs might be an advantage, provided they always proved more valuable at selling age.

At the other extreme are raisers of market lambs in whose hands a pair of twins, even though comparatively underdeveloped and sold perhaps at a lower price per pound, still will bring a much larger amount than the single lamb.

With ewes lambing for the first time, it is less desirable to have twin lambs than with older ewes. Young ewes do not ordinarily milk so well nor look after their lambs so faithfully, and thus they have a greater rate of loss in twin lambs than older ewes. In most flocks, if not all, containing the ordinary proportion of ewes of varying ages, the mark can well be set at 150 per cent of lambs in working for the greatest net returns.

Possible disadvantages in twin lambs must come from one or all of three causes: (1) Greater rate of loss among twins; (2) slower rate of growth as lambs; or (3) inability to reach the same size, weight, and breeding value as single lambs.

As regards the rate of loss, the experience of the Bureau of Animal Industry shows no greater losses among twins. In the lambing seasons of 1916 to 1920, inclusive, in the two flocks of Southdowns used in the experiments a total of 224 single lambs and 290 twin lambs was born. Of these 14.3 per cent of the single-born lambs died before reaching the age of 2 weeks, and 13.4 per cent of the twins.

COMPARATIVE WEIGHTS OF SINGLE AND TWIN LAMBS.

Comparative weights of twins and single lambs at six months old show that the milk received by the lambs is more important in influencing growth than is birth as a single or twin.

Records of 184 lambs dropped through three different years are grouped to show weights attained by both sexes and by single lambs, twin lambs, and lambs born as twins but having all of one ewe's milk (twins raised as singles). The weights of the ram lambs include 3 or 4 wethers.

TABLE 6.—*Weights of 6-months-old twin and single lambs.*

Kind.	Singles.		Twins.		Twins raised as singles.	
	Number.	Average weight.	Number.	Average weight.	Number.	Average weight.
		Pounds.		*Pounds.*		*Pounds.*
Ram lambs	32	85.4	45	81.6	9	82.7
Ewe lambs	46	73.8	37	67.6	15	78.3
All lambs	78	78.6	82	75.3	24	79.9

The twin-born ewe lambs averaged 6 pounds lighter at six months than those born singles, while in the case of ram lambs the difference was 4 pounds. In the smaller groups of twin lambs raised as singles the ewes made an especially good growth, averaging more than the single lambs.

Three experiments were conducted to determine whether twin ewe lambs would catch up in weight with the singles if given an opportunity. Of the 1915 crop, 19 head of singles and 22 twin-ewe lambs were fed separately for 112 days (December 8, 1915, to March 28, 1916). At the outset the singles were 8.6 pounds heavier and at the close of the test they were 11 pounds heavier. They received similar feed, but that eaten by the twins contained about 6 per cent more total energy. After running in the same lot on pasture until August 30, 1916, the single-born lambs were still 8 pounds heavier.

In November, 1916, 8 head of single ewe lambs and 8 head of twins that had been raised as twins were placed in a similar experiment. The average daily ration fed the twins contained 0.28 pound of protein and 1.84 therms of energy as compared with 0.24 pound of protein and 1.57 therms of energy for the singles. At the start the singles were 7 pounds heavier and at the close of the special feeding the weights were identical. The twins were somewhat fatter, however, and after running with the others on pasture until August 25, 1917, were 2.4 pounds lighter.

In the summer of 1917 an attempt was made to furnish lambs raised as twins sufficient extra grain to permit them to catch up with those born singles. From birth (about March 1) until July 1, there were 11 single ewe lambs and 3 born twins but raised as singles in one lot, and 8 twin-raised ewe lambs in the other lot. During that time the former ate 50 pounds of grain each and the twins 63 pounds, with the result that the twin lambs averaged 7 pounds lighter than the others. Subsequently the lambs were fed and pastured as one lot until December 29, 1917, at which time the singles were 3 pounds heavier. From December 29, 1917, to April 6, 1918, the single lambs ate an average daily ration of 1 pound of the following grain mixture: Cracked corn 100 parts, bran 30 parts, in connection with 2 pounds timothy hay and 2 pounds turnips per head. That eaten by the twin lambs consisted of $1\frac{3}{8}$ pounds of a mixture consisting of cracked corn 80 parts, oats 60 parts, bran 35 parts, in connection with 2 pounds of timothy hay and 2 pounds of turnips. On April 6 the singles weighed 107 pounds and the twins 110. That their extra gain was not fat is shown by the fact that after running on pasture with no feed until August 10, the twins were 3.1 pounds heavier per head than the singles. A comparison of the gains made by singles, twins raised as twins, and twins raised as singles is shown in Table 7.

The fact that lambs born as twins but receiving all of one ewe's milk often equal and sometimes outweigh single lambs makes the matter appear to be one of nourishment. The slight lack of growth and development of twin-ewe lambs below that of singles at market age is not serious in comparison with the advantage of larger numbers.

TABLE 7.—*Gains made by single and twin lambs in bureau flocks at Middlebury, Vt., and Beltsville, Md.*

Sex and flock.	Single lambs.					Twin lambs raised as twins.					Twin lambs raised as singles.				
	No. head.	Average weight.				No. head.	Average weight.				No. head.	Average weight.			
		Birth.	3 mos.	6 mos.	12 mos.		Birth.	3 mos.	6 mos.	12 mos.		Birth.	3 mos.	6 mos.	12 mos.
Middlebury flock:															
1916—Rams...	5	9.0	75.6	97.4	130.8	9	9.2	68.2	89.4	131.0	1	7.8	68.0	84.0	109.0
Ewes....	8	9.2	64.8	77.9	(1)	10	7.5	55.6	67.9	(1)	8	7.8	65.5	81.1	114.4
1917—Rams...	5	7.9	66.8	94.8	117.4	4	7.6	59.5	84.3	108.5	4	7.8	57.5	87.3	118.0
Ewes....	11	8.3	61.7	78.8	106.7	8	7.5	55.9	76.5	109.6	3	7.1	67.0	84.3	111.7
1918—Rams...	8	8.6	56.4	84.8	121.8	12	7.4	49.8	77.9	117.8	1	7.3	51.0	83.0	119.0
Ewes....	13	8.8	54.1	76.8	113.7	11	6.9	38.2	63.8	107.5	2	6.1	41.0	68.5	101.0
Average:															
Rams.....	18	8.5	64.6	91.1	123.1	25	8.1	58.0	83.1	121.0	6	7.7	58.1	86.0	116.6
Ewes......	32	8.7	59.4	77.9	110.5	29	7.3	49.1	68.9	108.4	13	7.4	62.1	79.9	111.7
Beltsville flock:															
1917—Rams.	2	8.4	40.5	69.0	96.0	3	6.9	45.2	73.5	94.7	2	6.2	38.8	67.8	91.8
Ewes..	8	7.7	42.8	63.6	82.0	3	6.4	39.8	60.8	86.7	1	6.6	55.0	74.0	96.0
1918—Rams.	5	8.3	59.9	82.7	109.4	6	7.1	49.1	77.3	119.8	....	.....	....	......	......
Ewes..	3	8.2	56.5	69.0	104.7	3	5.8	42.5	68.2	111.7	1	5.7	39.0	61.0	83.0
1919—Rams.	9	8.0	54.4	65.1	100.2	5	7.3	45.6	60.6	97.8	4	6.6	55.1	66.3	97.0
Ewes..	13	8.1	53.2	66.5	91.2	8	6.6	50.7	64.9	90.3	3	6.7	53.5	68.7	92.7
1920—Rams.	7	8.4	60.3	82.0	124.5	14	7.2	51.0	78.9	117.5	1	6.8	40.0	67.0	106.0
Ewes..	17	8.3	47.8	64.5	98.8	17	6.5	44.8	64.8	102.3	2	6.9	55.5	70.0	92.0
Average:															
Rams.....	23	8.2	56.2	74.4	109.2	28	7.2	49.0	74.7	112.0	7	6.5	48.3	66.8	96.8
Ewes......	41	8.1	49.2	65.3	93.6	31	6.5	45.6	64.8	98.6	7	6.6	52.2	68.7	91.6
Average:															
All rams...	41	8.4	59.9	81.7	115.3	53	7.6	53.2	78.7	116.3	13	7.0	52.8	75.7	105.9
All ewes...	73	8.4	53.6	70.9	99.8	60	6.9	47.3	66.7	102.3	20	7.1	58.6	75.9	104.7
All lambs..	114	8.4	55.9	74.8	105.8	113	7.2	50.2	72.3	109.5	33	7.1	56.9	75.9	105.2

[1] Placed in special experiment and weight not comparable.

SUMMARY.

1. Feeding at breeding time to increase the number of twins produced by ewes is called "flushing."

2. The percentage of lambs produced by a flock depends upon the number of dry ewes and the proportion of ewes producing twins and triplets.

3. The practical advantage of flushing lies in the production of twins, which in turn depends upon the number of ova produced by the ewe.

4. Experiments reported herein indicate that ewes getting in lamb first produce the largest percentage of twins.

5. Data from experimental work indicate that ewes should gain at least 7 pounds a head during the breeding season to obtain largest percentage of twins.

6. There seems to be a natural tendency toward twin production, which varies in different breeds.

7. It is only in extreme cases that the ram has shown any influence on the number of twin lambs produced by the flock.

8. Records do not indicate that ewes born twins of twin parentage are more prolific than single ewes.

9. There is no material difference in the size of twins and singles when fully developed.

10. Although at market age twin lambs would not weigh so much as singles, the difference in weight would be small compared to the total weight of the lambs for sale, thus making twins far more profitable.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 997

Joint Contribution from the Office of Farm Management and Farm Economics, H. C. TAYLOR, Chief; Bureau of Public Roads, THOS. H. MacDONALD, Chief; and Bureau of Animal Industry, JOHN R. MOHLER, Chief.

Washington, D. C. ▼ December 21, 1921

THE COST AND UTILIZATION OF POWER ON FARMS WHERE TRACTORS ARE OWNED.

286 Farms—Ohio, Indiana, Illinois—1920.

By H. R. Tolley, *Agricultural Engineer*, and L. A. Reynoldson, *Junior Farm Economist.*

CONTENTS.

INTRODUCTION.

During October and November of 1920 the Bureau of Animal Industry, the Office of Farm Management and Farm Economics, and the Bureau of Public Roads of the United States Department of Agriculture made an investigation of the cost and utilization of power on representative farms where tractors are owned in Ohio, Indiana, and Illinois. Two hundred and eighty-six farmers in these States who had been using tractors for a year or more were inter-

Note.—Special credit is due to W. R. Humphries, Bureau of Public Roads, for valuable assistance in collecting and in supervising the tabulation of the data presented in this bulletin.

Acknowledgement is also due to O. A. Juve, Office of Farm Management and Farm Economics, M. A. R. Kelley, Bureau of Public Roads, and G. C. Dignan, Bureau of Animal Industry, for assistance in collecting the data, and to Prof. J. I. Falconer, University of Ohio, Prof. O. G. Lloyd, Purdue University, and Prof. W. F. Handschin, University of Illinois, for assistance in the selection of the areas studied and for many courtesies to the investigators while the work was in progress.

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viewed. A complete record of all the farm operations and of the work which was done both with tractors and with horses for the year ending October 31, 1920, was obtained from each farmer. Data from which the cost of operating the tractor and the cost of keeping workstock could be determined, the acreages and yields of different crops, the size of the farm and the number of workstock before the purchase of the tractor, and related information were also collected.

The object of the investigation was to obtain information, in addition to that already available in the Department of Agriculture and the various State colleges of agriculture, which would assist in determining the most profitable forms of power for different farms under different conditions.

SUMMARY.

The average size of the farms visited was 258 acres. This is considerably above the average size of all farms in these States.

Two-plow tractors were owned on 174 of the 286 farms, 3-plow tractors on 104, and 4-plow tractors on 6 farms. One farmer owned a 1-plow machine and one farmer owned a 5-plow machine. Two-plow machines were found on 75 per cent of the farms with less than 160 crop acres, and on 53 per cent of those with 160 or more crop acres.

One hundred and six of the tractors had been in use 1 year, 100 had been in use 1½ or 2 years, 49 had been in use 2½ or 3 years, and 31 had been in use more than 3 years.

On the average each tractor was used for 30.8 full days during the year covered by the investigation. Of this period, 23.5 days were devoted to drawbar work on the home farm, 2.7 days to belt work, and 4.6 days to custom work. Of the 286 tractors, 73 did less than 20 days' work during the year and 26 did 50 or more days' work.

The number of workstock owned at the time of the investigation varied from 2 head on 11 of the farms to more than 15 on 5 of the larger farms. On the average each farm had 6.8 head at the time of the survey, and their value was $144 per head. In all, the 286 farms had 1,878 head of workstock and 111 colts less than 1 year old.

The average number of full days' work per year per horse, for all farms, was 68.6. On 20 of the farms, the workstock did less than 40 full days' work each, and on 27 they did 100 or more days' work per year.

The tractors did 85 per cent of the plowing on these farms, 73 per cent of the disking, 43 per cent of the harrowing, rolling, planking, and packing, 41 per cent of the grain cutting, and 15 per cent of the loading and hauling of hay.

Of 267 farmers who did spring plowing, 142 did it all with tractors, 121 used both tractors and horses, and 4 used horses only.

Of 225 who did fall plowing, 190 did it all with tractors, 27 used both tractors and horses, and 8 used horses only.

Of 284 farmers who did disking, all but 15 used tractors for at least a part of it. Two hunderd and seven used their tractors for harrowing, rolling, planking, or packing, 130 for cutting grain, and 37 for drawing the hay loader. Smaller numbers used their tractors for drawbar operations other than those enumerated.

In all, the power for 30 per cent of the drawbar work on these farms, as measured by days or horse labor required for it, was furnished by tractors and the remainder by horses.

On the average, the 2-plow tractors saved 25 to 30 days of man labor, and the 3-plow tractor 30 to 35 days, required for drawbar work during the year on these farms.

The average cost per head of keeping workstock on these farms for the year ending October 31, 1920, was $159, and the average cost per farm was $1,076.

This cost includes charges for feed at the average price for the year, chores at 25 cents per hour, shoeing, veterinary, harness, interest at 6 per cent, and depreciation. A manure credit of $15 per head was allowed.

Exclusive of grass and stalk pasture, the average ration per horse for the year consisted of 1.3 tons of hay, 1.2 tons of straw, 0.2 acre of stover, 37.8 bushels of corn, and 22.3 bushels of oats. The cost of feed per head was $134. Based on present prices (Sept., 1921), the cost of feed per head would be about $60.

The average cost per day of horse labor for the year of the survey was $2.43. At present prices, the cost on these farms would be not far from $1.30 per day.

The average first cost of the 2-plow tractors was $972; of the 3-plow tractors, $1,354; and of all tractors, $1,140. The average amount spent for equipment, mostly plows and disks, for use with tractors was $343. The average value of the horse-drawn implements disposed of after the purchase of the tractors was $12.

The average life of these tractors, as estimated by their owners, is 6.7 years. The annual depreciation of the 2-plow tractors amounted to $164, and of the 3-plow, $217. The annual cost of repairs, including the value of the owners' time spent in repairing the tractors, was $39 for both the 2-plow and the 3-plow sizes. The tractors were out of commission when needed an average of about 2 days during the year. A little over 50 per cent were not out of commission at all when needed, and about 1 in 7 were out of commission five days or more.

The fuel consumption per day for the 2-plow tractors varied from about 18 gallons for fall plowing to about 11 gallons for drawing the hay loader. For the 3-plow tractors it varied from 23 gallons for plowing to 15 gallons for drawing the hay loader. The 2-plow tractors covered 6.6 acres per day in spring plowing and the 3-plow machines 8.6 acres. The quantity of fuel required per acre was 2.7 gallons for each size.

The average cost per acre of power for the plowing done with 2-plow tractors was about $2 and with the 3-plow about $2.20. The cost of power for the plowing done with horses on these farms was about $2.90 per acre. Based on the present prices of feed, fuel, and oil (September, 1921), the cost of power for plowing with horses would be about $1.60 per acre, and with tractors about $1.70.

For most of the other operations the cost of power furnished by horses during the year of the investigation was slightly less than that furnished by tractors. The cost per acre of power for disking with tractors was $0.67; with horses, $0.64; for cutting grain with tractors, $0.67; with horses, $0.59. These figures represent the cost of power only, and do not include either the cost of man labor or that of the implements used.

The average cost per day of 2-plow tractors for drawbar work on the home farm was about $12.67, and of 3-plow tractors about $17.73.

The total cost of power furnished by the tractors for drawbar work at home during the year averaged $341. Based on the present price of fuel and oil (September, 1921), the cost would be about $280. This drawbar work on the home farm constituted 76 per cent of the total work done by the tractors, and only 76 per cent of the total annual charge for depreciation, repairs, and interest on investment is included in it. No charges for taxes, insurance, or shelter are included in the costs for either tractors or workstock.

Nine of these men started farming with tractors; the others increased the size of their farms by an average of about 20 acres after the tractors were purchased. No change occurred in the size of 172 of the farms, 81 were increased in size, and 24 were decreased.

On the 172 farms where no change in acreage occurred the number of workstock was reduced by 2.2 head, an average reduction of 26 per cent. Forty-four of these 172 men did not reduce the number of workstock, 62 disposed of 1 or 2 head, 43 disposed of 3 or 4 head, and 23 of more than 4 head. On these 172 farms 1 horse was kept for each 28.0 acres (total acres, not crop acres) before purchase of tractors, and at the time of the survey there was 1 horse for each 37.7 acres. For all the farms an average of 1 horse was kept for each 27.6 acres before the purchase of tractors, and there was 1 for each 37.9 acres at the time of the investigation.

With the tractors doing the bulk of the work of plowing and fitting the ground, the cultivation of corn was the operation which required the greatest amount of horse labor in the shortest time on most of these farms. However, on only 105 of the 286 farms were all the workstock used for cultivation, and on only 38 of the remainder were they all used for any other one operation. On just half of the farms the workstock were not all used for any one operation.

Individual farms varied greatly in the cost of power furnished by both horses and tractors; and by more careful management many farmers could doubtless reduce this cost. Repair costs and fuel consumption of the tractors in many cases could have been reduced by more careful operation. The cost of keeping workstock could have been reduced on many farms by more careful feeding practices. The facts that on 20 of the farms the workstock did less than 40 days of work per head during the year and that on half of the farms they were not all used for any single operation indicate that the greatest possible use was not being made of the available power represented by the horses. Either more work could have been accomplished by more efficient use of the horses on hand, or the number of horses kept could have been reduced and the cost of the operation of the farm correspondingly decreased.

The average annual cost of power for the drawbar work on the home farm which was done with tractors was equal to the cost of keeping 2.1 head of workstock, and this is practically the average number displaced per farm. On the basis of present prices, however, the cost of keeping workstock has declined considerably more than the cost of operating tractors.

Since, during the year covered by the investigation, the cost of power on the average farm was no greater than if it had all been furnished by horses, any saving in man-labor costs, any gain due to getting a larger amount of work done in a given time, and possibly other advantages connected with the use of tractors which can not be measured directly in dollars and cents, might be considered clear profit. On many of the farms, however, where there was no change in acreage, and where no workstock was displaced it is doubtful if such gains were great enough to balance the cost of operating the tractors.

AREAS IN WHICH INVESTIGATION WAS MADE.

Table 1 shows the counties visited in each State, the number of farmers from whom records were obtained, and the average size of their farms. The location of the counties is shown in figure 1.

In each area the average size of the farms where tractors are owned is considerably greater than the average size of all farms, and this fact must be borne in mind in interpreting any of the data contained in this bulletin. The proportions of the entire acreage devoted to different crops, the practices followed in preparing the ground, planting, cultivating, and harvesting the crops on the farms visited, however, are very similar to those on other farms in the respective areas.

TABLE 1.—*Location, number, and size of farms.*

Location.	Number of farms.	Average size of farms (acres).	Average number of crop acres.
Madison County, Ohio	34	363	276
Seneca County, Ohio	34	202	140
Madison County, Indiana	42	218	176
Montgomery County, Indiana	56	270	205
Livingston County, Illinois	60	247	211
Knox County, Illinois	60	256	198
All	286	258	201

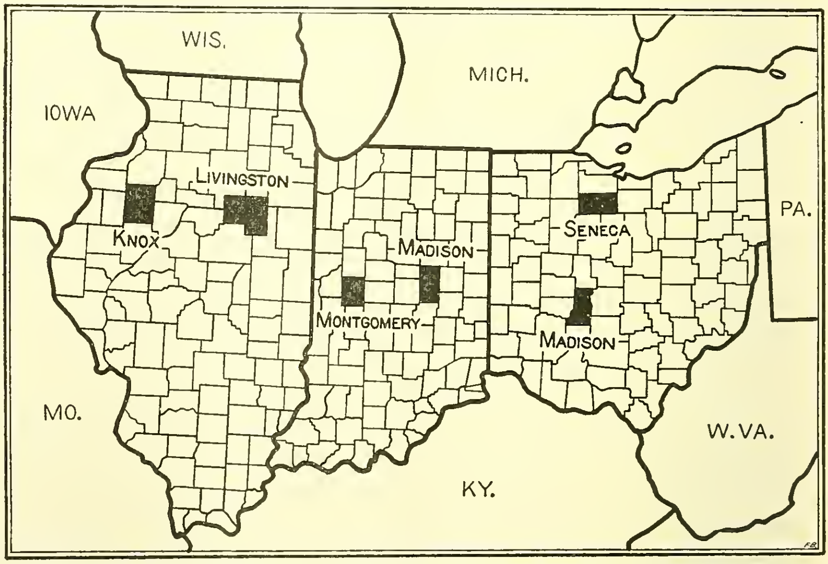

FIG. 1.—Areas in which investigation was made.

Madison County, Ohio.—The average size of all farms in this county, as determined by the 1920 census of agriculture, is 164 acres. Corn is the principal crop, occupying in 1919 about 46 acres per farm. A considerable part of the corn is cut by hand and husked by hand from the shock. Where this practice is followed no horse labor is used in the corn harvest except for hauling the husked corn from the field to the crib.

Wheat is the crop next in importance from the standpoint of acreage. There was an average of 28 acres per farm in this crop in 1919. Wheat usually follows corn in the rotation. It is sown after the corn is cut, without any preparation of the ground except disking. Oats is usually planted in the same way. Oats occupied an acreage less than half as great as that of wheat in 1919.

Seneca County, Ohio.—The average size of all farms in this county, as determined by the census of agriculture, is about 107 acres. The principal crops in order of the acreage occupied in 1919 are wheat, corn, hay, and oats. The acreage in corn in 1920 on the farms visited was slightly greater than the acreage in wheat, but the percentage of the acreage in corn was less on the farms visited in this county than in any other area.

A large part of the corn grown is ensiled, or cut and shocked and later run through a husker-shredder. Corn binders are used more generally in this county than in any other visited. As in Madison County, Ohio, wheat usually follows corn in the rotation, and is planted after the corn is cut, with no seed-bed preparation except disking. Commercial fertilizer is applied with wheat on most farms in both areas.

Madison County, Indiana.—The average size of all farms in this county is 84 acres, less than in any other county included in the investigation. The size of the farms visited in this county, however, was larger than of those visited in Seneca County, Ohio.

The principal crops in order of the acreage occupied in 1919 are corn, wheat, oats, and hay. The portion of the corn in this area husked from the standing stalk is greater than in either of the Ohio areas.

Wheat usually follows corn in the rotation, and on some farms part of it is sown with a one-horse drill between the rows of standing corn, without any preparation of the ground.

Montgomery County, Indiana.—The average size of all farms in this county is 118 acres. The chief crops in order of the acreage occupied in 1919 were corn, oats, hay, and wheat. In both of the Ohio areas and in Madison County, Indiana, wheat occupies a greater acreage than oats, while the reverse is true of this county and the two visited in Illinois.

Oats is usually sown on land which was planted to corn the previous year, and with end-gate seeders capable of covering an average of 30 to 50 acres per day. A large part of the corn is husked from the standing stalk.

In both the Indiana areas motor trucks are used very generally for hauling on the road. A few of the farmers visited in these areas owned motor trucks with which they did the bulk of their road hauling during the year, and nearly all the remainder hired trucks to haul part of their produce to market. On this account the amount of road hauling done with horses was less in these areas than in the Ohio and Illinois areas.

Livingston County, Illinois.—According to the 1920 census the farms in this county have an average size of 171 acres. Corn and oats are the principal crops. In 1919 there were on the average only

7 acres per farm in wheat and practically the same acreage in hay. The acreage devoted to these two crops was less in this county than in any other studied.

The average size of the farms in this county is greater than in any other county studied in the investigation. However, the average size of the farms visited in this county was considerably less than those visited in some of the other areas.

Knox County, Illinois.—The average size of the farms in this county is 153 acres. In 1919 there were about 42 acres per farm in corn, 20 acres in oats, 9 acres in wheat, and 15 acres in hay.

In both Illinois areas corn is practically all husked from the standing stalk. A considerable part of the corn is sold, most of which is shelled before being marketed. Endgate seeders are used almost universally for sowing oats.

Table 2 gives the acreages in different crops during the year covered by the investigation on the farms visited in the different areas.

TABLE 2.—*Acreages in different crops in different areas.*

[Averages.]

Area.	Number of farms.	Crop acres.								Acres not cropped.	Total size of farms, acres.
		Corn.	Wheat.	Oats.	Other small grain.	Other inter-tilled crops.	Hay and seed.	Rotation pasture.	Total.		
Madison County, Ohio	34	129.0	50.8	43.7	0.6	......	29.6	22.4	276.1	86.9	363.0
Seneca County, Ohio	34	40.6	38.9	18.0	2.1	1.4	32.2	6.9	140.1	61.8	202.0
Madison County, Ind.	42	66.0	39.4	18.9	3.1	.4	30.1	18.3	176.2	41.9	218.1
Montgomery County, Ind.	56	83.1	32.3	38.7	4.9	.1	28.0	17.6	204.7	64.8	269.5
Livingston County, Ill.	60	109.5	7.6	76.3	......	......	12.2	5.2	210.8	36.5	247.3
Knox County, Ill.	60	97.7	17.4	49.5	1.9	......	25.2	6.3	198.0	58.0	256.0
All	286	89.6	28.0	44.1	2.1	.3	25.1	12.0	201.2	56.4	257.6

In each area corn is the principal crop; it has the greatest acreage and makes the heaviest demands upon power and man-labor. The practices in growing and harvesting the different crops are quite similar in the different areas, with the exception of the harvesting of corn, and the common methods used in each area have been outlined above.

The land is generally level in all areas, and on the farms visited the fields were usually large enough to permit the efficient operation of tractors. On very few farms were any fields less than 10 acres in size included in the regular rotation.

SIZE AND AGE OF TRACTORS.

Table 3 shows the number of tractors of different sizes on the farms in the different areas.

TABLE 3.—*Number of tractors of the different sizes on the 286 farms studied.*

Area.	Number of farms.	1-plow tractor.	2-plow tractors.	3-plow tractors.	4-plow tractors.	5-plow tractor.
Madison County, Ohio	34	1	26	6	1	....
Seneca County, Ohio	34	....	22	11	1	....
Madison County, Ind	42	....	34	7	....	1
Montgomery County, Ind	56	....	31	25	....	....
Livingston County, Ill	60	....	29	27	4	....
Knox County, Ill	60	....	32	28	....	....
Total	286	1	174	104	6	1

The 2-plow size predominated in each area. However, the proportion of farmers using this size was considerably greater in the Ohio areas and in Madison Co., Indiana, than it was in Montgomery Co., Indiana and in the two Illinois areas.

Every farmer visited had used his tractor for at least one full year's work. The number of months the tractors of different sizes had been owned at the time of the investigation is given in Table 4.

TABLE 4.—*Number of tractors of different ages on the 286 farms studied.*

Age.	1-plow tractor.	2-plow tractors.	3-plow tractors.	4-plow tractors.	5-plow tractor.	All sizes.
14 months or less	1	74	29	2	....	106
15 to 26 months	....	60	39	1	....	100
27 to 38 months	....	28	20	1	....	49
39 months and over	....	12	16	2	1	31
All ages	1	174	104	6	1	286

The one 1-plow tractor had been used just one year, and the 5-plow tractor had been used four years.

The farmers were visited in October and November, and those who had owned their tractors 14 months or less had used them for just one full year's work. The men who had owned their tractors from 15 to 26 months had used them for one and a half or two years; those who had owned their tractors 27 to 38 months had used them two and a half or three years; and those who had owned their tractors 39 months and over had done more than three full years of work with them.

Sixty-five per cent of the tractors which had been owned two years and less were 2-plow machines. However, only 50 per cent of those that had been owned over 2 years were of the 2-plow size. On the average, the 2-plow tractors had been owned 21 months, the 3-plow tractors 25 months, and all tractors 23 months.

WORKSTOCK.

The total number of workstock of different kinds, their weight, and their value on the farms in different areas at the time of the investigation are given in Table 5.

TABLE 5.—*Number of workstock, their weight and value, in different areas.*

Area.	Number of farms	Mares.			Geldings.			Mules.		
		Number.	Average weight.	Average value.	Number.	Average weight.	Average value.	Number.	Average weight.	Average value.
			Lbs.	*Dolls.*		*Lbs.*	*Dolls.*		*Lbs.*	*Dolls.*
Madison County, Ohio	34	168	1,409	156	75	1,394	150	19	1,143	161
Seneca County, Ohio	34	103	1,448	148	56	1,446	142	6	1,075	212
Madison County, Ind	42	136	1,405	134	69	1,355	125	4	1,050	120
Montgomery County, Ind	56	162	1,338	128	111	1,344	131	47	1,075	186
Livingston County, Ill	60	293	1,367	151	172	1,331	126	36	1,189	159
Knox County, Ill	60	222	1,320	123	165	1,298	119	34	1,130	204
All	286	1,084	1,372	140	648	1,350	129	146	1,125	180

The larger number of mares than geldings in each area indicates that when disposing of surplus workstock these farmers have usually sold geldings in preference to mares. Mules were found on 56 of the 286 farms, and on most of these 56 there was but one span, the average number per farm where mules were used being 2.6.

The number of colts in comparison to the number of workstock on these farms is shown in Table 6. The number of "other" colts includes all young stock which had not been broken to harness. Most of them were foaled in 1919 and 1918, but some young horses and mules foaled in 1917 had never been worked. For all farms there was only one 1920 colt for each 16.9 head of workstock, and on more than three-fourths of the farms there were no 1920 colts. Only 10 per cent of the mares on these farms raised colts during the year of the investigation.

TABLE 6.—*Number of workstock and number of colts in different areas.*

Area.	Number of farms.	Number of workstock.	Number of 1920 colts.	Number of other colts.
Madison County, Ohio	34	262	21 (11 farms)	127 (24 farms).
Seneca County, Ohio	34	165	8 (6 farms)	30 (16 farms).
Madison County, Indiana	42	209	19 (12 farms)	68 (16 farms).
Montgomery County, Indiana	56	320	11 (8 farms)	40 (17 farms).
Livingston County, Illinois	60	501	27 (15 farms)	83 (30 farms).
Knox County, Illinois	60	421	25 (14 farms)	63 (20 farms).
All	286	1,878	111 (66 farms)	411 (123 farms).

The practices with regard to keeping workstock and raising colts on these farms where tractors are owned are probably not exactly typical of all farms in the same communities, but the figures do indicate that there has been a marked decrease in the number of colts raised on these farms, and that at the present rate not enough colts are being produced for replacement.

SIZE OF FARM.

On farms of similar type, the number of crop acres is closely correlated with the amount of horse and tractor work, and for the purpose of comparing these items the farms here have been arranged according to the number of crop acres in each. The area in rotation pasture during the year of the investigation has been included in the crop area, so that the number of crop acres in a farm as used here is the total number of acres in the regular rotation. Land in bluegrass and other land which has been in pasture for a number of years, even though improved and tillable, was not included in the crop area. Of course, the rotation on different farms and in different areas varied somewhat, and the practices on different farms also varied, so that the number of crop acres in a farm did not determine entirely the amount of power required for operating it.

The number of crop acres in the different farms was as follows:

Farms.	Crop acres.
7	Less than 80
28	80 to 119
71	120 to 159
56	160 to 199
47	200 to 239
36	240 to 279
19	280 to 319
22	320 or more

These figures indicate that most of the tractors owned in these areas are on the larger farms. The average total size of all farms in the 6 counties is not over 120 acres.

On the average, the number of crop acres on the farms visited is about 80 per cent of the total acres. If the same ratio of crop acres to total acres holds for all farms in these counties, the average number of crop acres for all farms is not far from 100. In other words, something like half the farms in these 6 counties contain 100 or less crop acres. But only 35 of the 286 farms on which tractors are owned, one-eighth of the total, contain less than 120 crop acres.

The number of acres in the different crops on the farms of different sizes is shown in Table 7. In each group, corn is the principal crop and occupies a greater acreage than all the small grains combined.

TABLE 7.—*Acreages in different crops on farms of different sizes.*

Crop acres in farm.	Number of farms.	Acres in crops.								Acres not cropped.	Total size of farm, acres.
		Corn.	Wheat.	Oats.	Other small grain.	Other intertilled crops.	Hay and seed.	Rotation pasture.	Total.		
Less than 80	7	25.6	10.7	11.3	.8	......	15.0	1.4	64.8	38.0	102.8
80–119	28	41.8	18.0	19.6	.6	1.1	16.9	3.4	101.4	38.1	139.5
120–159	71	60.2	18.2	28.5	1.7	.3	20.7	7.5	137.1	42.0	179.1
160–199	56	79.2	24.4	37.5	2.3	.4	25.7	9.8	179.3	54.2	233.5
200–239	47	96.8	25.1	53.2	1.9	......	21.7	16.7	215.4	61.1	276.5
240–279	36	121.3	35.7	58.1	3.4	......	30.2	9.7	258.4	59.1	317.5
280–319	19	130.1	34.4	74.1	3.2	......	27.8	23.7	293.3	71.9	365.2
320 and over	22	189.6	75.4	83.9	3.2	......	48.0	30.6	430.7	109.2	539.9
All	286	89.6	28.0	44.1	2.1	.3	25.1	12.0	201.2	56.4	257.6

SIZE OF FARM AND SIZE OF TRACTOR.

The number of tractors of different sizes on the farms of different sizes (as measured by the number of crop acres) is shown in Table 8.

TABLE 8.—*Number of tractors of different sizes on farms of different sizes.*

Size of farms (crop acres).	Number of farms.	1-plow tractor.	2-plow tractors.	3-plow tractors.	4-plow tractors.	5-plow tractor.
Less than 80	7	....	5	2	....	....
80 to 119	28	1	22	5	....	....
120 to 159	71	....	52	19	....	....
160 to 199	56	....	29	26	1	....
200 to 239	47	....	27	18	2	....
240 to 279	36	....	18	18	....	....
280 to 319	19	....	10	9	....	....
320 or more	22	....	11	7	3	1
Total	286	1	174	104	6	1

Seventy-five per cent of the farms with less than 160 crop acres were equipped with 2-plow tractors, and 53 per cent of those with 160 or more crop acres were equipped with this size of machine.

WORKSTOCK ON FARMS OF DIFFERENT SIZES.

The average number of workstock, the number of days of horse labor per farm, and the number of days' work per head on the farms of different sizes during the year of the investigation are shown in Table 9. The number of days' work per head was obtained by dividing the number of days' work on the farm by the number of workstock kept. Each farmer gave the number of hours which are considered a full day's work on his farm both for the workstock and for the tractor, and the average is practically 10 hours for each.

The number of workstock varied considerably on farms of the same size. Likewise the number of days of horse labor per farm varied considerably, depending upon the acreages and yields of the different crops, upon the practices followed in preparing the seed bed, planting, cultivating, and harvesting, upon the amount of horse labor used in caring for live stock and for miscellaneous work, and upon the amount of work done with the tractor.

TABLE 9.—*Number of workstock, days' of horse labor, and days' work per head on farms of different sizes.*

Size of farm (crop acres).	Number of farms.	Number of work-stock.	Horse labor per farm per year, days.	Days' work per head per year.
Less than 80	7	3.4	203.2	59.7
80 to 119	28	3.9	239.4	64.0
120 to 159	71	5.1	319.0	66.4
160 to 199	56	6.2	416.5	70.1
200 to 239	47	7.4	449.6	62.5
240 to 279	36	8.0	532.9	70.9
280 to 319	19	9.3	587.6	66.4
320 and over	22	12.5	1,070.1	91.7
All	286	6.8	451.5	68.6

The number of days' work per head, being dependent upon both the entire amount of horse labor used on the farm and the number of workstock kept, likewise showed great variations, ranging from less than 40 to more than 100 days. The size of the farm in itself had very little bearing on the number of days' work per horse. While the average for the farms with 320 or more crop acres is considerably higher than for the other sizes, the horses worked less than 70 days per head on 6 of the 22 farms. Figure 2 shows the number of farms with different amounts of work per horse during the year.

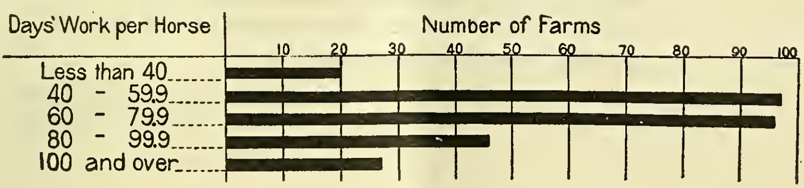

FIG. 2.—Variation in number of days' work per horse

WORK DONE BY TRACTOR.

The average number of days of drawbar and belt work on the home farm and of custom work done by the tractors on farms of different sizes are shown in Table 10.

There was a larger percentage of small machines on the smaller farms than on the larger ones, and to this extent the number of days work per year is not a true index of the actual amount of work done by the tractors on the farms of different sizes. The table does show, however, the relative importance of the different classes of work. The number of days of drawbar work on the home farm increases quite regularly with the increase in the size of the farm, and on the average the men on the smaller farms did a somewhat greater amount of custom work with their tractors during the year of the investigation.

For the entire 286 farms, 76.3 per cent of the work the tractors did, as measured in days, was drawbar work on the home farm, 8.8 per cent was belt work at home, 6.5 per cent was drawbar custom work, and 8.4 per cent was belt custom work.

TABLE 10.—*Days of tractor work on farms of different sizes.*

Size of farm (crop acres).	Number of farms.	Days of work on home farm.		Days of custom work.		Total days.
		Drawbar.	Belt.	Drawbar.	Belt.	
Less than 80	7	11.1	2.0	4.0	5.9	23.0
80 to 119	28	17.5	2.3	2.3	3.1	25.2
120 to 159	71	19.1	3.1	2.6	3.7	28.5
160 to 199	56	22.1	3.0	2.2	2.4	29.7
200 to 239	47	26.0	2.1	1.3	1.3	30.7
240 to 279	36	28.5	2.1	1.9	1.6	34.1
280 to 319	19	31.7	2.0	1.5	0.4	35.6
320 and over	22	32.6	3.9	1.0	4.3	41.8
All	286	23.5	2.7	2.0	2.6	30.8

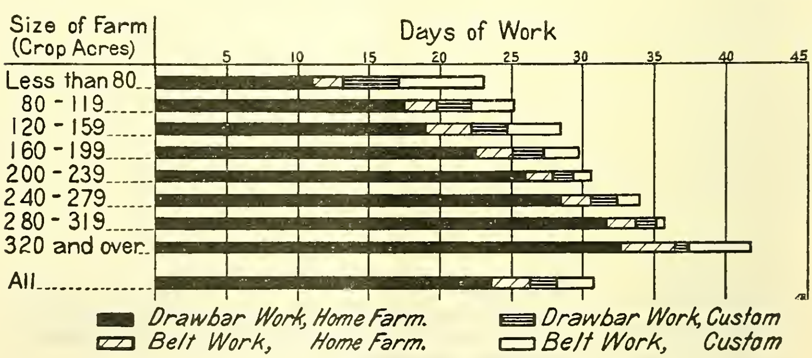

FIG. 3.—Days of work per year done by tractors on farms of different sizes.

On the farms with less than 80 crop acres the drawbar work on the home farm constituted only about 48 per cent of the total; and on those with 80 to 119 crop acres it constituted about 69 per cent of the total. On the farms with 280 to 319 crop acres, drawbar work at home constituted 89 per cent of the total, and on those with 320 or more crop acres, it constituted about 78 per cent of the total.

Figure 3 shows graphically the relative importance of the different kinds of work on the farms of different sizes, and illustrates the error which would be made in assuming that the entire usefulness of a tractor is confined to work where it competes directly with horses.

The number of days of work done by an individual tractor depended upon the particular field operations for which it was used, the amount of belt and custom work done, and to a certain extent upon the amount of time it was out of running order when it was needed, as well as upon the size of the farm. The variation in the number of days' work done during the year by the entire 286 machines is shown in figure 4. Nine of the machines were used for less than 10 days and 7 for 60 or more.

The number of days of drawbar and belt work on the home farm and of custom work done by the 2-plow and 3-plow tractors is given in Table 11. The number of tractors of sizes other than the 2 and 3 plow is not great enough to afford an accurate comparison. The 3-plow tractors did considerably more belt work both on the home farm and for the neighbors than did the 2-plow machines. The drawbar work on the home farm constituted 80 per cent of the total work done by the 2-plow tractors and only 71 per cent of that done by the 3-plow machines.

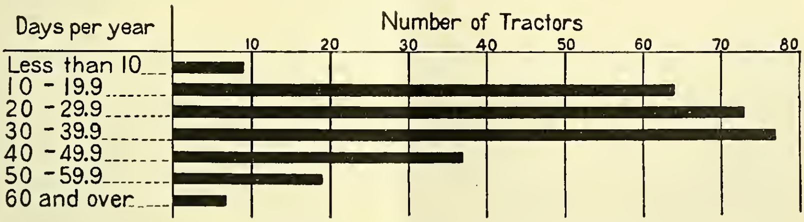

FIG. 4.—Variation in number of days tractors were used per year.

TABLE 11.—*Days work per year done by 2-plow and 3-plow tractors.*

Size of tractor.	Number.	Days of work on home farm.		Days of custom work.		Total.
		Drawbar.	Belt.	Drawbar.	Belt.	
2-plow	174	25.8	2.1	2.6	1.8	32.3
3-plow	104	20.2	3.5	1.3	3.5	28.5

DRAWBAR WORK.

The 23.5 days of drawbar work on the home farm which the average tractor did was divided among the following operations:

	Days.
Plowing	12.4
Disking, harrowing, and other work in fitting ground	7.6
Cutting grain	1.5
Loading and hauling hay	.4
Other	1.6

Although the tractors on these farms were used more for plowing than for any other drawbar operation, the amount of time spent on other work almost equaled that spent in plowing.

The "other" drawbar work, which amounted to 1.6 days for the average tractor, consisted of many operations, such as cultivating corn, drawing the corn binder or corn picker, hauling manure, and drilling grain, but less than 10 per cent of the farmers used their tractors for any one of these operations and on the average the length of time the tractors were used for any one was less than the time they were used for drawing the wagon and hay loader.

The average number of days the 2 and 3 plow tractors were used on the different drawbar operations and the average number of acres covered per day by each are shown in Table 12.

TABLE 12.—*Average number of days per year 2-plow and 3-plow tractors were used for different drawbar operations and average number of acres covered per day.*

[174 two-plow tractors and 104 three-plow tractors.]

Operation.	2-plow.		3-plow.	
	Days per year.	Acres per day.	Days per year.	Acres per day.
Spring plowing	7.9	6.62	6.3	8.63
Fall plowing	5.1	6.46	5.2	8.62
Disking	4.0	21.60	2.3	30.78
Disking in combination	3.4	19.69	4.0	23.83
Harrowing, rolling, etc	1.1	39.05	.2	51.38
Drawing hay loader	.4	10.50	.4	11.57
Cutting grain	1.9	19.73	.9	23.22
Other work	2.0		.9	
Total	25.8		20.2	

There was little variation in the amount of ground covered per day by the tractors at the various operations in the different areas. The average number of acres covered per day, at least in plowing, on the farms visited in this investigation is evidently very near the average of all farms in this section. Reports from over 600 Illinois tractor owners to the Department of Agriculture in 1917 and 1918, as summarized in Farmers' Bulletin 963, "Tractor Experience in Illinois," showed that the 2-plow machines covered an average of 6½ acres per day of 10 net working hours and 3-plow machines 8¾ acres. Reports from about 70 farmers in McLean County, Illinois, in 1918 and 1919, and summarized in Department Bulletin 814, "A Standard Day's Work in Central Illinois," showed that 2-plow tractors covered 7.0 acres per day in spring plowing and 6.4 acres per day in fall plowing, and that 3-plow tractors covered 8.7 acres per day in the spring and 8.1 acres in the fall.

Table 12 shows that the 2-plow tractors were used more extensively than the 3-plow machines for the light operations of harrowing, rolling, etc., and cutting grain. In disking, the 2-plow machines pulled disks alone a greater part of the time while the 3-plow machines usually pulled harrows or other light implements in combination with the disks.

Table 13 shows the number of owners of 2 and 3 plow tractors who used their machines on the different operations:

TABLE 13.—*Number of owners using their tractors on the different operations.*

Operation.	Owners using 2-plow tractors for operation specified.		Owners using 3-plow tractors for operation specified.	
	Number.	*Per cent.*	*Number.*	*Per cent.*
Plowing (spring or fall)	All	100	All	100
Pulling disks alone	95	55	45	44
Pulling disks in combination with harrows, rollers, or plankers	101	58	64	62
Pulling harrows, rollers, etc., alone	53	30	7	7
Drawing hay loaders	24	14	13	12
Drawing grain binders	101	58	27	26
Other draw-bar work on home farm	62	36	16	15

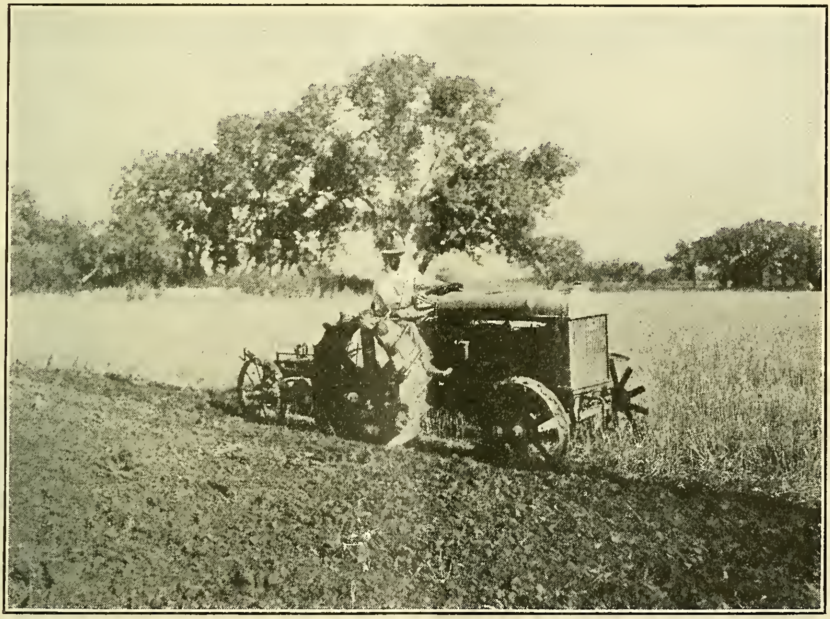

FIG. 5.—Tractors did 85 per cent of all the plowing on these farms.

Plowing.—Table 14 shows the average number of acres plowed during the year, and the number plowed with tractors and with horses in both the spring and fall on farms of different sizes. A little over half of the crop area of the farms was plowed during the year. Eighty-five per cent of all this plowing was done with the tractors; 81 per cent of the spring plowing was done with them, and 91 per cent of the fall plowing. Every man interviewed had used his tractor for some plowing during the year, and 140 of the 286 had done all of their plowing with tractors. (See fig. 5.)

TABLE 14.—*Plowing done with tractors and with horses on farms of different sizes.*

Size of farm (crop acres).	Number of farms.	Average acres plowed per farm.	Spring plowing.		Fall plowing.		Per cent of total plowed with tractor.
			Acres with tractors.	Acres with horses.	Acres with tractors.	Acres with horses.	
		Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Per cent.*
Less than 80	7	33.0	26.0	2.3	4.7	0	93.0
80 to 119	28	55.9	35.2	2.9	16.5	1.3	92.5
120 to 159	71	72.0	37.5	5.3	27.7	1.5	90.6
160 to 199	56	95.4	49.1	9.3	34.4	2.6	87.5
200 to 239	47	113.5	60.4	5.6	45.3	2.2	93.1
240 to 279	36	140.8	59.8	14.4	58.5	8.1	84.0
280 to 319	19	147.6	67.0	11.2	65.2	4.2	89.6
320 and over	22	213.9	93.0	63.2	42.2	15.5	63.2
All	286	105.4	52.1	11.8	37.7	3.8	85.2

For all farms about 60 per cent of the plowing was done in the spring and in each size group a greater acreage was plowed in the spring than in the fall. The areas differed considerably, however, in their practice with regard to spring and fall plowing. The percentage of the plowing done in the spring on the farms visited in the different areas was as follows:

	Per cent.
Madison County, Ohio	88
Seneca County, Ohio	67
Madison County, Ind	74
Montgomery County, Ind	72
Livingston County, Ill	23
Knox County, Ill	59

The areas did not differ greatly in the percentage of the total plowing done with tractors. In all, 267 of the 286 men did some plowing in the spring and 225 did some fall plowing.

Spring plowing.—The number of men on farms of different sizes who did all the spring plowing with tractors, those who used both tractor and horses, and those who used horses only was as shown in Table 15.

TABLE 15.—*Kind of power used for spring plowing on farms of different sizes.*

Size of farms (crop acres).	Number of farmers.	Farmers using tractors only.	Farmers using tractors and horses.	Farmers using horses only.
Less than 80	7	5	2	....
80 to 119	28	21	7	....
120 to 159	65	41	23	1
160 to 199	53	27	25	1
200 to 239	43	23	19	1
240 to 279	31	12	19	....
280 to 319	18	9	9	....
320 or more	22	4	17	1
Total	267	142	121	4
Per cent	100	53	45	2

As the size of farm, and consequently the amount of plowing, increased, the percentage of those who did it all with tractors decreased. Sixty-seven per cent of the men with less than 160 crop acres, 52 per cent of those with 160 to 239 crop acres, and only 35 per cent of those with 240 or more crop acres did all their spring plowing with their tractors.

The number of acres plowed with horses on the smaller farms, as shown in Table 14, indicates that on many of these farms the horses were used only for finishing or for plowing small and irregular fields. On many of the larger farms, however, the amount of spring plowing to be done was so great that the tractors could not do it all in the time available, and horses were worked regularly at plowing during the plowing season. This condition existed on nearly all of the 22 farms with 320 or more crop acres, where an average of 63 acres of spring plowing was done with horses.

Fall plowing.—Table 16 shows the number of men on farms of different sizes who did all their fall plowing with tractors, those who used both tractors and horses, and those who used horses only.

TABLE 16.—*Kind of power used for fall plowing on farms of different sizes.*

Size of farms (crop acres).	Number of farmers.	Farmers using tractors only.	Farmers using tractors and horses.	Farmers using horses only.
Less than 80	2	2	....	....
80 to 119	20	16	4	....
120 to 159	62	55	6	1
160 to 199	42	35	5	2
200 to 239	38	34	3	1
240 to 279	29	23	5	1
280 to 319	16	15	1	....
320 or more	16	10	3	3
Total	225	190	27	8
Per cent	100	84	12	4

A much larger percentage used tractors exclusively for fall plowing than for spring plowing, and no marked tendency was shown on the large farms to supplement the tractors with horses. Except where land is being plowed for winter wheat, the season for fall plowing is long, compared with the season for spring plowing. Furthermore, the hot weather which usually occurs during the fall plowing season and the harder plowing give the tractor a somewhat greater advantage over horses than it has in spring plowing.

Disking.—Though the tractors were used more for plowing than for any other operation on these farms, 73 per cent of the total disking was done with them. On the farms where winter wheat followed corn and occupied an important place in the rotation, the seed bed was prepared almost entirely with the tractor and disk. The method usually emplo¬ed was first to cut and shock the corn and then disk the land, following with the disk drill drawn by horses. In Illinois and to a less extent in Indiana the land planted in oats was prepared with the tractor. The cornstalks from the preceding year were broken with the disk and the seed bed put in shape for planting the crop.

On some farms the tractors had not been used to any great extent for disking freshly plowed ground in the spring, because of danger of packing the soil. On many of the larger farms, where it was necessary to supplement the tractor with horses in preparing the seed bed, horses were used for disking while the tractor was being used for plowing.

The fact that a smaller portion of the disking than of the plowing was done with horses was in the main due to these two conditions.

Of the 286 operators, 284 did some disking during the year. In Table 17 is given the number of men on the various sized farms who did all their disking with their tractors, those who used both tractors and horses, and those who used horses only. The disking has not been separated into spring and fall work, or into work on plowed and unplowed ground.

TABLE 17.—*Kind of power used for disking on farms of different sizes.*

Size of farms (crop acres).	Number of farmers.	Farmers using tractors only.	Farmers using tractors and horses.	Farmers using horses only.
Less than 80	7	4	1	2
80 to 119	28	24	3	1
120 to 159	70	39	28	3
160 to 199	56	33	18	5
200 to 239	46	24	20	2
240 to 279	36	18	17	1
280 to 319	19	10	9	....
320 or more	22	8	13	1
Total	284	160	109	15
Per cent	100	57	38	5

Sixty-four per cent of the men with less than 160 crop acres, 56 per cent of those with 160 to 239 crop acres, and 47 per cent of those with 240 or more crop acres did all their disking with tractors. The fact that more than half of these men did all the disking with their tractors and 95 per cent used them for part of the work indicates a well established place for the tractor in this work as well as in plowing.

Harrowing, rolling, planking, and packing.—In most cases not more than two of these operations were performed on a farm during the year. Six operators had not used spike-tooth or spring-tooth harrows, rollers, plankers, or packers during the year, but had fitted their ground entirely with disks.

When tractors furnished the power, the implements were generally used in combination rather than individually, the most common practice being to pull one or more of these implements behind the disk. In all, 207 men did at least part of this work with tractors. One hundred and sixty-four of them used these implements behind their disk harrows, and 43 used them alone. (See fig. 6.)

The number of men on the various-sized farms who used these implements and the kind of power employed are given in Table 18.

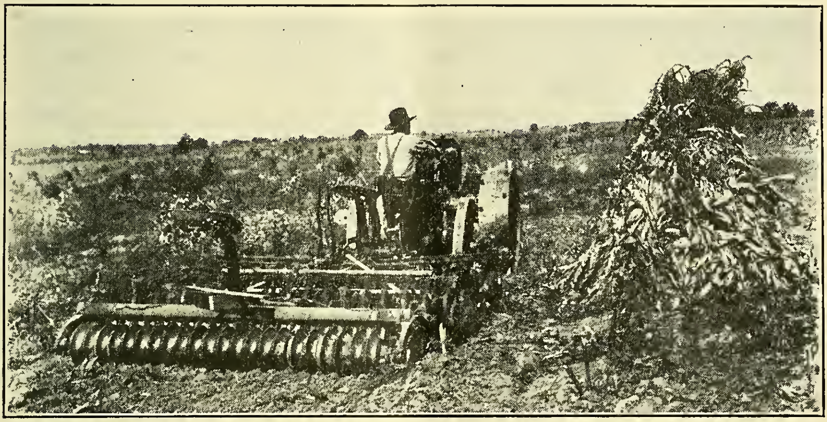

FIG. 6.—Tractor preparing corn ground for winter wheat with a double disk and packer.

TABLE 18.—*Kind of power used for harrowing, rolling, planking, and packing on farms of different sizes.*

Size of farms (crop acres).	Number of farmers.	Farmers using tractors only.	Farmers using tractors and horses.	Farmers using horses only.
Less than 80	7	3	3	1
80 to 119	28	11	14	3
120 to 159	70	20	33	17
160 to 199	53	12	26	15
200 to 239	47	7	26	14
240 to 279	35	7	19	9
280 to 319	18	4	9	5
320 or more	22	2	11	9
Total	280	66	141	73
Per cent	100	24	50	26

Here again the size of the farm had some influence on the portion of this work done with tractors. On 32 per cent of the farms with less than 160 crop acres, and on only 18 per cent of those with 160 or more crop acres, all this work was done with tractors. The implements used for this work are normally of light draft, and where the tractor and horses were used simultaneously for fitting the ground, the former was often used on the plow or disk and the latter for harrowing, etc.

In all, 72 per cent of the harrowing, planking, rolling, and packing done with tractors was done with one or more of these implements behind a disk, and 28 per cent independent of the disk. The size of the tractor had a direct bearing upon the combination used, for the 3-plow outfits were able to pull greater loads than the 2-plow machines. Only 61 per cent of the work done with 2-plow tractors was done with harrows, rollers, etc., behind disks, while 92 per cent of that done with 3-plow tractors was done behind disks.

Farms where all work previous to planting was done with tractors.—While the larger part of the plowing and disking and a considerable portion of the lighter work of harrowing, planking, rolling, and packing on these farms was done with tractors, on only 39 of the 286—14 per cent of the total—was all of the work of preparing the seed bed done with tractors. Even on farms whose operators considered their machines suitable for all this work, horses usually did part of it.

Most of the farms where tractors were used exclusively were operated by one man alone. Where an extra man was available a part of this work was nearly always done with horses.

The seed-bed preparation was done with tractors entirely on 21 per cent of the farms with less than 160 crop acres, but horses were used for some seed bed preparation on all but 9 per cent of the farms with 160 or more crop acres. Thirty-four of these 39 men operated 2-plow outfits and 5 of them 3-plow outfits. Thus 20 per cent of all the men who owned 2-plow machines and only 5 per cent of those who owned 3-plow machines did all of this work with tractors. Even though a larger percentage of the men on smaller farms owned 2-plow machines, apparently the greater versatility of the smaller machines made them more satisfactory for all the kinds of work required in preparing the seed bed.

Cutting grain.—Seven of the 286 men interviewed either raised no small grain or paid to have it cut by others. The kinds of power used by the remaining 279 were as follows:

108 or 39 per cent used tractors only.
22 or 8 per cent used tractors and horses.
149 or 53 per cent used horses only.

The 22 men who used both tractors and horses did not always use them simultaneously. More often the two sources of power were used at different times, one on oats and the other on wheat for example.

The size of the farm apparently had little to do with the kind of power used in cutting grain. Forty per cent of the men who had less than 160 crop acres, 42 per cent of those with 160 to 239 crop acres, and 33 per cent of those with 240 or more crop acres cut all their grain with tractors. The size of the tractor however, did have some influence on its use for cutting grain. Fifty-four per cent of the grain was cut with tractors on the farms where 2-plow machines were owned and only 26 per cent on the farms where 3-plow machines were owned. On the average the smaller tractors were used 1.9 days while the larger outfits were used 0.9 day for this work. (See Table 12.)

On nearly every farm only a single binder was owned, as one was usually sufficient for handling the acreage in small grain. On the 22 farms with 320 or more crop acres there was an average of 75 acres of wheat and 84 acres of oats. Either horses or tractor should cut each of these crops with a single binder in not more than 5 days (see Tables 12 and 22), and in favorable seasons at least this much time is available.

The principal reasons given by these men for using the tractor for cutting grain were that it relieved the horses of hard work in hot weather, and made it possible to get the work done in a shorter time when the season was unfavorable.

Loading hay.—On 59 of the 286 farms no hay was raised during 1920. On 37, or 16 per cent, of the remaining 227 farms, the tractors were used for at least a part of the work of pulling the wagon and hay loader. Twelve of the 37 men used their tractors not only for loading the hay in the field but also for drawing the wagons to the barn for unloading. The remaining 25 used their horses for part of the work of loading and hauling hay. The most common practice on these 25 farms was to use two or more wagons for haying. The tractor was used in the field drawing a wagon and hay loader while the horses drew the loaded wagons to the barn.

The amount of hay grown on these farms was small, compared with the amount of corn and small grain, the average acreage of both hay and seed being only 25 acres (see Table 2). On most of the farms only the second cutting of clover was thrashed for seed but on a few the entire crop was thus used. On account of the small acreage of hay a considerable number of these farmers did not own hay loaders, but loaded their hay by hand. The tractors were never used in connection with haying where this practice was followed, and this accounts in part for the comparatively small number who used their tractors for haying. In an investigation of the influence of the tractor on the use of horses made in 7 corn-belt States in 1918 and reported in Farmers' Bulletin 1093 it was found that "12 per cent of the operators interviewed used their machines for pulling the wagon and loader." Labor shortage was responsible in part for the use of the tractors at that time. On most of the farms the work was done with one man fewer than when horses were used.

While the number of corn-belt tractor owners who use their tractors in haying is evidently small, the results of both these investigations indicate that under certain conditions tractors can be used advantageously for this work.

BELT WORK.

The use of the tractor for belt work does not influence horse labor and should really be considered a separate enterprise. However, the doing of such work with the tractor adds to its usefulness and reduces the cost per day of work for such items as depreciation, interest, and repairs. As shown in Table 10, these 286 tractors were used an average of 2.7 days for belt work on the home farm during the year. However, 91, nearly a third, of the 286 were used for no belt work on the home farm during the year.

Table 11 shows that on the average the 3-plow tractors were used considerably more for belt work than the 2-plow machines. Eighty-five or 82 per cent of the 104 three-plow machines and only 103 or 59 per cent of the 174 two-plow machines were used for belt work on the home farm during the year. (See fig. 7.) Table 19 shows

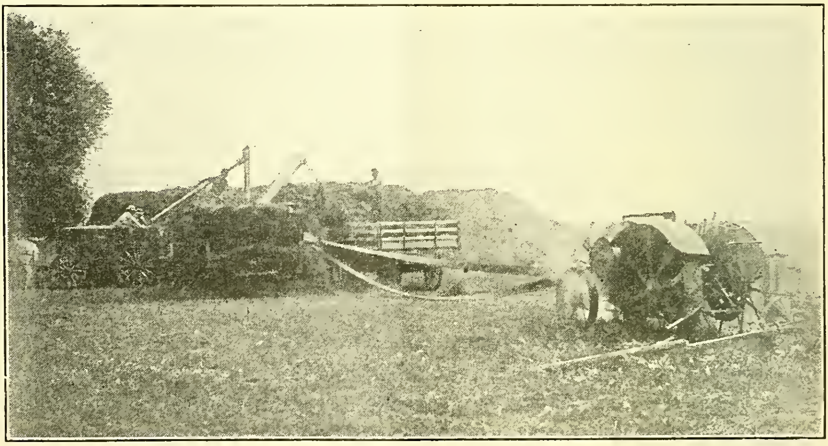

FIG. 7.—Three-plow machines were used more for belt work than the two-plow machines.

the number of men who used their tractors for different kinds of belt work during the year and the average time spent on each kind of work:

TABLE 19.—*Belt work on home farm.*

Operation.	Number performing.	Days used.	Operation.	Number performing.	Days used.
Sawing wood	110	1.4	Shredding	35	3.8
Grinding feed	101	1.5	Shelling corn	15	1.1
Filling silos	58	1.8	Other work	29	2.5
Thrashing	40	3.2			

A large number of the men who sawed wood or ground feed during the year used their tractors for this work. A few owned small stationary engines which were used. On the average 1.4 full days was sufficient for sawing the year's supply of firewood and 1.5 days for grinding the year's supply of feed. Usually the wood was sawed at one or two different times, while for grinding feed the tractor was run for only a few hours per week in the winter months.

The tractors were often not powerful enough for the heavier work of filling silos, thrashing, shredding, and shelling corn, and this accounts in part for the small number of men who used their tractors for these operations. However, there were no silos on many of the farms; shredding was not common in any except the Ohio areas and in the Madison County, Indiana, area; the practice of shelling corn on the farm was common only in the Illinois areas; and on a majority of the farms thrashing was still done with custom outfits.

CUSTOM WORK.

One hundred and eighty-three farmers did some custom work with their tractors during the year. This work amounted to an average of 4.6 days for all tractors (see Table 10), or 7.2 days for the 183 which were used for custom work. The number of men who used their tractors for different kinds of custom work and the average number of days spent by them at each operation are given in Table 20. In all, 116 tractors were used for custom drawbar work, and 113 for custom belt work.

TABLE 20.—*Custom work.*

Operation.	Number performing.	Days used.
Drawbar:		
Plowing	74	5.0
Disking	35	2.0
Other work	45	3.1
Belt:		
Filling silos	42	3.3
Thrashing	31	8.5
Sawing wood	28	1.9
Shredding	23	7.2
Other work	37	3.6

More than half of the drawbar custom work done by the tractors was plowing. The "other" drawbar work shown in the table included dragging roads, cutting grain, and other kinds of field work, but less than 10 per cent of the owners did any one kind of this work for hire. Comparatively few men did any one belt operation for hire, but from the standpoint of the time spent at the different operations by the men who actually performed them for hire, thrashing and shredding were more important than plowing.

TRACTORS WHICH WERE USED FOR NEITHER BELT NOR CUSTOM WORK.

While drawbar work on the home farm amounted on the average to only 76 per cent of the total work done by the tractors, 55 of the 286 tractors were used for nothing but this class of work during the year covered by the investigation.

The location of the farms on which these 55 tractors were owned is as follows:

Madison County, Ohio	4
Seneca County, Ohio	0
Madison County, Ind	4
Montgomery County, Ind	14
Livingston County, Ill	21
Knox County, Ill	12

On most of the farms visited in Illinois and in Montgomery County, Ind., there was no wood to cut. Silos were not as common in these three areas as in the others. Less livestock was kept on the farms in Livingston County, Ill., than in any other area, and consequently few of the tractors there were used for grinding feed. In fact, on many of the farms in both Illinois areas the only belt work done was thrashing and shelling corn, and the power for this work in most cases was furnished by steam engines.

The greater the percentage of farmers in a community who own tractors, the less will be the opportunity of doing custom work with them, even if the tractor owners desire to do it. Tractors were more numerous in Livingston County, Ill., than in any other area visited, and only 25 of the 60 men interviewed there had used their tractors for custom work during the year.

WORK DONE BY HORSES.

The average number of days of horse labor used for the various operations on the farms of different areas is shown in Table 21, and the daily duty of one horse for each of the field operations in Table 22. The daily duty of one horse, i. e., the number of acres covered per day per horse, at the different operations varied somewhat in the different areas, and to this extent the number of days of horse labor is not a true index of the actual amount of work done by the horses.

Plowing.—Since the tractors did 85 per cent of the plowing on these farms, the average number of days of horse labor used for this work is necessarily small. On the average it amounted to less than 20 days per year in each area except in Madison County, Ohio. The greater use of horses for plowing in this area was due to the fact that several of the farms were so large and the amount of spring plowing so great that the tractors could not do all of it in the time available and the horses were used regularly to supplement the tractors. Table IX shows that the tractors covered slightly less ground per day in fall plowing than in spring plowing. Similarly, the average daily duty of one horse was slightly less for fall plowing than for spring plowing.

TABLE 21.—*Days of horse labor at various operations in different areas.*

Operations.	Madison County, Ohio.	Seneca County, Ohio.	Madison County, Ind.	Montgomery County, Ind.	Livingston County, Ill.	Knox County, Ill.	All.
Spring plowing	42.8	11.1	14.6	15.6	6.8	5.1	14.1
Fall plowing	4.2	3.1	4.0	3.0	8.4	4.7	4.8
Total	47.0	14.2	18.6	18.6	15.2	9.8	18.9
Disking	17.9	5.6	3.3	4.9	37.9	14.1	15.2
Harrowing, rolling, etc	10.5	23.3	10.7	17.8	21.9	26.8	19.3
Total, fitting ground other than plowing	28.4	28.9	14.0	22.7	59.8	40.9	34.5
Broadcast seeding	.2	.1	.7	2.0	3.6	2.4	1.8
Drilling grain	24.1	11.9	13.2	13.1	.7	4.5	10.0
Total, seeding grain	24.3	12.0	13.9	15.1	4.3	6.9	11.8
Planting corn	18.8	6.9	10.2	11.9	12.8	11.8	12.2
Cultivating, 1-row	80.5	34.5	38.4	57.2	80.9	92.2	66.2
Cultivating, 2-row	14.9	4.9	15.5	26.4	12.0	8.8	14.2
Total, cultivating	95.4	39.4	53.9	83.6	92.9	101.0	80.4
Mowing	5.9	8.0	6.4	8.3	3.2	4.8	5.9
Raking and tedding	1.7	4.9	1.2	2.5	2.1	2.5	2.4
Loading and hauling hay	10.2	15.2	9.8	9.4	4.1	9.0	9.1
Total, haying	17.8	28.1	17.4	20.2	9.4	16.3	17.4
Cutting grain	13.0	12.2	7.6	12.6	11.7	6.7	10.7
Thrashing	39.5	20.9	30.5	29.6	30.1	35.9	31.3
Cutting corn	.9	14.2	4.3	7.3	1.5	1.5	3.5
Silage	12.4	4.7	7.6	4.4	1.2	3.5	5.0
Husking from stalk	70.2	3.1	71.5	90.6	95.7	109.8	81.0
Cribbing corn	43.9	2.4	1.4	.0	.0	.0	5.7
Shredding fodder	.4	24.1	3.6	1.0	.8	.1	3.8
Total, corn harvest	127.8	48.5	88.4	103.3	99.2	114.9	99.0
Other field work	1.9	7.7	6.4	6.4	2.4	2.7	4.4
Hauling manure	91.5	49.2	43.8	30.5	32.8	37.4	43.8
Miscellaneous work on farm	115.9	45.1	40.7	48.4	32.3	37.0	49.1
Road hauling	40.2	41.1	28.8	22.3	44.3	42.0	35.4
Custom work	2.2	6.1	2.7	5.4	.2	.3	2.6
Horse labor hired	.0	.2	.4	3.3	.2	1.2	1.0
Total	653.7	360.1	376.5	427.3	447.2	462.4	451.5

TABLE 22.—*Daily duty of one horse at various operations in different areas.*

[Acres per day per horse.]

Operations.	Madison County, Ohio.	Seneca County, Ohio.	Madison County, Ind.	Montgomery County, Ind.	Livingston County, Ill.	Knox County, Ill.	All.
Spring plowing	0.86	0.74	0.73	0.88	0.81	1.00	0.84
Fall plowing	.80	.75	.62	.80	.75	1.03	.80
Disking	3.17	2.56	2.64	3.13	4.08	4.26	3.79
Harrowing, rolling, etc	5.28	5.14	5.27	5.50	9.23	8.09	7.08
Broadcast seeding	18.86	15.50	14.23	16.60	22.97	20.18	20.15
Drilling grain	4.08	5.08	3.88	3.42	4.57	4.02	3.98
Planting corn	6.92	5.85	6.55	8.64	8.63	8.28	7.79
Cultivating, 1-row	3.40	2.98	3.34	3.33	3.67	3.40	3.42
Cultivating, 2-row	4.06	4.33	3.90	4.30	4.20	4.93	4.28
Mowing	4.84	4.99	4.65	3.86	4.54	5.50	4.64
Raking	12.68	7.94	8.77	9.12	5.85	8.73	8.40
Loading hay	2.21	2.30	2.07	2.76	2.11	2.56	2.49
Cutting grain	3.78	3.88	3.79	3.89	4.32	4.36	4.10
Cutting corn	2.73	2.43	2.59	2.05	2.26	2.12	2.49
Husking corn	.57	.55	.60	.71	1.03	.84	.79

Fitting ground other than plowing.—The tractors did the greater part of the work of disking, harrowing, and rolling, but on the average the amount of horse labor used for these operations was nearly twice as great as that used for plowing. Twice as much horse labor was used for disking in Livingston County, Ill., as in any other area, which was due mainly to soil conditions in that area. It had been found on some of the farms that the use of the tractor on plowed ground packed the soil seriously, and on such farms the horses did practically all the disking of plowed ground during the year covered by the investigation.

Seeding grain.—The table shows that small grain was drilled almost exclusively in the Ohio areas and in Madison County, Ind., but that endgate seeders were in common used in other areas. A few farmers in each of the first three areas used endgate seeders for sowing their

FIG. 8.—One man and three horses on a two-row cultivator accomplish nearly twice as much work as one man and two horses on a one-row machine.

oats, but the common practice was to use the drill for both oats and wheat. In the three latter areas practically all the oats was sown with endgate seeders. The use of the endgate seeder reduces both horse-labor and man-labor requirements for this operation, the average daily duty of one horse with the endgate seeder being 20 acres and with the drill only 4 acres.

Planting corn.—Corn planting was done entirely with horses on every farm and the 2-row, 2-horse machine was used exclusively. The differences in the average requirements per farm for this operation are due largely to the differences in the acreage devoted to this crop in the different areas (see Table 2).

Cultivating corn.—Two men cultivated all their corn with their tractors, and 14 others used their machines for part of this work. The table shows that on the average more horse labor was used in corn cultivation than for any other work except corn harvest. Corn harvest, however, was usually spread over a greater length of time than cultivation, and on most of the farms corn cultivation was the operation which required the greatest amount of horse labor in the shortest time.

Eighty-four of the 284 men who used horses for cultivating used 2-row cultivators for at least part of the work, and 22 of the 84 used 2-row implements exclusively. (See fig. 8.)

On the average the daily duty of one horse on a 2-row cultivator was about 25 per cent higher than the duty of one horse on a 1-row implement, and if 2-row cultivators had been used exclusively the amount of horse labor required for cultivating would have been 25 per cent less than if 1-row cultivators had been used exclusively.

FIG. 9.—Horses only were used for mowing hay on these farms.

Corn cultivating represented the peak of man labor as well as of horse labor requirements on many of the farms, and since one man with a 2-row cultivator accomplished nearly twice as much as one man with a 1-row, the more extended use of the 2-row machine on some of the farms where the acreage in corn was too great to be cultivated with a single 1-row implement would have made it possible to reduce both the number of horses kept on the farm and the number of men employed during the cultivating season.

Haying.—Hay occupied only a small acreage on most of the farms visited, and while the horses did 92 per cent of the total work on this crop the amount of horse labor required for it was small compared with the amount used in cultivating and harvesting corn and in harvesting and thrashing grain. (See fig. 9.)

Variations in practices on individual farms had considerable effect on the amount of horse labor used. On some farms the hay was loaded with a hay loader directly from the swath; on others it was tedded at least once and raked into windrows before loading. Tedders were used on only a small portion of the farms and no figures for the daily duty of one horse at this work are given. The large acreage covered per day per horse in raking in Madison County, Ohio, is due to the fact that on many of the farms there only one horse was used on the rake although in the other areas 2 horses were nearly always used regardless of the size of the rake. The daily duty of a horse at loading and hauling hay depended almost entirely on whether a loader was used and upon the size of the crew. The figures in Table 22 are simply averages of all farms in each area, regardless of the method of loading employed and the number of men and teams used for the work.

Cutting and thrashing grain.—The small amounts of horse labor used for cutting grain in Madison County, Ind., and Knox County, Ill., are due to the fact that tractors did a larger portion of the work in these counties than in the other areas. Tractors were used for cutting over 50 per cent of the grain in both of these areas. Tractors were used for cutting nearly 50 per cent of the grain in Madison County, Ohio, but the acreage of small grain on the farms visited there (see Table 2), was so great that the amount of horse labor used for this operation was greater than for any other area.

The horse labor listed under thrashing includes all the labor used on these farms for hauling the bundles from the fields to the thrasher and for hauling the thrashed grain to the elevator or market when done by the regular thrashing crew. A large part of this work was "exchange labor," but in practically every case the horses owned by the men interviewed did approximately an equal amount of work in thrashing on neighboring farms. While this work required on the average 31 days of horse labor and on most farms the thrashing was all done in one or two days, the use of the horses owned on a particular farm usually extended over a period of one to two weeks.

Harvesting corn.—The amount of horse labor used for the different corn-harvesting operations reflects the practices in the different areas. The use of horses in cutting corn was confined entirely to the corn binder, and these machines were not in general use in any area except Seneca County, Ohio. The horse labor listed under "Silage" is only that used in hauling corn from the field to the ensilage cutter. On the average, husking from the standing stalk (see fig. 10) required a greater use of horses than any other of the corn harvesting operations, but in Seneca County, Ohio, very little corn was harvested in this way, and in Madison County, Ohio, a considerable part of the crop was ensiled or cut and husked from the shock. The common practice there was to husk the corn by hand from the shock and throw it in piles, the only horse labor used being that required to haul the husked corn from field to the bin or crib. The amount of horse labor used for this particular operation is listed under "Cribbing corn." The horse labor listed under "Shredding fodder" is that required for hauling fodder to the husker and shredder and any other used for hauling the husked corn from the machine to the bin. The husker-shredder was used on practically every farm in Seneca County, Ohio.

Although the methods of harvesting corn varied considerably in the different areas, these differences in method apparently had little influence on the total amount of horse labor per acre required for harvesting corn. For all farms an average of 1.1 days of horse labor

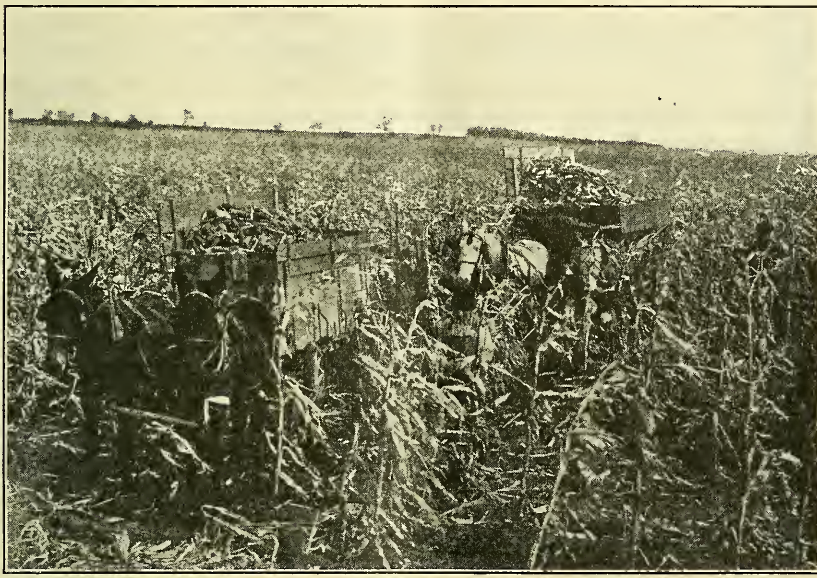

FIG. 10.—Husking corn from the standing stalk was more common in Illinois than in Indiana and Ohio.

per acre were used for corn harvest, and the average number of days of horse labor used in the different areas is as follows:

	Days.
Madison County, Ohio	1.0
Seneca County, Ohio	1.2
Madison County, Ind	1.3
Montgomery County, Ind	1.2
Livingston County, Ill	0.9
Knox County, Ill	1.2

The small amount of labor used in Livingston County, Ill., was due to the fact that the yield per acre in this area was low in 1920 and the number of acres covered per day in husking from the standing stalk depends almost entirely upon the yield. In Madison County, Ohio, a larger portion was cut by hand than in any other area and this resulted in a slight reduction in the amount of horse labor used.

Other field work.—All horse labor used for field operations other than those listed above is included under this item in Table 21. This work consisted of such operations as planting, cultivating, and harvesting potatoes, tomatoes, and sugar beets; applying fertilizer and sowing grass seed wherever done as separate operations; and hulling clover seed. While on the average this work was not important, on some of the farms more horse labor was used on it than on part of the operations that have been listed separately. In all, 107 of the 286 men used horses for some work of this character and on these 107 farms it amounted to 12 days on the average.

Hauling manure.—The amount of horse labor used for this work varied greatly on individual farms, depending upon the number and kinds of live stock kept, the methods of feeding, and the disposition of the manure. On the average more horse labor was used for hauling manure than for any other field operation except cultivating and harvesting corn. In Seneca County, Ohio, where the acreage in corn was low, more horse labor was used for manure hauling than for either corn cultivation or corn harvest.

Miscellaneous work on the farm.—Under this heading in Table 21 is placed all horse labor used on the farm itself which is not classified elsewhere. It includes such work as hauling stover from the field to the barn or feed lot, hauling straw from the stack to the barn, moving feed or hauling feed and water for live stock, hauling wood, building and repairing fences, mowing weeds, and work in the orchard and garden. Most of this work was done at times when field work was not pressing and a large part of it was light work, but on the average horses were used on it for a greater length of time than on hauling manure.

Road hauling.—All of the horse labor used for hauling produce from the farm and supplies to the farm, excepting the comparatively small amount used in hauling grain directly from the separator to to market, is included here. In the two Indiana areas a considerable portion of this hauling was done with motor trucks (see page 7) and on that account the amount of horse labor used for road hauling there was less than in other areas.

Custom work.—Some of the farmers interviewed had hired out horses to neighboring farmers or had used them for building or repairing roads during the year. The figures in Table 20 show the average amount of such work done per farm in the different areas. The workstock on 33 of the farms had done some such work during the year, and while for all farms this work amounted to an average of 2.6 days, it amounted to an average of over 22 days for the 33 farms.

Horse labor hired.—Twenty-three of the men interviewed had hired some of the horse labor which was used on their farms during the year. The amount of horse labor used for the various operations as given in Table 21 includes all the horse labor used, no difference being made between horses owned and horses hired, and to determine the actual number of days of labor performed by horses owned on these farms the labor performed by hired horses is subtracted from the total. Although this hired horse labor amounted to an average of only 1.0 day for all farms, it amounted to about 13 days on the 23 farms. If it is possible to hire horses when they are needed, this practice is preferable to keeping one or two horses throughout the year for only a few days work during the rush season.

Work done with 2-horse teams.—Loading and hauling hay from the field to the barn or stack, hauling grain to and from the thrashing machine, all the work of corn harvest (except cutting corn and drawing the mechanical picker on a few of the farms), and hauling to and from the farm were almost universally done with 2-horse teams. On a large majority of the farms manure was hauled, whether in wagon or spreader, with two horses, and wagons drawn by two horses were used for a large percentage of the miscellaneous work on the farm. On the average a total of 265 days of horse labor was used for these operations.

A few farmers used three horses for drawing their manure spreaders, and a few used four horses for drawing the wagon and hay loader and for road hauling when the roads were muddy. But even after making a liberal allowance for the portion of this work which was done with 3 or 4 horse teams, approximately 50 per cent of the time during which horses were used was occupied in hauling or other wagon work with 2-horse teams.

This work does not require an expenditure of energy on the part of horses proportionate to the amount of time used for it. In nearly all of this work the horses and wagon are standing still a considerable part of the time, and the horses are drawing only an empty wagon approximately half of the time they are in motion.

On practically all of the farms, teams of at least three horses were used for work in preparing the seed bed, for drilling and cutting grain, for cutting corn, and for drawing a 2-row cultivator. Teams of more than two horses were never used, however, for broadcast seeding of small grain, planting corn, drawing 1-row cultivators, and mowing, raking, and tedding hay. These operations occupied on the average a total of 88 days of horse labor per farm. In all, a total of 353 days of horse labor were used on the average farm for the wagon work listed above, and for these 2-horse field operations. This is over 75 per cent of the total horse labor used during the year.[1]

[1] Detailed records kept by the Office of Farm Management and Farm Economics on 14 farms in west-central Illinois where tractors were not owned show that 62 per cent of the horse labor was used in 2-horse units.

HORSE LABOR EQUIVALENT OF TRACTOR WORK.

Table 23 shows the horse labor equivalent of the drawbar work done at home by the tractors in the different areas. Table 14 (page 18) shows that on the average the tractors did 52.1 acres of spring plowing and 37.7 acres of fall plowing per farm, and Table 22 (page 27) shows that the daily duty of one horse was 0.84 acre at spring plowing and 0.80 acre at fall plowing. Thus on the average, 62.1 days of horse labor would have been required to do the spring plowing which the tractors did and 47.1 days to do the fall plowing. In other words the average tractor did the equivalent of 109.2 days of horse labor in plowing. The figures for each operation in the various areas were obtained in a similar manner.

TABLE 23.—*Horse-day equivalent of tractor work in different areas.*

Operations.	Madison County, Ohio.	Seneca County, Ohio.	Madison County, Ind.	Montgomery County, Ind.	Livingston County, Ill.	Knox County, Ill.	All areas.
	Horse-days.	*Horse-days.*	*Horse-days.*	*Horse-days.*	*Horse-days.*	*Horse-days.*	*Horse-days.*
Plowing	126.0	80.9	103.1	106.3	131.6	96.1	109.2
Fitting ground after plowing	88.8	67.0	76.2	99.7	52.6	72.1	68.4
Haying	....	1.2	4.6	1.8	.2	1.8	1.5
Cutting grain	16.6	2.8	12.3	6.1	6.5	9.0	7.4
Other drawbar work	14.3	3.6	12.2	6.5	4.0	9.0	7.9
Total	245.7	155.5	208.4	220.4	194.9	188.0	194.4

Comparison of the number of days of drawbar work actually done by the tractors with the horse-labor equivalent shows that in each area the tractors did as much work per day as would have been done by eight or nine horses. The average number of days the tractors were used for drawbar work on the home farm in the different areas was as follows:

	Days.
Madison County, Ohio	30.0
Seneca County, Ohio	17.0
Madison County, Ind	23.7
Montgomery County, Ind	25.4
Livingston County, Ill	21.3
Knox County, Ill	24.0

For the entire 286 farms the tractors did as much work per day as would have been done by 8.3 horses. When plowing, each 2-plow tractor performed the equivalent of 7.9 days of horse labor per day in the spring and 8.1 days in the fall. The 3-plow tractors performed the equivalent of 10.3 days of horse labor in the spring and 10.8 days in the fall. (See tables 12 and 22).

The average number of days of horse labor per year per head in the different areas was as follows:

	Days.
Madison County, Ohio	79.2
Seneca County, Ohio	72.3
Madison County, Ind	72.3
Montgomery County, Ind	72.4
Livingston County, Ill	54.9
Knox County, Ill	68.0

Comparison of these figures with those in table 23 shows that on the average each tractor did as much drawbar work during the year as was done by 2.8 horses. In Seneca County, Ohio, the work done by each tractor was equivalent to the number of days of horse labor performed by 2.2 horses during the year, while in Livingston County, Ill., it was equivalent to that performed by 3.5 horses. The horse labor equivalent of the work done by tractors in this area was not as great as in some of the other areas, but the workstock were used a considerably smaller number of days per year than in any other area.

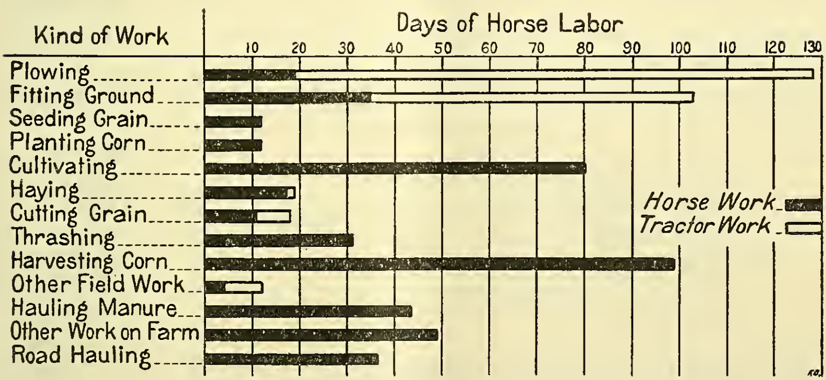

FIG. 11.—Proportion of different kinds of work done with horses and tractors.

PROPORTION OF WORK DONE BY HORSES AND BY TRACTORS.

Table 24 shows the average number of days of horse labor per farm used on the different operations, the horse labor equivalent of the work done by the tractors, the number of days of horse labor which would have been necessary if tractors had not been owned, and the percentage of the different operations done with tractors. The same items are shown graphically in figure 11. The horse labor listed under "Other field work" is the same as that shown in Table 21, but the tractor work listed there consisted partly of seeding grain, cultivating, and harvesting corn (see page 15).

TABLE 24.—*Proportion of different operations done with horses and with tractors (all farms).*

Operation.	Days of horse labor per farm.	Horse-day equivalent of tractor work.	Total.	Percentage done with tractors.
Plowing	18.9	109.2	128.1	85.2
Fitting ground after plowing	34.5	68.4	102.9	66.5
Seeding grain	11.8	....	11.8	....
Planting corn	12.2	....	12.2	....
Cultivating	80.4	....	80.4	....
Haying	17.4	1.5	18.9	7.9
Cutting grain	10.7	7.4	18.1	40.9
Thrashing	31.3	....	31.3	....
Corn harvest	99.0	....	99.0	....
Other field work	4.4	7.9	12.3	....
Hauling manure	43.8	....	43.8	....
Other work on farm	49.1	....	49.1	....
Road hauling	36.4	....	36.4	....
Total	449.9	194.4	644.3	30.1

As measured in terms of the days of horse labor required for it, the tractors did 30.1 per cent of the drawbar work on these farms. The proportion of the work done with the tractors varied among the individual farms, but there was no great variation in the average for the different areas.

The percentage of the work, in terms of days of horse labor, done by the tractors in the different areas was as follows:

	Per cent.
Madison County, Ohio	27.0
Seneca County, Ohio	30.2
Madison County, Ind	35.6
Montgomery County, Ind	34.0
Livingston County, Ill	30.5
Knox County, Ill	28.9

The tractors on the larger farms did considerably more drawbar work than the machines on the smaller farms, but the size of the farm had very little influence on the proportion of the total done with the tractor.

If it had been possible to measure the work done by the tractor and workstock in terms of drawbar pull and distance traveled, the proportion of the total done by the tractors would have been considerably greater. A large proportion of the work done by the tractors was plowing and other work in preparing the seed bed, which requires steady pulling of a heavy load, while a large part of the work done by the horses was hauling and other work which does not require steady pulling of heavy loads.

The 2-plow tractors were used more for disking and for the lighter operations of harrowing, rolling, etc., and for cutting grain than were the 3-plow machines (see Table 12). The proportion of the total work required for plowing and preparing the seed bed and for cutting grain which was done with the 2-plow and 3-plow outfits on the farms where they were owned is shown in Table 25.

TABLE 25.—*Percentage of different operations done with 2-plow and with 3-plow tractors.*

Operation.	2-plow (174 farms).	3-plow (104 farms).
	Per cent.	*Per cent.*
Spring plowing	83.7	80.6
Fall plowing	88.5	93.3
Disking	82.0	63.3
Harrowing, rolling, etc	49.1	36.2
Cutting grain	53.8	25.9

NUMBER OF WORKSTOCK USED ON DIFFERENT OPERATIONS.

The number of workstock used for each operation as well as the number of workstock owned was obtained from the operators of the farms visited. Table 26 gives the number of workstock on the different farms and the number of operators who used all for cultivating corn or some other one operation.

TABLE 26.—*Number of workstock owned on different farms and number of farms where all were used for some one operation.*

Number of work-stock owned.	Number of farms.	Number of farms where all workstock were used for cultivation.	Number of farms where workstock were not all used for cultivation, but were all used for some other operation.	Number of farms where all workstock were never used for any one operation.
2	11	10	1	0
3	15	9	6	0
4	43	29	9	5
5	41	18	5	18
6	57	27	7	23
7	32	4	3	25
8	39	5	4	30
9	15	1	1	13
10	12	1	2	9
11	1	0	0	1
12	4	0	0	4
13	6	0	0	6
14	5	0	0	5
16	1	0	0	1
18	1	0	0	1
20	2	1	0	1
24	1	0	0	1
Total	286	105	38	143

Ninety-three per cent of the men with 4 or less head of workstock, 57 per cent with 5 or 6, 23 per cent with 7 or 8, 19 per cent with 9 or 10, and 5 per cent with over 10 used them all for some one operation. One-half of the operators never used all of their workstock for any one operation.

On most of the farms the cultivation of corn required more horse labor than any other single operation in the limited amount of time available for the work. Of the 143 men who used all of their work-stock for some one operation 73 per cent used them for the cultivation of corn.

Two men cultivated their corn entirely with their tractors, 14 used their tractors for part of the work, and 270 used horse-drawn cultivators only. The acreage in corn on these 270 farms and the number of horses used on each for cultivating were as shown in Table 27.

TABLE 27.—*Number of horses used for cultivating corn on farms of different sizes using horse-drawn cultivators only.*

Acres in corn.	Number of farms.	Farms using 2 horses.	Farms using 3 horses.	Farms using 4 horses.	Farms using 5 horses.	Farms using 6 horses.	Farms using 7 horses.	Farms using 8 horses.	Farms using 9 horses.	Farms using 10 horses.	Farms using 11 horses.	Farms using 12 or more horses.
Less than 35	20	17	1	2								
35 to 54	42	7	11	18	4	2						
55 to 74	51		2	32	8	8	1					
75 to 94	49			21	15	12		1				
95 to 114	43			14	7	16	2	4				
115 to 134	20				1	16	1	2				
135 to 154	24				1	13	3	5	1			1
155 or more	21					4	3	3	3	3	1	4

Apparently some of these men used more horses than necessary for their corn cultivation. Two horses should be ample for cultivating 35 acres or less, but three men used more than two horses. Three or four horses, drawing one 2-row or two 1-row cultivators, should be sufficient for 35 to 54 acres of corn, and a majority of the men with 55 to 74 acres used only 4 horses for cultivating, yet 23 of the 93 men with 35 to 74 acres in corn used more than 4 horses for cultivating. Similarly, the cultivating could evidently have been done with fewer horses on some of the farms with greater acreages in corn.

If 2-row cultivators had been used exclusively on the farms where two 1-row outfits were used, only three horses and one man would have been required for the work. A more extended use of 2-row machines on the farms with larger acreages in corn would have often made it possible to do the cultivating with fewer horses, and fewer men as well.

On some of these farms more horses were needed for some other operation than for corn-cultivating. If machines and men are available for cultivation on such farms, it might be profitable to use the horses which would otherwise be idle. This practice is responsible for the large number of horses used for cultivating on some of the farms.

On 38 of the farms the workstock were not all used for cultivation, but were used for some other one operation. The particular operation for which all the horses were used depended on the amount and kind of crops raised and the operations for which the tractor was used. On some of the farms where only 3 or 4 head were owned they were all used for cutting grain. On some few they were all used for fitting ground, haying, or husking corn.

In some seasons hay must be made and grain must be cut before corn cultivating is finished. On this account it can not be said that all of the men who did not use all of their horses for any one operation could have reduced the number kept with safety. Many farmers, however, used their tractors for cutting grain and some for drawing a wagon and hay loader. Even though an operator may not consider it profitable to use his tractor for such work, it might be more economical to perform these operations with the tractor than to keep extra horses throughout the year.

Every man who owned 2 or 3 head of workstock used them all for some one operation, and every man who owned 4 or 5 head used all but one. Sixty-six of the 155 men who owned 6 to 10 head and all but one of the 21 who owned more than 10 head had at least 2 more horses than were used for any one operation. On 26 of the 286 farms there were at least 4 more horses than had been used for any one operation during the year.

The reliability of the tractor was such that on most of the farms it was not necessary to keep extra horses for use in case the tractors were out of commission when needed (see page 53). On many of the farms the acreage had not been increased and the number of workstock had not been reduced since the purchase of the tractor (see page 56). In view of these facts it is evident that either more work could have been accomplished by more efficient use of the horses on hand, or the number of horses kept could have been reduced and the cost of the operation of the farm correspondingly decreased.

COST OF KEEPING WORKSTOCK.

A record of the amount and value of the feed consumed by the workstock during the year ending October 31, 1920, and the value of these feeds was obtained from each farmer. The amount of time spent in taking care of the horses, the value and depreciation of work harness, the change in value of the workstock, the value of colts foaled during the year, and the cash outlay for shoeing and veterinary services were also obtained. In computing the cost of keeping the workstock these items, together with interest at 6 per cent on the average value, were included. A manure credit of $15 per head was deducted from this total cost to obtain the net cost per farm and per head. Table 28 shows the cost per head in the different areas.

TABLE 28.—*Cost of keeping workstock in different areas.*

Area.	Number of farms.	Average number of workstock per farm.	Cost per head. Feed.	Shoeing.	Veterinary.	Chores.	Interest.	Harness.	Depreciation.	Total.	Manure credit.	Net cost per head.
Madison County, Ohio	34	8.1	$135.96	$3.05	$0.58	$15.43	$9.57	$5.43	$3.36	$173.38	$15.00	$158.38
Seneca County, Ohio	34	5.0	160.25	3.75	.66	22.58	9.02	5.21	4.64	206.11	15.00	191.11
Madison County, Ind	42	5.4	135.56	3.13	1.19	16.52	7.87	4.87	1.20	170.34	15.00	155.34
Montgomery County, Ind	56	6.0	123.10	2.23	1.04	16.47	8.49	3.52	13.68	168.53	15.00	153.53
Livingston County, Ill	60	8.4	128.78	1.27	1.69	14.07	8.86	5.10	6.72	166.49	15.00	151.49
Knox County, Ill	60	7.0	135.13	1.41	1.03	14.65	8.08	4.97	12.09	177.36	15.00	162.36
All	286	6.8	133.64	2.16	1.13	15.83	8.62	4.82	7.79	173.99	15.00	158.99

The average net cost per farm of keeping the workstock during the year was $1,076. The costs per farm in the different areas were:

Madison County, Ohio	$1,278
Seneca County, Ohio	956
Madison County, Ind	839
Montgomery County, Ind	926
Livingston County, Ill	1,280
Knox County, Ill	1,133

The greater number of workstock kept on the larger farms (see Table 9) naturally makes the cost per farm greater. The average cost per farm on the farms of different sizes was:

Less than 80 crop acres	$621
80 to 119 crop acres	660
120 to 159 crop acres	849
160 to 199 crop acres	1,006
200 to 239 crop acres	1,120
240 to 279 crop acres	1,292
280 to 319 crop acres	1,367
320 or more crop acres	1,966

No attempt was made to obtain figures on the cost of housing the animals or on taxes and insurance. These items, however, would amount to only a small percentage of the total. United States Department of Agriculture Bulletin 560, "The Cost of Keeping Farm Horses and the Cost of Horse Labor," based on detailed cost account records, shows that for the period of 1909 to 1914 these charges amounted to about 10 per cent of the total cost of keeping horses in Illinois and Ohio. Figures presented in the University of Illinois Agricultural Experiment Station Bulletin 231, "The Horse and the Tractor," shows that for the six years, 1913 to 1918, the charge for shelter there amounted to 3.1 per cent of the total cost of keeping workstock, and for the years 1917 and 1918 amounted to a little over 2 per cent.

Feed.—Table 29 shows the average annual feed consumption per head in the different areas. The detailed rations for the workstock were obtained on only 253 of the 286 farms. On the remaining 33 farms the value of the feeds consumed was obtained but the amounts were not.

TABLE 29.—*Feed for workstock.*

Area.	Number of farms.	Average annual feed consumption per head.									Cost of feed per head.
		Hay (tons).	Straw (tons).	Stover (acres).	Corn (bushels).	Oats (bushels).	Pasture and grass.		Stalk pasture.		
							Number of months or acres.	Number of farms.	Number of months or acres.	Number of farms.	
Madison County, Ohio	32	1.63	0.13	2.60	36.1	4.6	5.8 months 3.2 acres	12 20	....	....	$135.96
Seneca County, Ohio	23	2.72	.12	1.06	37.4	29.2	4.2 months 3.2 acres None	15 5 3	....	....	160.25
Madison County, Ind.	22	1.66	1.04	.22	37.0	13.5	5.9 months 2.3 acres	13 9	3.0 months None	1 21	135.56
Montgomery County, Ind.	56	1.54	.98	.11	36.2	23.4	5.3 months 2.1 acres	46 10	3.0 months None	48 8	123.10
Livingston County, Ill.	60	.47	2.49	.02	39.9	29.2	4.2 months 2.1 acres None	26 32 2	3.1 months 4.3 acres None	25 21 14	128.78
Knox County, Ill.	60	1.15	1.23	.04	38.3	24.4	4.1 months 1.6 acres None	32 21 7	3.3 months 2.6 acres None	23 30 7	135.13
All	253	1.32	1.22	.20	37.8	22.3	4.8 months 2.3 acres None	144 97 12	3.1 months 3.3 acres None	97 51 105	133.64

The feeding practices varied considerably in the different areas. In the Ohio areas and on a number of the farms visited in Indiana corn stover made up a substantial part of the winter ration of the workstock. In Illinois and on the Indiana farms where most of the corn was husked from the standing stalk the horses were usually turned into the stalk fields when husking was finished, and the stalk pasture took the place of the stover. On many farms, especially in Ohio and Indiana, the workstock had access to the straw piles, but the owners usually considered that the straw thus consumed by the horses was of little value and would make no charge for it. Whenever the farmers considered that the straw used for bedding had any value, this was included in the ration, and no attempt was made to differentiate between it and straw used for feed. The large amount of straw and the small amount of hay in the ration for Livingston County, Ill., is due to the fact that in the year 1919 very little hay was produced in this county, and on many of the farms the horses had been wintered on straw and stalk pasture only.

On some farms it was rather difficult to obtain an accurate estimate of the amount and value of both the grass and stalk pasture which should be charged to the workstock. The number of months the horses were on pasture and the value of pasture per head per month was obtained from part of the men and from others the number of acres of pasture which the horses used and the value per acre for the season.

Exclusive of the grass and stalk pasture, the average ration per head consisted of 6,120 pounds of roughage and 2,830 pounds of grain. This is probably somewhat lower than the average amount of feed per year consumed by the horses on the farms where tractors are not owned in these same areas. It was impossible to obtain accurate figures on this subject, but many of these tractor owners stated that their horses were idle most of the time when horses on other farms were being used daily for the heavy work of plowing and preparing the seed bed, and that during such times their horses were on pasture, or received only a light ration of grain and hay.

The average prices of feeds for the year as obtained from the farmers in the different areas are given in Table 30.

TABLE 30.—*Prices of horse feeds in different areas.*

Location.	Hay per ton.	Stover per acre.	Straw per ton.	Corn per bu.	Oats per bu.	Pasture.		Stalks.	
						Per acre.	Per month.	Per acre.	Per month.
Madison County, Ohio	$23.93	$5.58	$3.57	$1.48	$0.69	$7.17	$2.85	....	....
Seneca County, Ohio	24.17	8.34	5.00	1.50	.81	7.00	2.23	....	....
Madison County, Ind	23.91	10.55	7.90	1.52	.75	9.11	2.19	....	$1.50
Montgomery County, Ind	22.61	6.11	8.74	1.47	.75	6.80	2.18	....	1.74
Livingston County, Ill	28.62	10.80	9.56	1.43	.73	6.81	2.33	$1.35	1.79
Knox County, Ill	25.76	8.38	9.02	1.47	.73	7.50	2.51	1.11	1.59
All	24.94	6.96	8.74	1.47	.74	7.25	2.34	1.14	1.73

The value of grain and hay is now (Sept., 1921) considerably less than during the year covered by the investigation. Based on the prices for grain and roughage given below, the cost of the average ration per year would be about $60.

Corn, 53 cents per bushel.
Oats, 29 cents per bushel.
Loose hay, $13 per ton.
Straw, $4.50 per ton.
Stover, $3.50 per acre.

The figures for corn, oats, and hay are the average prices to farmers in Sept., 1921, for the States of Ohio, Indiana, and Illinois, as reported by the Bureau of Crop Estimates. The prices of the straw and stover have been obtained by reducing the prices given in Table 30 by the percentage of decline in the price of hay since the time of the investigation.

The average cost per farm of feed for the workstock for the year 1920 as obtained in the investigation was $904. If the feed had been charged to the workstock at the 1921 prices shown above, the cost per farm would have been about $400, a reduction of about 55 per cent below the 1920 cost. Assuming no change in other costs and credits, the 1921 cost per farm of maintaining the workstock would be about $575, or $85 per head.

Chores.—The total time spent in feeding and caring for the workstock amounted to 430 hours per farm for the year, or about 63 hours per head. The figures given in Table 28 represent the value of this time at 25 cents per hour. This rate is approximately the average value per hour of all farm labor in this section during the year of the survey. It must be remembered that all this work was done either by the farmer himself or by the regular labor without any actual cash outlay for it, and that a considerable part of the time thus used would not have been profitably employed otherwise.

Depreciation.—The total value of all workstock on the farm at the time of the investigation, the value of the workstock on the farm at the beginning of the year covered by the investigation, the cost of any which had been bought during the year, and the amount received for any which had been sold were obtained from each farmer. Colts which were foaled during the year of the investigation were credited to the workstock at their value (minus the breeding fee) at the time of the survey. All these figures were combined to obtain the total appreciation or depreciation of the workstock on the farm.

On all the 286 farms a total of only 111 colts had been foaled during the year. (See Table 6.) The average value of these colts at the time of the survey was not far from $50 and the breeding fee in most cases had been $15. Thus, for all farms, the credit for colts amounted to about $2 per head of workstock.

On this basis the workstock had depreciated on 154 of the farms during the year of the investigation by an average of $136 per farm. They had appreciated on 64 farms by an average of $92 per farm, and there had been no change of value on the remaining 68 farms, thus making a net depreciation of about $53 per farm, or $7.79 per head. This depreciation amounted to a little over 5 per cent of the value of the workstock. If the credit for colts had not been included the depreciation would have amounted to nearly 7 per cent of the value of the workstock.

Only a part of the feed consumed by the workstock is salable, and a large part of the costs other than feed do not represent any outlay of cash on the part of the farmer. Likewise the manure produced, for which a credit of $15 per head has been allowed, had no sale value on a large majority of these farms.

The corn, oats, and hay consumed by the workstock was practically all salable, and in most cases the straw which was included as part of the ration could have been sold. Stover, however, could rarely have been sold; the pasture, both grass and stalk, charged to the horses is principally a by-product of the general system of farming practiced in this section, and only in isolated cases could it have actually been sold.

On this basis the value of salable feed consumed during the year was \$113 per head or about \$772 per farm. On nearly all the farms, the only other costs which involved either the use of salable material or labor or the expenditure of cash were the shoeing and veterinary bills, which together amounted to \$22 per farm. Thus salable feed and cash expense together amounted on the average to about 74 per cent of the net cost of keeping the workstock.

Cost of horse labor.—The cost per day of horse labor on each farm was found by dividing the total cost of keeping the workstock on that farm by the number of days of horse labor used during the year. For all farms the average cost per day was \$2.43. The average length of the working day for the horses was nearly 10 hours (see page 12), and consequently the cost per hour of horse labor on these farms

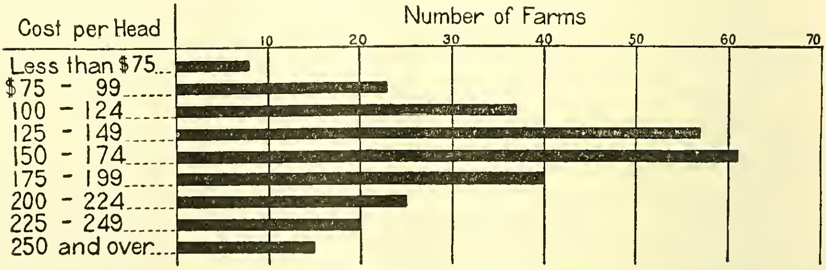

FIG. 12.—Variation in 1920 cost per head of keeping horses.

was between 24 and 25 cents. The cost per day on any farm is dedependent upon the number of workstock kept, the cost of keeping them, and the number of days work during the year. The different farms varied greatly in the cost per head of keeping workstock, owing to variations in the different items of cost. The cost per head of feed was twice as great on some of the farms as on others. It has already been pointed out that farms of the same size varied considerably in the number of workstock kept, and that similar variations occurred in the number of days the horses worked per year. Figures 12 and 13 show the variations in the cost per head of keeping the workstock and in the cost per day of horse labor on these farms. It is apparent that by more careful management both the cost per day of horse labor and the total cost of keeping the workstock could have been reduced on many farms.

The acres per day covered by 1 horse at various operations on these farms have been given in Table 22. The cost per day of horse labor divided by the number of acres covered by one horse gives the cost per acre of power as furnished by horses for the different operations. While the costs vary widely from farm to farm, the average gives a basis of comparing the cost of power as furnished by horses with that furnished by tractors for the different operations.

The average cost of power per acre furnished by horses for the principal operations on which tractors were also used was as follows:

Spring plowing	$2.89
Fall plowing	3.04
Disking	.64
Harrowing, rolling, etc	.34
Drawing hayloader	.98
Drawing grain binder	.59

These figures represent the cost of power only and not the total cost of performing the different operations. The cost of man labor and the cost of the implements must be added to the cost of power, to obtain the total cost.

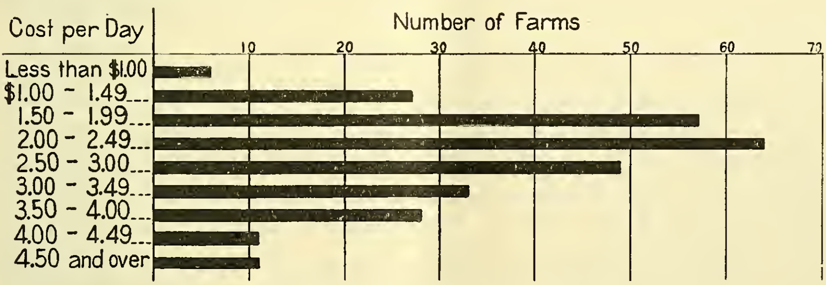

FIG. 13.—Variation in cost per day of horse labor (1920).

If the 1921 prices of feeds (as given on page 42) were used in computing the cost of horse labor, the cost per day would be $1.29 and the cost of power as furnished by horses for the different kinds of work would be 53 per cent of the figures given above.

The cost per unit of horse labor on these farms where tractors are owned can not be considered as exactly representative of the costs on the farms where tractors are not owned, as on many of the farms the cost per head of keeping the workstock was lower than it would have been if tractors had not been owned, and the number of days' work per head also would have been considerably different on many of the farms.

COST OF USING TRACTORS.

The first cost of each tractor and the owner's estimate of its life were given. The cost of any equipment not included in the price of the tractor was added to the reported first cost. This equipment consisted of belt pulleys, fenders, and in a few cases governors. The annual depreciation of each tractor was determined by dividing its first cost by the owner's estimate of its life.

The cash outlay for repairs during the year and the amount of time spent by the owner in repairing or overhauling the tractor were obtained. Interest was charged at 6 per cent on the average investment.

The total annual cost for depreciation, repairs, and interest was divided by the number of days of work done by the tractor during the year to obtain the cost per day of work for these items. To this was added the cost of fuel and oil used per day to obtain the total cost per day of use, and the sum divided by the number of acres covered in a day to obtain the acre-cost of using the tractor on the different operations. No charges for shelter, insurance, and taxes are included. These charges would amount to only a small percentage of the total cost, however.

In the following discussion the 2-plow and 3-plow machines are treated separately in order to afford a comparison between the two sizes. On all the 286 farms there were only 8 tractors of sizes other than these (see page 9), and no figures for them are given. The 286, however, are included in every case in the figures for "All tractors."

First cost.—The average first cost of the 174 2-plow machines was \$972; of the 104 3-plow machines, \$1,354, and of the entire 286, \$1,140. These figures include the first cost of all extra equipment, for the tractors themselves, but do not include the cost of new implements purchased. Every farmer owned a tractor plow and a majority had also purchased tractor disks. Some had also procured belt machines for use with the tractors. On the average the amount which had been spent by the owners of the 2-plow tractors for implements and machines was \$271, and by the owners of 3-plow tractors \$430. For all farms this item amounted to an average of \$343.

Life.—The average estimated life of the 286 tractors was 6.7 years. The average of the estimates for the 2-plow tractors was 6.4 years, and for the 3-plow 7.0 years.

TABLE 31.—*Estimated life of tractors.*

Estimated life of tractor (years).	Number of owners estimating life of tractor as specified.	
	Owners of 2-plow tractors.	Owners of 3-plow tractors.
3	5	5
4	17	4
5	51	30
6	33	13
7	17	13
8	22	14
9	7	2
10	21	16
11	....	1
12	1	3
15	....	3

The estimates of the 174 owners of 2-plow tractors and the 104 owners of 3-plow tractors were as given in Table 31.

It is seen that for each size the largest number estimated the life at 5 years. The wide range in the estimates was due not only to the condition of the tractors at the time of the investigation and the amount of work which would be done with them in the future but also to a considerable extent to each individual owner's idea as to when it would be more profitable to discard his tractor than to spend more time and money in keeping it in running order.

The averages of the estimates for the 2-plow and 3-plow tractors of different ages are given in Table 32. There evidently was no tendency on the part of the men who had owned their machines only a short time to over-estimate the length of time their tractors would last. For each size the average of the estimates of the men who had owned their tractors 14 months or less; i. e., those who had done just one full year's work with them, was less than the average of all estimates.

TABLE 32.—*Estimated life of 2-plow and 3-plow tractors of different ages.*

Age of tractor (months).	2-plow tractors.		3-plow tractors.	
	Number.	Estimated life (years).	Number.	Estimated life (years).
14 and less	74	6.3	29	6.6
15 to 26	60	6.6	39	7.2
27 to 38	28	6.5	20	7.0
39 and over	12	6.2	16	7.6
All	174	6.4	104	7.0

Depreciation.—The annual depreciation charge for each tractor was determined by dividing its first cost by the owner's estimate of its life. The wide range in the estimated life necessarily caused a wide range in the annual depreciation charges for the different machines, but this method is probably the best available, and the average determined in this way will at least show the importance of this item of cost.

The average annual depreciation for all tractors was $185. For 2-plow tractors it was $164, and for the 3-plow $217. For most of the machines this charge was the greatest single item of cost connected with their use.

Repairs.—The average amount which was spent during the year on the 286 machines for repairs, including both the cost of parts and the cash outlay for labor, was $29.95. The costs for 2-plow and 3-plow tractors of different ages are shown in Table 33. The cost for the year was $20 or less for over half the machines in each age group, and the greater average cost for the older tractors was due to high repairs on a few machines. Forty-eight of the men spent nothing for repairs during the year.

TABLE 33.—*Annual repair cost of 2-plow and 3-plow tractors of different ages.*

Age of tractor (months).	2-plow.		3-plow.	
	Number.	Average repair cost.	Number.	Average repair cost.
14 and less	74	$20.73	29	$24.93
15 to 26	60	38.88	39	22.64
27 to 38	28	38.18	20	37.55
39 and over	12	44.25	16	43.25
All	174	31.42	104	29.32

Table 34 shows the number of owners of tractors who spent different amounts for repairs during the year.

TABLE 34.—*Cost of tractor repairs.*

Amount spent for repairs.	Owners who spent amounts specified.	
	Owners of 2-plow tractors.	Owners of 3-plow tractors.
Nothing	30	18
$20 or less	78	43
$21 to $40	22	18
$41 to $60	18	10
$61 to $80	6	7
$81 to $100	9	3
Over $100	11	5

The average annual cost for repairs on the 2-plow tractors had been 3.2 per cent of the first cost of the tractors, and the repairs on the 3-plow machines had been 2.2 per cent of their first cost. For the 2-plow machines which had been used 39 months or over, i. e., had done at least three full years of work at the time of the investigation, the repairs during the year had amounted to 4.6 per cent of the first cost, and for the 3-plow tractors 3.2 per cent.

Unpaid labor.—In addition to the cash outlay for labor and repairs, each farmer was asked the amount of time spent by him or by the regular farm labor during the year in repairing the tractor. On an average, this labor amounted to 1.8 days for the year, but no such labor was used on 78 of the 286 tractors. Part of these 78 tractors required no repairs during the year and most of the remainder were machines whose owners were not capable of doing the repair work.

The actual number of days used on the different machines is shown in Table 35.

TABLE 35.—*Unpaid labor used in repairing tractors.*

Labor used (days).	Tractors on which specified amounts of labor were used.	
	2-plow tractors.	3-plow tractors.
0	49	28
1	41	29
2	47	17
3	16	12
4	10	9
5 and over	11	9

Nearly all of the men who spent more than one or two days on repair work gave their machines a general overhauling during the year.

The value of this labor at $5 per day has been included in the cost of operating the tractors Five dollars per day, or 50 cents per hour, is considerably higher than the value of ordinary farm labor during the year of investigation, but is considerably lower than the prices charged by regular experts and repair men. On the average this charge amounted to $8.55 for the 2-plow tractors, $9.45 for the 3-plow tractors, and $9.06 for all tractors.

Interest.—Interest is charged at 6 per cent on the average investment. The average investment has been found by the rule:

$$\text{Average investment} = \frac{\text{first cost} \times (\text{years of service} + 1.)}{\text{years of service} \times 2.}$$

This is the generally accepted formula for determining the average investment in equipment where a fraction of the first cost is charged off each year for depreciation. The interest charge when computed on this basis is slightly greater than when computed on one-half of the first cost.

The average interest charge for the 2-plow tractors was $34, for the 3-plow $47, and for all tractors $40.

Fuel and oil.—The average amounts of fuel and oil used per day by the 2-plow machines at the different drawbar operations are given in Table 36 and the amounts used by the 3-plow tractors in Table 37. The fuel and oil required per day by the 3-plow tractors was considerably greater for every operation than that required by the 2-plow machines, but this was offset by the greater number of acres covered per day by the larger machines (see Table 12), so that there was practically no difference in the requirements per acre between the 2-plow and the 3-plow machines for any of the operations.

TABLE 36.—*Fuel and oil requirements per day and per acre of 2-plow tractors for different operations.*

Operation.	Number of tractors.	Requirements per day.		Requirements per acre.	
		Fuel.	Oil.	Fuel.	Oil.
		Gals.	*Gals.*	*Gals.*	*Gals.*
Spring plowing	164	17.97	1.10	2.71	0.17
Fall plowing	129	18.46	1.06	2.86	.16
Disking	95	17.98	1.03	.83	.05
Disking in combination	101	17.78	1.09	.90	.06
Harrowing, etc	53	16.23	1.01	.42	.03
Drawing hay loader	24	11.45	.85	1.09	.08
Drawing grain binder	101	14.50	.92	.73	.05

TABLE 37.—*Fuel and oil requirements of 3-plow tractors for different operations.*

Operation.	Number of tractors.	Requirements per day.		Requirements per acre.	
		Fuel.	Oil.	Fuel.	Oil.
		Gals.	*Gals.*	*Gals.*	*Gals.*
Spring plowing	94	23.12	1.29	2.68	0.15
Fall plowing	80	23.33	1.32	2.71	.15
Disking	46	22.02	1.34	.71	.04
Disking in combination	64	22.74	1.30	.95	.05
Harrowing, etc	7	21.60	1.51	.42	.03
Drawing hay loader	13	15.06	1.09	1.30	.09
Drawing grain binder	27	17.31	1.16	.75	.05

Between 75 and 80 per cent of the tractors were operated on kerosene. Some of the tractors which were operated on gasoline only were not designed for burning kerosene, and the owners of the others believed that the better service given by their machines when operated on gasoline was sufficient to pay for the difference in cost between gasoline and kerosene.

The average costs of fuel and oil to these farmers during the year of the investigation were: Gasoline 28 cents, kerosene 19 cents, and cylinder oil 72 cents. The price of fuel and oil increased considerably during the year. The average price of each kind of fuel was practically the same for all areas. The quality and price of the lubricating oil used varied considerably, depending upon the owner's idea of what constituted proper lubrication, and to some extent upon the make of the tractor.

Costs per day and per acre.—The average costs per day and per acre of using the 2-plow and the 3-plow tractors for different drawbar operations on the home farm are shown in Table 38. The fuel consumption per day for the lighter operations was less than for the heavy work of plowing and disking, and this is partly responsible for the somewhat lower cost per day of using the tractors for harrowing and for drawing the hay loader and the grain binder.

TABLE 38.—*Average cost per day and per acre of using tractors for various operations.*

Operation.	2-plow tractors.			3-plow tractors.		
	Number of tractors.	Cost per day.	Cost per acre.	Number of tractors.	Cost per day.	Cost per acre.
Spring plowing	164	$12.78	$2.01	94	$18.07	$2.15
Fall plowing	129	12.86	2.06	80	18.69	2.22
Disking	95	13.35	.71	46	17.13	.59
Disking in combination	101	12.55	.70	64	16.82	.76
Harrowing, etc	53	11.97	.35	7	19.14	.49
Drawing hay loader	24	10.02	1.14	13	14.18	1.05
Drawing grain binder	101	11.60	.64	27	16.45	.76

Much of the variation in these average costs, however, is due to the fact that the machines were not all used for the same operations. For instance, 95 2-plow tractors were used to pull disks alone, and the average cost per day for these 95 was $13.35. One hundred and one tractors were used for disking in combination with harrows or other light implements, and the average cost per day was $12.55. This does not mean that for any particular tractor the cost per day was less when it was used for pulling both a disk and a harrow than when it was used for pulling a disk alone. It simply indicates that the daily charges for depreciation, repairs, interest, fuel, and oil for the 95 used for pulling disks alone was greater than for the 101 used for pulling both disks and harrows. Similarly the high cost of $19.14 per day shown for harrowing with the 3-plow tractors was due simply to the fact that the charges mentioned above were high for the 7 tractors which were used for this work. When these variations in the cost of operating individual tractors are taken into account, there is little significance in the differences shown between 2-plow and 3-plow tractors in the cost of power for the different operations.

The average cost per day of using the 2-plow tractors for drawbar work was $12.67, the 3-plow tractors $17.73, and all tractors $14.51. Except for possible differences in the amounts of fuel and oil used, the costs per day of using the tractors for belt and custom work would be approximately the same as the costs for drawbar work.

The marked decline in the prices of gasoline, kerosene, and lubricating oil since the investigation was made has resulted in a considerable decrease in the cost of operating tractors. At present (September, 1921) the average price of gasoline to farmers in the areas studied is about 19 cents, kerosene 10 cents, and lubricating oil 40 cents. The cost of fuel and oil for the tractors as computed on these prices is 57 per cent of the cost as based on the 1920 prices. Assuming no change in depreciation, interest, and repair costs, the present cost per day and per acre of operating the tractors would be 82 per cent of the 1920 costs given above. (See Table 42.)

Effect of amount of work done per year on cost of using tractors.—Table 39 shows the cost per day and per acre of plowing with the 2-plow machines, classified according to number of days of work during the year. Table 40 gives similar information for the 3-plow tractors. Annual depreciation, repairs, and interest charges did not increase in proportion to the amount of work done for either size of machine, and consequently the daily costs of these items were least for the machines which did the greatest amount of work.

For each size the average daily charge for depreciation, interest, and repairs on the tractors which were used 50 days or more during the year was less than a third of that for machines which were used less than 20 days, and the cost per acre of power for plowing done by the machines which did over 50 days' work was less than a half the cost for those which did less than 20 days' work during the year. Such differences are reflected directly in the cost per acre or per bushel of producing crops and show how the man whose farm is large and so organized that he obtains large use from his equipment can produce at low cost.

These figures do not indicate, however, that the farmer should endeavor to use his tractor as many days during the year as possible simply for the sake of reducing the cost per day of operating it. Even though the cost per day decreases rapidly with increased use, the total cost per year must increase. For instance, the cost per day of power for plowing with the 2-plow tractors which were used 20 to 30 days during the year was $13.45. On the average these machines did approximately 25 days of work during the year and the total cost per year of use was $325 to $350. The cost per day of use of the 2-plow machines which did from 40 to 50 days of work during the year was only $10.81, but the total cost per year was $475 to $500.

These figures further indicate that, since the number of days of work has only a slight effect upon the total annual charges for depreciation, interest, and repairs, the tractor owner need consider only the cost of fuel and oil when deciding whether or not to use his machine for operations where its use is of doubtful value.

TABLE 39.—*Effect of number of days of work per year on cost of using 2-plow tractors for plowing.*

Days of work per year.	Number of tractors.	Annual cost.				Daily cost (depreciation, interest, and repairs).	Cost for plowing.	
		Depreciation.	Interest.	Repair and upkeep.	Total.		Per day.	Per acre.
Less than 20	37	$150	$34	$30	$214	$14.50	$19.14	$3.00
20 to 29.9	41	158	35	37	230	8.90	13.45	2.24
30 to 39.9	54	168	34	39	241	6.97	11.49	1.76
40 to 49.9	25	167	33	61	261	6.08	10.81	1.76
50 and over	17	195	35	32	262	4.60	8.55	1.26

TABLE 40.—*Effect of number of days of work per year on cost of using 3-plow tractors for plowing.*

Days of work per year.	Number of tractors.	Annual cost.				Daily cost (depreciation, interest, and repairs).	Cost for plowing.	
		Depreciation.	Interest.	Repair and upkeep.	Total.		Per day.	Per acre.
Less than 20	33	$183	$44	$29	$256	$21.07	$25.88	$3.13
20 to 29.9	30	204	48	42	293	11.72	17.37	2.13
30 to 39.9	22	257	50	39	346	10.17	15.87	1.78
40 to 49.9	11	239	46	48	332	7.58	13.16	1.58
50 and over	8	261	52	58	371	6.22	11.61	1.29

RELIABILITY OF TRACTORS.

The reliability of a tractor has a very decided effect upon its profitableness. In order to obtain definite information on this point each farmer visited was asked how many days during the year his tractor was not in running order when needed. On the average, the 286 tractors were out of commission when needed 1.9 days during the year. One hundred and fifty-three, or 53 per cent of the total, were always ready for work when needed, and 54, 19 per cent of the total, were out of commission more than 2 days.

There was little difference in this respect between the 2-plow and the 3-plow machines. On the average, the 2-plow machines were out of order when needed 1.8 days during the year and the 3-plow, 2.1 days. Just 50 per cent of the smaller machines and 60 per cent of the larger ones were not out of commission at all. The age of the tractors likewise had no marked influence upon their reliability. Forty-one of the 106 which had been in use just one year and 15 of the 31 which had been in use over 3 years were out of commission at least one day.

The actual number of days the 174 two-plow tractors and the 104 three-plow tractors were out of order during the year is shown in Table 41.

TABLE 41.—*Number of tractors that were out of order different numbers of days.*

Days out of order.	Number of 2-plow tractors.	Number of 3-plow tractors.
0	87	62
1 or 2	56	22
3 or 4	11	3
5 or 6	12	9
7 or more	8	8

Most of the men whose tractors were out of commission more than two days had bad breaks while the machines were being used, and it was impossible to procure repair parts or the services of experts promptly. A delay of one or two days may not result in any serious loss, but a tractor which is out of commission a week or more at a time when its services are needed can scarcely be considered profitable.

COST OF POWER FOR DIFFERENT OPERATIONS AS FURNISHED BY HORSES AND BY TRACTORS.

The cost per acre of power during the year covered by the investigation for the different operations for which both horses and tractors were used on these farms is shown in Table 42. The costs based on present prices (Sept., 1921) of feed, fuel, and oil are also shown.

The 1920 cost per acre of power furnished by horses is given on page 45. The 1921 horse costs are based on an annual cost per head of $85 for keeping workstock, or $1.29 per day of horse labor (see page 45). The 1921 tractor costs are 82 per cent of the 1920 costs. (See page 51).

Disking in combination, i. e., drawing a disk and a harrow or roller at one operation, was not done with horses on any of the farms, and the cost of power for harrowing and rolling with horses has been added to that for disking to obtain a cost comparable to the cost of performing the two operations at once with the tractors.

The cost of power for plowing done with tractors during the year of the investigation was only about 70 per cent of that for the plowing done with horses, but with the exception of disking in combination the cost of power furnished by the tractors for each of the other operations was slightly greater than that furnished by horses. These figures, of course, represent the cost of power only, and they do not include either the cost of man labor or of the implements used for the different operations. Neither do they take into account possible differences in the quality of work resulting from the use of the two sources of power.

TABLE 42.—*Cost of power for different operations as furnished by horses and by tractors.*

[Cost per acre.]

Operation.	1920				1921	
	Horses.	Tractors.			Horses.	Tractors.
		2-plow.	3-plow.	All.		
Spring plowing	$2.89	$2.01	$2.15	$2.07	$1.53	$1.70
Fall plowing	3.04	2.06	2.22	2.13	1.62	1.75
Disking	.64	.71	.59	.67	.34	.55
Disking in combination	.98	.71	.76	.72	.52	.59
Harrowing, rolling, etc	.34	.35	.49	.37	.18	.30
Drawing hayloader	.98	1.14	1.05	1.11	.52	.91
Drawing grain binder	.59	.64	.76	.67	.31	.55

NOTE.—The cost of man labor and of the implements used must be added to the cost of power to obtain the total cost of performing the different operations. The horse costs shown for 1921 are 53 per cent and the tractor costs 82 per cent of the 1920 costs.

ANNUAL COST OF POWER FOR DRAWBAR WORK.

Table 43 shows the average cost of the power furnished by the 2-plow, 3-plow, and all tractors for drawbar work on the home farm during the year covered by the investigation. On the average, this drawbar work on the home farm constituted 80 per cent of the total work done by the 2-plow machines, 71 per cent of that done by the 3-plow machines, and 76 per cent of that done by all tractors. Consequently the figures represent approximately these percentages of the total cost of operating the tractors.

TABLE 43.—*Total annual cost of tractors for drawbar work on home farm.*

[Averages.]

Operation.	2-plow tractors.			3-plow tractors.			All tractors.		
	Days work per year.	Cost per day.	Cost per year.	Days work per year.	Cost per day.	Cost per year.	Days work per year.	Cost per day.	Cost per year.
Spring plowing	7.9	$12.78	$100.96	6.3	$18.07	$113.84	7.3	$14.85	$108.40
Fall plowing	5.1	12.86	65.59	5.2	18.69	97.19	5.1	15.23	77.67
Disking	4.0	13.35	53.40	2.3	17.13	39.40	3.4	14.59	49.61
Disking in combination	3.4	12.55	42.67	4.0	16.82	67.28	3.5	14.29	50.02
Harrowing, etc	1.1	11.97	13.17	.2	19.14	3.83	.7	12.04	8.43
Drawing hayloader	.4	10.02	4.01	.4	14.18	5.67	.4	11.57	4.63
Drawing grain binder	1.9	11.60	22.04	.9	16.45	14.81	1.5	12.61	18.92
Other work	2.0	[1] 12.50	25.00	.9	[1] 18.00	16.20	1.6	[1] 14.50	23.20
Total	25.8	....	$326.84	20.2	....	$358.22	23.5	....	$340.88

[1] Approximate.

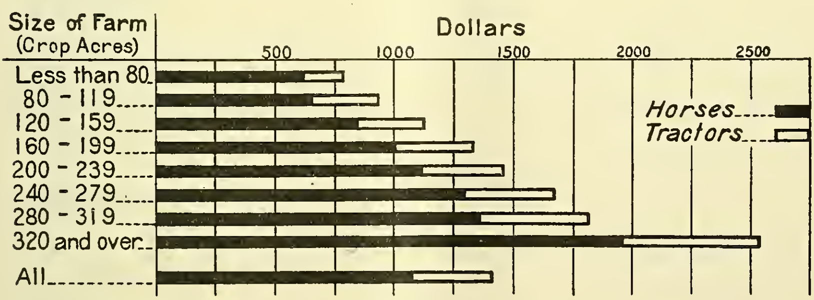

FIG. 14.—Cost of power for drawbar work on farms of different sizes (1920).

The cost of the power for drawbar work furnished by the average tractor was equal to the cost of keeping 2.1 head of workstock. The cost of keeping horses has declined considerably more than the cost of operating tractors since the investigation was made (see page 54) and based on present prices (Sept., 1921) the cost of the power furnished by the tractors would be equal to the cost of keeping 3.3 head of workstock.

The cost of keeping the workstock on the average farm during the year of the investigation was $1,076. Thus the total cost of power, both horse and tractor, for drawbar work was $1,417. Seventy-six per cent of this total was chargeable to the workstock and 24 per cent to the tractor.

The cost of power, both horse and tractor, for drawbar work on farms of different sizes is shown in Table 44, and in figure 14.

TABLE 44.—*Cost of power on farms of different sizes.*

Size of farm (crop acres).	Number of farms.	Cost of keeping horses.	Cost of tractor for drawbar work.	Total cost of power.	Per cent tractor cost was of total cost.
Less than 80	7	$621	$172	$793	21.7
80 to 119	28	660	279	939	29.7
120 to 159	71	849	279	1,128	24.7
160 to 199	56	1,006	331	1,337	24.8
200 to 239	47	1,120	340	1,460	23.3
240 to 279	36	1,292	386	1,678	23.0
280 to 319	19	1,367	452	1,819	24.8
320 and over	22	1,966	576	2,542	22.6
All	286	1,076	341	1,417	24.1

CHANGES IN SIZE OF FARM AND NUMBER OF WORKSTOCK AFTER PURCHASE OF TRACTORS.

The average size of farm and the number of workstock in the different areas both before the purchase of tractors and at the time of the investigation, are shown in Table 45. For all farms, there was an increase of about 20 acres after the tractors were purchased, and during the same time a decrease of 1.8 head of workstock. The number of acres (total acres in farm) per horse increased from 27.6 to 37.9, or about 37 per cent. Where there was a change in the size of the farm the number of crop acres in the farm before the purchase of the tractor was not obtained; consequently figures showing the average number of crop acres per horse for all farms before the purchase of tractors are not available.

TABLE 45.—*Size of farm and number of workstock before and after purchase of tractors in different areas.*

Area.	At time of investigation.				Before purchase of tractor.		
	Size of farm.	Work-stock.	Total acres per horse.	Crop acres per horse.	Size of farm.	Work-stock.	Total acres per horse.
	Acres.	*Number.*	*Acres.*	*Crop acres*	*Acres.*	*Number.*	*Acres.*
Madison County, Ohio	363.0	8.1	44.8	34.1	317.1	9.2	34.5
Seneca County, Ohio	202.0	5.0	40.4	28.0	182.0	6.1	29.8
Madison County, Ind	218.1	5.4	40.4	32.6	199.4	7.9	25.6
Montgomery County, Ind	269.5	6.0	44.9	34.1	251.8	8.7	28.9
Livingston County, Ill	247.3	8.4	29.4	24.7	240.4	9.4	25.6
Knox County, Ill	256.0	7.0	36.6	28.3	235.6	9.2	25.6
All	257.6	6.8	37.9	29.6	237.5	8.6	27.6

The greatest increase in size of farm was in Madison County, Ohio, and the least in Livingston County, Ill. The greatest increase in acres per horse was in Montgomery County, Ind., and the least in Livingston County, Ill.

Nine of the 286 men started farming with tractors, 81 increased the size of their farms after purchasing tractors, 24 decreased the size of their farms and there was no change in acreage on the remaining 172. All of those who were farming smaller acreages than before the purchase of tractors were renters who had moved to smaller farms or owners who in 1920 rented out some ground which they formerly farmed themselves. On the average these men were farming 84 less acres and using 5.1 less horses than before the purchase of tractors.

Farms which were increased in size.—The 81 men who were farming greater acreages than before they purchased tractors were located in the following areas:

	Men.
Madison County, Ohio	11
Seneca County, Ohio	9
Madison County, Ind	14
Montgomery County, Ind	17
Livingston County, Ill	13
Knox County, Ill	17

One-third of the men interviewed in Madison County, Ind., were farming greater acreages, while less than one-fourth of those in Livingston County, Ill., had increased the size of their farms.

The average size of the farms operated by these 81 men before they purchased tractors was 206.4 acres and at the time of the survey the average size was 296.8 acres. They kept on the average 7.6 head of workstock—one for each 27.0 acres (total not crop acres)—before the purchase of tractors. At the time of the investigation they were keeping 6.9 head, or one for each 42.3 acres.

The number of men who increased the size of their farms by different amounts were as follows:

41	Less than 80 acres.
28	80 to 159 acres.
12	160 acres and over.

The changes in the number of workstock kept were as follows:

Of the 41 who were farming less than 80 additional acres

23 had reduced their workstock by an average of 3.5 head.
13 were keeping the same number of workstock as before.
5 had increased their workstock by 1 head.

Of the 28 who were farming 80 to 159 additional acres

10 had reduced their workstock by an average of 2.5 head.
8 were keeping the same number as before.
10 had increased their workstock by an average of 2.3 head.

Of the 12 who were farming 160 or more additional acres

5 were keeping the same number as before.
7 had increased their workstock by an average of 3.7 head.

Farms where acreage was not changed.—The average size of the 172 farms where the acreage was the same as before the purchase of tractors was 244.5 acres, and the number of crop acres was 187.8. Those who increased the size of their farms after the purchase of tractors, had in general been farming somewhat smaller acreages than these men. The men who had not changed their acreage had kept on the average, 8.7 head of workstock before the purchase of tractors—one head for each 28.0 acres, and one for each 21.5 crop acres. At the time of the investigation they had 6.5 head—one for each 37.7 acres and one for each 29.0 crop acres.

The size of the tractor evidently had no influence on the reduction in workstock. One hundred and seven of the 172 men who did not change their acreage owned 2-plow, and 61 owned 3-plow machines. Before the purchase of tractors, the owners of each size kept one horse for each 21.7 crop acres. At the time of the investigation the owners of the 2-plow machines had one head for each 28.8 crop acres, and the owners of the 3-plow machines one for each 29.6 crop acres. On the average, the owners of each size reduced their workstock by 2.2 head.

Every farmer was keeping at least two head of workstock in addition to his tractor, and no one who did not increase his acreage owned less than three head before the purchase of his tractor.

Table 46 shows the actual number owned before the purchase of the tractors and the number disposed of by the 172 men.

TABLE 46.—*Changes in number of workstock after purchase of tractor made by 172 owners whose acreage remained the same.*

Number of workstock before purchase of tractors.	Number of owners.	Number of owners who disposed of—								
		None.	1 head.	2 head.	3 head.	4 head.	5 head.	6 head.	7 head.	9 head.
3 or 4	7	4	2	1	......	......	......	......	......	......
5 or 6	38	11	8	11	4	4	......	......	......	......
7 or 8	44	10	9	13	6	5	1	......	......	......
9 or 10	41	8	1	13	8	5	2	4	......	......
11 or 12	30	4	1	2	6	5	7	4	1	......
More than 12	12	7	......	1	......	......	......	......	3	1
Total	172	44	21	41	24	19	10	8	4	1

The organization of the farm must be known in detail before one can say definitely how many head of workstock a farmer should keep for the greatest profit after he purchases a tractor, but it is apparent that some of these men were still keeping more workstock than needed. (See page 37.) Table 47 shows the average number of crop acres, and the number per horse before and after the purchase of tractors on the farms where different numbers of workstock were disposed of.

TABLE 47.—*Relation of number of horses disposed of to size of farm and to crop acres per horse.*

Number of horses disposed of.	Number of farms.	Crop acres per farm.	Crop acres per horse. Before purchase of tractor.	Crop acres per horse. After purchase of tractor.
0	44	205.9	23.4	23.4
1	21	155.5	23.2	27.2
2	41	178.3	22.1	29.4
3	24	178.5	20.3	30.8
4	19	187.6	21.4	39.2
5 or more	23	209.6	18.3	37.4
All	172	187.8	21.5	29.0

Some of the men who did not dispose of any workstock had owned only 3 or 4 head and probably needed all of them for some one operation even with a tractor on the place (see Table 26). This was not true of nearly all of the 44, however. The table shows that they had not been keeping appreciably fewer workstock in proportion to the size of their farms than had most of the men who reduced their workstock after the purchase of tractors; and that the number of crop acres per horse at the time of the investigation was less than on the other farms.

INCREASE IN INVESTMENT DUE TO PURCHASE OF TRACTORS.

Table 48 shows the net increase in investment due to the purchase of tractors.

The costs of the tractors and of the implements purchased for use with them are given on page 46. The owners of both the 2-plow and the 3-plow tractors who did not change the size of their farms disposed of 2.2 head of workstock on the average. The acres per horse before and after the purchase of tractors on these farms were practically the same as on the farms which were changed in size, and on account of this fact it seems fair to assume that the men who changed the size of their farms would have been keeping 2.2 more head of workstock if they had not owned tractors. The average value per head of the workstock on the farms was $144, and while the value of the workstock which was disposed of was not obtained in detail, an investigation made in the Corn Belt in 1918 (see Farmers' Bulletin 1093) showed that after the purchase of tractors "it was not the poorest horses which were sold but those of about average quality."

TABLE 48.—*Increase in investment due to purchase of tractor.*

Item.	2-plow tractors.	3-plow tractors.	All tractors.
Cost of tractor	$972	$1,354	$1,140
Cost of implements for tractor	271	430	343
Total	1,243	1,784	1,483
Value of workstock disposed of (2.2 head, at $144)	317	317	317
Value of horse-drawn implements disposed of	11	14	12
Total	328	331	329
Net increase in investment	915	1,453	1,154

In all 67 men disposed of some of their horse-drawn implements after purchasing tractors, and the average amount received by these 67 men for such implements was $51. As shown in the table, this item amounted to an average of $12 for all farms. Most of the implements sold were plows and disks. Many farmers who did not sell any horse-drawn equipment stated that they had not used some of their old equipment since the purchase of tractors, but at best the value of the implements which could have been sold was small as compared with the other items shown in the table.

While the purchase of tractors resulted in an increase in investment of more than $1,000 on the average, the cost per year of power for operating the farms did not increase. The cost of the drawbar work done by the average tractor during the year of the investigation was equal to the cost of keeping 2.1 head of work stock, but 2.2 head had been displaced on the average farm, and the cost per head of keeping the remaining work stock was somewhat less than it would have been if tractors had not been owned.

SAVING OF MAN LABOR DUE TO USE OF TRACTORS.

The total amount of man labor used for the operation of these farms before tractors were purchased was not obtained and consequently it is impossible to give definite figures as to the saving of man labor effected by the tractors on individual farms. However, a comparison of the accomplishment of the tractors with that of one man when using horses should give an indication of the average reduction in man labor effected by the tractors.

The acres covered per day by the 2-plow and the 3-plow tractors at the different drawbar operations are given in Table 12 (page 16), and the daily duty of one man in the different areas when using horses for spring and fall plowing, disking, harrowing, etc., and cutting grain is given in Table 49.

TABLE 49.—*Daily duty of one man with horses at operations on which tractors were also used.*

[Acres per day.]

Operation.	Madison Co., Ohio.	Seneca Co., Ohio.	Madison Co., Indiana.	Montgomery Co., Indiana.	Livingston Co., Illinois.	Knox Co., Illinois.	All.
Spring plowing	2.18	2.22	2.21	2.61	3.88	3.94	2.68
Fall plowing	1.88	2.33	1.92	2.85	3.60	3.11	2.65
Disking	12.46	9.83	10.33	14.30	18.95	18.80	16.67
Harrowing, etc	16.80	16.00	15.21	19.93	38.09	33.10	26.28
Cutting grain	14.05	13.36	13.27	15.88	17.64	17.61	15.55

The greater amount of work accomplished per man when plowing and fitting ground in the two Illinois areas was due to the use of larger teams and implements. A team of four horses is the common unit on the farms in these areas, while in Ohio and Indiana teams of three, and sometimes only two, horses are used with proportionally smaller implements. With the rate of doing work when using horses the same as given in the table the drawbar work which the average 2-plow tractor did in 25.8 days and that which the average 3-plow tractor did in 20.2 days would have required 50 to 55 days for one man with horses. Thus the 2-plow machines saved on the average 25 to 30 days of man labor during the year, and the 3-plow machines 30 to 35 days.

Since disks and harrows or other light implements were never used in combination when horses furnished the power, the operation of "disking in combination" as done with tractors is practically equivalent to the two separate operations of disking and harrowing or rolling as done with horses. In "Loading hay" and "Other work" done with the tractors as shown in Table 12, it is not possible to make a direct comparison of the man-labor requirements, but on the average the tractors probably saved not far from one day for each day of use. (See page —.)

One man always operated both tractor and implement in plowing and other work of fitting ground. One man usually operated both tractor and binder in cutting grain, but on some farms a second man was used on the binder.

The tractors did 85 per cent of the plowing on these farms and much of that done with horses was finishing up or plowing small and irregular fields. For such work 2-horse or 3-horse teams were generally used. If these tractor owners had done all their plowing with horses some of them probably would have used larger units, and the saving of man labor effected by the tractor would not have been as great as that indicated above.

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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 998

Washington, D. C. PROFESSIONAL PAPER July 3, 1922

EFFECT OF BORAX IN FERTILIZER ON THE GROWTH AND YIELD OF POTATOES.

By B. E. Brown, *Biochemist, Office of Soil-Fertility Investigations, Bureau of Plant Industry, U. S. Department of Agriculture, in cooperation with the Maine Agricultural Experiment Station.*[1]

CONTENTS.

PURPOSE OF THE INVESTIGATIONS.

Injury to field crops through the use of fertilizers containing borax was first observed in Indiana in 1917, and a report by Conner (*1*)[2] appeared in 1918.

So far as is known no reported authentic case of borax injury again occurred until 1919, when ample proof of the poisonous action of this compound was afforded. During the growing season of 1919 injury to a number of important crops by borax, notably potatoes, cotton, and tobacco, was observed, and a number of publications (*2*,*3*,*4*,*5*,*6*) on this subject were subsequently issued.

The Bureau of Plant Industry, as a result of reports from various sections, conducted an investigational survey in the field in 1919 to determine the severity and extent of the injury, with special reference to potatoes and cotton. The survey was based in part on experimental plat work with fertilizers containing borax and in part on actual observation in affected fields. As a result of these investigations, as well as those by others, it was found that borax caused the trouble. It was deemed essential, however, to conduct well-controlled field tests during the season of 1920 for the purpose of studying

[1] Experiments conducted during the season of 1920 on the Aroostook farm of the Maine Agricultural Experiment Station, at Presque Isle, Me.

[2] Serial numbers (italic) in parentheses refer to "Literature cited" at the end of this bulletin.

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certain matters, namely: (1) The effect of different rates of application of borax per acre when mixed with fertilizer, as compared with equal quantities of fertilizer to which borax was not added, upon the growth and yield of a number of crop plants; (2) the influence of th time and method of application of a fertilizer mixture containing borax in varying quantities; and (3) the influence of rainfall and soil type on the extent of borax injury. Accordingly, cooperative experimental field work was conducted at Presque Isle, Me., on Caribou loam, with potatoes; at New Bunswick, N. J., on Sassafras loam, with potatoes and corn; at the Arlington Experimental Farm, Va., on Arlington clay loam with potatoes, corn, cotton. Lima beans, and string beans; and at Muscle Shoals, Ala., on Colbert and Decatur loams with corn and cotton.

Blair and Brown (*7*) presented an article in Soil Science giving the results obtained at New Brunswick, N. J., with potatoes and corn. A report by Skinner and Allison (*9*) on the results obtained with cotton at Muscle Shoals, Ala., and at the Arlington Experimental Farm, Va., is shortly to appear. The present bulletin embodies the results obtained at Presque Isle, Me., with potatoes, when grown on Caribou loam (*8*, p. 6), the important soil type of that region.

PLAN OF THE EXPERIMENTS.

The experiments as carried out in Maine were similar to those at the other field stations in that the same fertilizer was used and the rates of application of borax per acre were the same, the only difference being that the quantity of fertilizer applied was 2,000 pounds per acre in Maine and 1,500 pounds per acre in New Jersey.

What was actually done was to make up a 4–8–4 fertilizer mixture from nitrate of soda, sulphate of ammonia, cottonseed meal, acid phosphate, and muriate of potash, the ammonia being derived equally from the three nitrogen sources. To this 4–8–4 mixture were added varying quantities of borax, so that anhydrous borax was applied at the following rates per acre: 1, 2, 3, 4, 5, 10, 20, 30, 50, 100, 200, and 400 pounds. In order properly to compare the influence of the borax, five control plats, to which fertilizer alone was added, were included. To simplify the field work, the plat numbers were made to correspond to the rate of application of borax per acre. That is, plat 1 received 1 pound of borax per acre, plat 10 received 10 pounds of borax per acre, and plat 400 received 400 pounds of borax per acre. To each plat, irrespective of the quantity of borax added, the same quantity of fertilizer was applied. The land used for the experiment was divided crosswise into three equal sections, in order to provide for the following methods of applying the fertilizer: To the plats in section 1 the normal fertilizer and the fertilizer-borax mixtures were applied in the furrow on May 31, mixed with the soil, and allowed to remain until June 5; on June 5 the normal fertilizer and fertilizer-borax mixtures were applied to sections 2 and 3; in section 2, the mixtures were applied as in section 1; while in section 3 they were sown broadcast and well raked into the soil before planting. All three sections were then planted on June 5.

RESULTS OF THE EXPERIMENTS.

On July 5, one month after planting, notes on the experiments were taken by Dr. Donald Folsom, of the Maine Agricultural Experiment Station. The notes and observations made by him disclose the following: (1) The average number of plants above ground in the control plats in all sections was 343. These rows received fertilizer at the rate of 1 ton per acre, but no borax. (2) The average number of plants above ground in all sections of the 12 fertilizer-borax plats was only 216. These 12 plats received borax varying from 1 to 400 pounds per acre. (3) As the quantity of borax increased there was a marked falling off in the number of plants above ground, until with an application rate of 400 pounds per acre only 12 plants appeared. The application of borax at the rate of 10 pounds per acre materially reduced the number of plants above ground, there being 284 plants as compared with the 343 of the control plats. The plats receiving borax at the rate of 5 pounds per acre had 306 plants. The 20-pound application showed 205 plants; the 30-pound application, 139 plants; the 50-pound application, 116 plants; the 100-pound application, 38 plants; the 200-pound application, 18 plants; and, as previously stated, the 400-pound application only 12 plants.

On August 5 the writer inspected the borax experiments for the purpose of taking notes, obtaining photographic records, etc. At this time the stand, differences in growth, appearance of vines, etc., were definitely established. The main fact disclosed was that section 2, where the fertilizer-borax mixtures were applied in the furrow at the time of planting, looked much more seriously affected than section 1, where the fertilizer-borax mixtures were applied in the furrow and stood awhile before planting. Section 3, however, in which the fertilizer-borax mixtures were sown broadcast, showed injury, not so marked as in section 2, but the plants were uniformly below the standard established by the plants in section 1. Apparently broadcasting was effective in curtailing the injury by borax to a considerable extent, but this good effect was offset by the fact that the fertilizer itself was not as available to the plants, especially where small quantities of borax were applied, as it would have been if applied in the furrow, which is the usual custom.

Applying the fertilizer in the furrow, followed by immediate planting, as in section 2, is the usual practice in Aroostook County, so that the degree of injury occurring in this section as well as curtailment of yield would be of greater practical significance than in sections 1 and 3. The accompanying illustrations [3] show very well the type and degree of injury found, especially the effect of applying small quantities of borax. (Pl. I.) As the quantity of borax increased there was a marked falling off in the number of plants on a plat (Pl. II) as well as a reduction in the size of the plants (Pl. III, Figs. 1 and 2, compared with a normal plant in Fig. 3). A great many apparently empty hills when dug into disclosed seed pieces affected to the extent shown in Plate IV, Figure 1. The greatest degree of injury resulted from the use of the larger quantities of borax, namely, 100, 200, and 400 pounds per acre (Pl. IV, Fig. 2).

During the investigational survey in Maine in 1919 the quantity of anhydrous borax found in commercial fertilizers collected ranged from 0.73 to 2.3 per cent. In view of the fact that 2,000 pounds represents the usual quantity of fertilizer applied per acre, it is evident that the borax applied ranged from 14.6 to 46 pounds. The type of field injury shown in 1919 was similar to that found with the 20, 30, and 50 pound applications in the borax experiment of 1920, thereby serving to substantiate the previous findings. Some of the injurious effects noted in both seasons were as follows. (1) Failure of seed to germinate; (2) dying back of underground sprouts; (3) bleaching of foliage, or, if the plant was not seriously injured, a marginal yellowing of the leaflets; (4) reduction in size of plants below normal; and (5) a reduction in yield.

On September 9, the plats were harvested and the weights of the potatoes, by plats for the three sections, were recorded (Table 1). The results are presented graphically in Figure 1.

In section 1, where borax was applied in the furrow, injury occurred from the 10-pound application of borax and became progressively worse. It will be noted, however, that the degree of injury was less than in section 2, where the borax was applied in the furrow and planting was done immediately. The application of 1, 2, and 3 pounds of borax per acre apparently stimulated plant growth, and the yields were increased.

In section 2 the injury was apparently produced with as small quantities of borax as 3 or 4 pounds per acre, certainly with 5 pounds; and the injury with 10 pounds and more was great.

One of the significant features of section 2 is the effect shown on the yield by the 10, 20, 30, and 50 pound applications of borax, as this was practically the range found during the investigational survey made in 1919.

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[3] The writer is indebted to Dr. C. F. Clark, of the Office of Horticultural and Pomological Investigations for his cooperation in obtaining photographic records.

FIG. 1.—EFFECT ON POTATOES OF 10-POUND, 5-POUND, AND 4-POUND APPLICATIONS OF BORAX PER ACRE.

FIG. 2.—EFFECT ON POTATOES OF 3-POUND, 2-POUND, AND 1-POUND APPLICATIONS OF BORAX PER ACRE.

Control rows on right and left. No injury shown by such small quantities of borax.

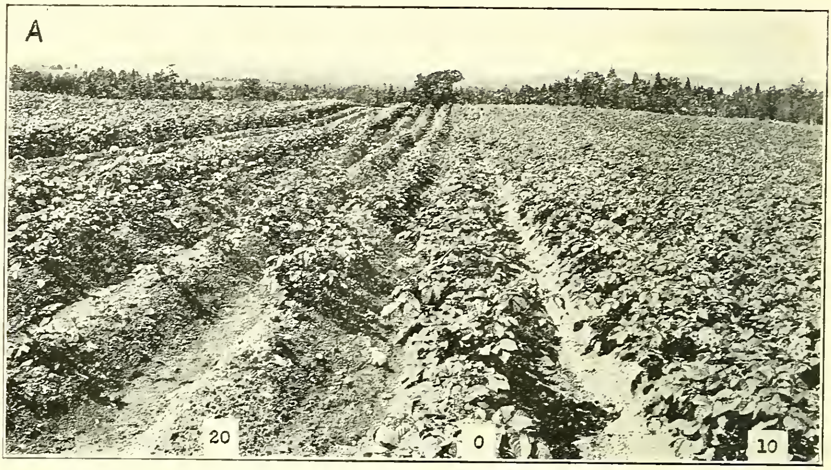

FIG. 1.—EFFECT ON POTATOES OF 20-POUND, CONTROL, AND 10-POUND APPLICATIONS OF BORAX PER ACRE.

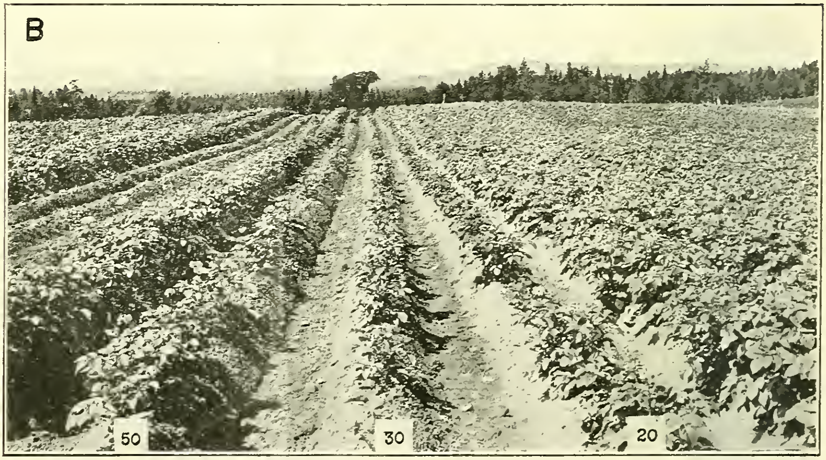

FIG. 2.—EFFECT ON POTATOES OF 50-POUND, 30-POUND, AND 20-POUND APPLICATIONS OF BORAX PER ACRE.

Control rows on right and left.

FIG. 1.—INDIVIDUAL POTATO PLANT. SMALL AND BADLY INJURED FROM AN APPLICATION OF 20 POUNDS OF BORAX PER ACRE.

FIG. 2.—INDIVIDUAL POTATO PLANT FROM SAME ROW AS THAT SHOWN IN FIGURE 1, BUT SHOWING SOME RECOVERY.

FIG. 3.—INDIVIDUAL POTATO PLANT FROM A CONTROL PLAT WHICH RECEIVED NO BORAX.

FIG. 1.—INJURY TO POTATO SEED PIECES FROM APPLICATION OF 50, 30, AND 20 POUNDS OF BORAX PER ACRE.

Appearance two months after planting.

FIG. 2.—EFFECT ON POTATOES OF 400-POUND, 200-POUND, AND 100-POUND APPLICATIONS OF BORAX PER ACRE.

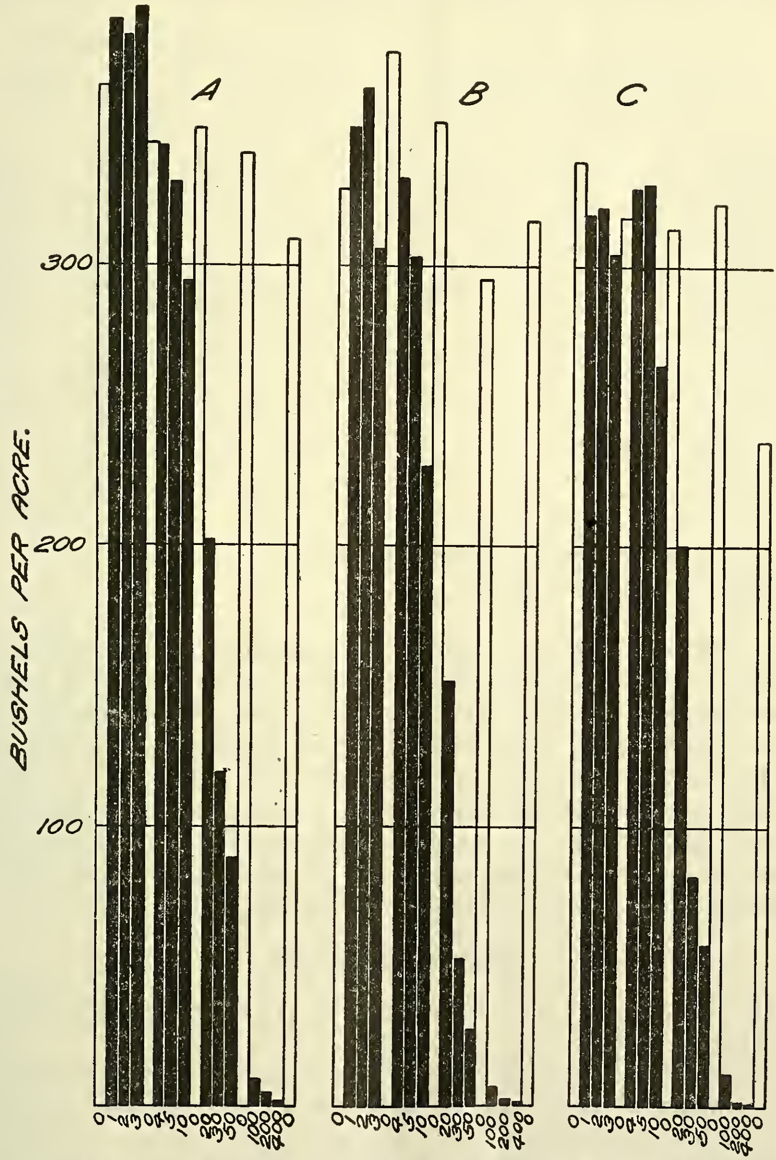

FIG. 1.—Diagram showing the yield of potatoes in experiments with borax at Presque Isle, Me., in 1920. The figures at the base of each column denote the number of pounds of borax applied per acre. The controls, designated by 0, received only a complete commercial fertilizer, applied at the rate of 2,000 pounds per acre. The borax treatments were prepared by mixing the borax with the same quantity of commercial fertilizer that was used in the controls. Application of fertilizer: *A*, In the furrow one week before the time of planting; *B*, in the furrow at the time of planting; *C*, broadcast over the rows at the time of planting.

TABLE 1.—*Yield of potatoes in borax experiment at Presque Isle, Me., in 1920.*

Quantity of borax applied per acre.	Yield per acre (pounds).		
	Section 1.[a]	Section 2.[b]	Section 3.[c]
0 (Control 1)	21,760	19,600	20,240
1 pound	23,200	20,960	19,120
2 pounds	22,880	21,760	19,440
3 pounds	23,440	18,320	18,240
0 (Control 2)	20,560	22,560	19,040
4 pounds	20,480	19,840	19,680
5 pounds	19,720	18,160	19,760
10 pounds	17,600	13,680	15,840
0 (Control 3)	20,880	21,040	18,800
20 pounds	12,080	9,040	12,000
30 pounds	7,120	3,120	4,880
50 pounds	5,280	1,600	3,400
0 (Control 4)	20,320	17,680	19,300
100 pounds	560	320	640
200 pounds	240	80	160
400 pounds	80	[d] 40	80
0 (Control 5)	18,560	18,960	14,240

[a] Fertilizer applied in the furrow about one week before planting.
[b] Fertilizer applied in the furrow planting.
[c] Fertilizer applied broadcast at planting.
[d] All culls.

In section 3 the general trend of the results is similar to that in sections 1 and 2, the first sign of injury occurring, however, with the 10-pound application. In this section the method of applying the fertilizer-borax mixtures apparently depressed the yield of the last contral as the yield dropped off considerably. In this connection, in view of the fact that single rows were employed in the borax experiments, it would seem that broadcasting a fertilizer-borax mixture containing such a large quantity of borax might easily tend to influence the yield of the adjacent control row.

RAINFALL RECORD.

The daily rainfall record for the months of June, July, and August is given in Table 2.

The rainfall, subsequent to planting on June 5, was well distributed during the remainder of that month, at least until June 29, on which date 1.09 inches fell, followed by 1.01 inches on June 30. It would seem that the rain, which fell between June 5 and June 29—a somewhat critical period in the early life of the potato plant—was sufficient to keep the soil in good condition without much chance of any great leaching of the borax to lower soil zones.

TABLE 2.—*Precipitation at Presque Isle, Me., for June, July, and August, 1920.*

Day.	Rainfall record (inches).			Day.	Rainfall record (inches).		
	June.	July.	August.		June.	July.	August.
1		0.45	0.17	17			
2	0.13			18		0.03	
3	.50	.37	.63	19	0.20	.42	
4		.43		20		.05	
5		1.10		21	.06		
6				22	.57		0.23
7	.73	.11		23	1.02	.06	1.32
8		1.00		24	.10	.03	
9				25	.12	.02	
10			.43	26			.01
11	.49		.12	27	.03		
12			.46	28			
13		.04		29	1.09		
14			.01	30	1.01	.08	.08
15			.01	31			.15
16	.04	.09					

SUMMARY.

This bulletin presents the results of borax experiments conducted on Caribou loam, the principal soil type in Aroostook County, Me. Injury definitely occurred with an application as low as 5 pounds of borax per acre, when put in the furrow and when the planting was done immediately, which is the method customarily followed in this section of Maine. The other methods of applying the fertilizer, broadcasting at the time of planting and applying in the furrow some time before planting, did not show injury in as low concentrations of borax as showed injury when the fertilizer-borax mixtures were applied in the furrow at the time of planting. As the quantity of borax was increased the injury in all cases became progressively worse, until, with the larger quantities of borax per acre, great injury ensued.

The moderate and fairly regular rainfall during the month of June was not sufficient to carry the borax out of the reach of the growing plant, so that no alleviation of the injurious action was noticeable.

The types of injury observed in the commercial fields during 1919 were similar to those found in the borax experiments of 1920. Some of the reactions with borax, observed in both seasons, were as follows: Failure of the seed piece to germinate, the killing of sprouts, the absence of roots at seed pieces, general weakness of plants which came through the ground, bleaching of the foliage (or at least a marginal yellowing of the leaf), a poor stand, and low yields.

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BULLETIN No. 999

Contribution from the Bureau of Markets and Crop Estimates
H. C. TAYLOR, Chief

Washington, D. C. ⊕ August 26, 1921

PRICES OF FARM PRODUCTS IN THE UNITED STATES.

By G. F. WARREN.

CONTENTS.

No price is high or low except by comparison. If the price of a product has been cut in half it does not mean that the product is necessarily cheap. One must know the general price level in order to make comparisons.

The Bureau of Labor Statistics of the Department of Labor publishes an index number of wholesale prices each month. Prices of 328 commodities are obtained and by comparison with previous prices an index number showing the general price level is prepared. Index numbers of wholesale prices since 1791 are shown in Table I. (See also fig. 1.)

By comparing prices with the general price level one can judge them fairly accurately. Compared with the five-year average before the war, wholesale prices in 1918 had doubled, or were represented by 200. Many commodities were higher and many lower than this figure would indicate. Any product that had not doubled in price was then relatively cheap. Any product that had more than doubled was relatively high priced.

RISE AND FALL IN PRICES DURING THREE WAR PERIODS.

A very great similarity in the rise and fall of prices is shown for War of 1812, Civil War, and World War periods. In each case the highest price level was reached after the war closed, and in each case there was an extremely violent drop in prices.

TABLE I.—*Index numbers of wholesale prices in the United States.*[1]

[Five-year average, Aug. 1909–1914, equals 100.]

Year.	Index No.	Year.	Index No.	Year.	Index No.	Year.	Index No.
1791	107	1824	108	1857	104	1890	85
1792	113	1825	110	1858	94	1891	85
1793	119	1826	109	1859	92	1892	80
1794	....	1827	109	1860	92	1893	80
1795	158	1828	104	1861	93	1894	73
1796	....	1829	103	1862	109	1895	71
1797	170	1830	100	1863	137	1896	68
1798	167	1831	106	1864	176	1897	68
1799	160	1832	108	1865	200	1898	70
1800	....	1833	106	1866	176	1899	77
1801	170	1834	99	1867	159	1900	84
1802	140	1835	114	1868	148	1901	82
1803	144	1836	127	1869	142	1902	85
1804	154	1837	126	1870	131	1903	86
1805	159	1838	121	1871	125	1904	85
1806	155	1839	126	1872	128	1905	87
1807	147	1840	108	1873	127	1906	92
1808	143	1841	107	1874	123	1907	98
1809	....	1842	99	1875	118	1908	93
1810	165	1843	94	1876	109	1909	96
1811	160	1844	94	1877	102	1910	99
1812	162	1845	95	1878	93	1911	98
1813	189	1846	98	1879	89	1912	101
1814	235	1847	98	1880	99	1913	102
1815	185	1848	93	1881	97	1914	102
1816	157	1849	91	1882	100	1915	102
1817	159	1850	94	1883	98	1916	126
1818	155	1851	98	1884	92	1917	178
1819	137	1852	95	1885	86	1918	200
1820	117	1853	101	1886	85	1919	219
1821	112	1854	104	1887	85	1920	250
1822	115	1855	104	1888	87		
1823	110	1856	104	1889	87		

[1] American Statistical Association, New Series, No. 120, p. 846, December, 1917. U. S. Bur. Labor Bul. 173, p. 137, and later reports.

NOTE.—All index numbers are recalculated so that the five-year average before the war, August, 1909, to July, 1914, equals 100. Some of the original data are given on an 1860 base. Data for 1890 and 1891 are given on both bases. When 1860 equals 100 the average for 1890 and 1891 is 92.25. When August, 1909, to July, 1914, equals 100 the average for 1890 and 1891 is 85.05. Data with 1860 as a base are therefore divided by 92.25 and multiplied by 85.05.

In many calculations in this bulletin one more decimal place was carried than is published. In some cases this makes an apparent discrepancy. For example, 103.4÷99.6=103.8. The figures published would be 103, 100, and 104.

The rise in prices during the World War was much the same as during the Civil War period, but continued longer after the close of the war and resulted in a more violent drop than occurred after either the War of 1812 or the Civil War.

After each of the previous wars a very violent drop in prices occurred, followed by partial recovery and somewhat stable prices for a year or more, then again followed by a longer but less violent drop and again followed by a period of somewhat stable prices.

Prices by months for the World War period are given in Table II. Based on five-year averages before the war as 100, prices during the World War period reached a maximum of 276 in May, 1920, then dropped to 151 in June, 1921. The drops for each month were as follows:

June	1	January	12
July	7	February	10
August	10	March	6
September	10	April	8
October	18	May	4
November	18	June	2
December	19		

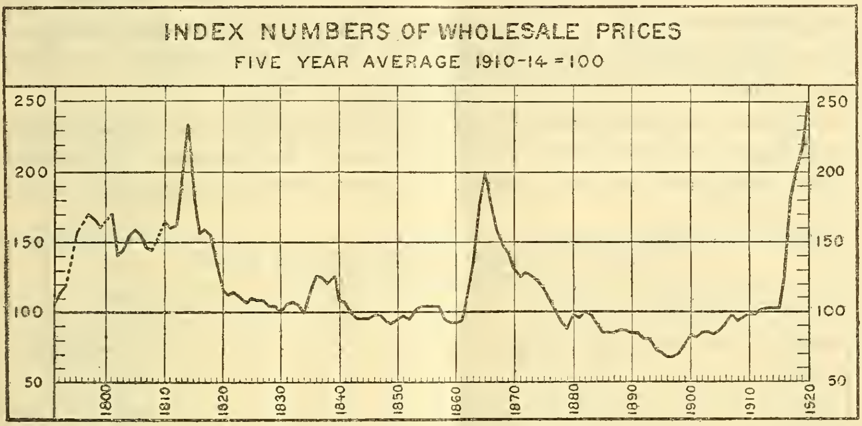

FIG. 1.—Wholesale prices in the United States for 130 years.

TABLE II.—*Index numbers of wholesale prices in the United States, August, 1909, to July, 1914=100.*[1]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1900...	84	85	85	85	84	83	83	83	82	82	83	83
1901...	82	81	81	81	81	81	82	83	83	83	83	83
1902...	83	83	83	84	85	86	86	86	85	87	87	87
1903...	88	88	87	87	85	86	85	86	86	85	85	84
1904...	85	86	86	86	85	85	85	85	85	85	85	86
1905...	86	87	86	86	85	86	87	89	88	89	90	90
1906...	91	91	91	91	91	92	93	93	93	93	95	96
1907...	97	97	97	97	97	98	99	99	99	99	97	95
1908...	95	94	93	93	92	92	92	93	92	92	92	93
1909...	94	94	94	94	94	95	96	96	97	98	99	100
1910...	100	100	101	100	99	99	99	100	99	99	98	98
1911...	97	97	97	97	96	97	98	99	98	98	98	98
1912...	99	99	100	102	102	102	102	102	102	102	102	102
1913...	102	102	102	102	101	101	102	103	103	103	103	102
1914...	102	101	101	99	102	101	100	103	104	102	102	101
1915...	100	102	101	101	102	101	103	103	100	103	104	107
1916...	112	113	116	118	120	121	122	127	130	136	146	149
1917...	153	158	163	174	184	188	189	190	186	184	186	185
1918...	189	190	190	193	193	197	203	208	212	209	211	210
1919...	207	201	205	207	210	212	223	233	225	228	235	243
1920...	253	254	257	270	276	275	268	258	248	230	212	193
1921...	181	171	165	157	153	151	......	......	......	......	......	......

[1] Index numbers as published by the United States Bureau of Labor Statistics converted to a 5-year basis. The average for July for the five years ending with July, 1914, is called 100. Similarly the average for other months for five years preceding the war is 100.

NOTE.—Some data are published with 1890–1899 as a base and some with 1913 as a base. With 1890–1899 as a base 1913 is 135.2. All figures with 1913 as a base are converted to the 1890–1899 base by multiplying by 135.2. The 5-year averages before the war are then as follows: January, 132.4; February, 132.4; March, 132.9; April, 132.8; May, 133.1; June, 132.2; July, 132; August, 131; September, 132; October, 132.2; November, 132.3; December, 132.5. Figures for each month on the 1890–1899 base are divided by the above numbers to get the table as given above.

As is usual in such violent adjustment, the drop began slowly, increased in rapidity, then dropped more gradually, and apparently has now (June, 1921) about completed the violent drop. Judging by the Civil War experience and by the slow rate of recession now, some price recovery is to be expected in the near future. This does not mean that all prices will rise. When more products rise in price than fall, the general price level will rise, but many products will be going down. It is to be expected that those that have dropped excessively will rise, and that prices of most things that are much above the general price level, will fall.

Another characteristic of prices during a period of rapid change in the general price level is the violence of fluctuation. In normal times the prices of each individual farm product usually fluctuate

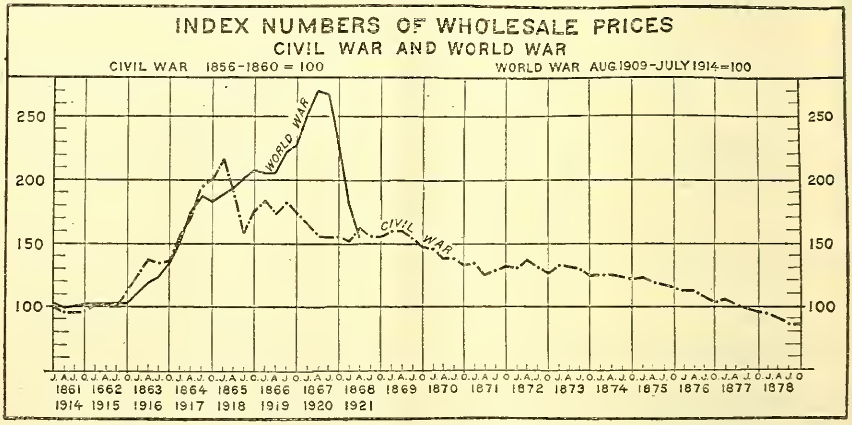

FIG. 2.—Wholesale prices in the United States, by quarterly periods, showing the violent drop and partial recovery after the Civil War and the more violent drop after the World War.

about the general price level. In periods like the present there is more than the usual uncertainty as to supply and demand, and an even greater disturbing factor is the shifting of the general price level about which individual prices fluctuate. Figures 6 to 11 and 13 show that sudden and violent changes in prices occur very frequently when the general price level is unstable.

During each of the periods of rapidly rising prices, as from 1899 to 1912, the cost of living has been widely discussed, largely because wages have tended to lag behind prices and salaries and incomes from investments have changed even more slowly.

When prices fall very rapidly farmers and others who go in debt to produce articles to sell find the payment of debts to be increasingly difficult. At each period of rapidly falling prices the money question has been generally discussed.

MONEY AND PRICES.

Index numbers of monetary circulation, bank deposits, wholesale prices, and farm prices are shown in Table III. The close relationship between prices and money is shown. At first bank deposits advanced more rapidly than prices, but the index numbers for prices later rose to a higher point than bank deposits.

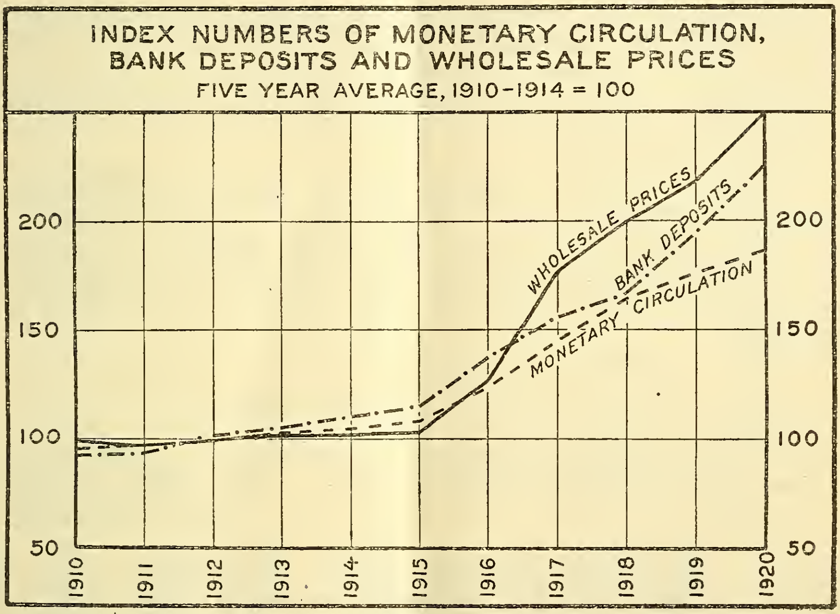

Fig. 3.—Monetary circulation, bank deposits, and wholesale prices in the United States.

Table III.—*Monetary circulation, bank deposits, and wholesale prices in the United States.*

[All index numbers 1910–1914=100.]

Year.	Monetary circulation.[1]		Bank deposits.[1]		Index No. wholesale prices (Table 1).	Index No. of weighted average prices of 31 farm products (table XVIII).
	Circulation (000,000 omitted).	Index No.	Deposits (000,000 omitted).	Index No.		
1910	3,102	95	15,283	91	99	104
1911	3,214	98	15,906	94	98	96
1912	3,285	100	17,024	101	101	99
1913	3,364	103	17,476	104	102	99
1914	3,402	104	18,518	110	102	100
1915	3,569	109	19,226	114	102	100
1916	4,024	123	22,878	136	126	118
1917	4,764	146	26,290	156	178	179
1918	5,379	164	27,932	166	200	203
1919	5,766	176	32,703	194	219	212
1920	6,088	186	37,860	225	250	216

[1] U. S. Statistical Abstract, p. 754, 1919; Report Comptroller of Currency, pp. 22 and 262. 1920.

RELATION OF WEATHER TO PRODUCTION.

The average yield of potatoes in the United States per acre harvested in 1916 was 81 bushels; in 1917 it was 101 bushels. The yield of corn per acre in 1900 was 25 bushels; in 1901 it was 17 bushels. In 1915 wheat yields averaged 17 bushels, but only 12 bushels in the following year. These differences are primarily due to variations in rainfall.

The yield per acre in pounds for the six grain crops—corn, oats, wheat, barley, rye, and buckwheat—are given in Table IV. In 1894 the production was 936 pounds per acre; the following year it was 1,227 pounds. In 1901 the yield was 924 pounds per acre and in 1902 it was 1,273 pounds.

The year 1916 was an unfavorable year and was largely responsible for the seriousness of the food situation in 1917, but fortunately no such drought year as 1894 or 1901 occurred during the war period. With an increasing area of semiarid land under cultivation, the variation in crops owing to fluctuations in rainfall is of increasing importance.

TABLE IV.—*Production of grain in the United States.*

[Pounds of corn, oats, wheat, barley, rye, and buckwheat.[1]]

Year.	Acres (000 omitted).	Pounds (000,000 omitted).	Pounds per acre.	Pounds per capita.	Year.	Acres (000 omitted).	Pounds (000,000 omitted).	Pounds per acre.	Pounds per capita.
1866	61,682	69,110	1,120	1,948	1894	144,216	134,972	936	1,996
1867	64,972	68,249	1,050	1,885	1895	163,052	199,984	1,227	2,901
1868	66,715	75,679	1,134	2,047	1896	167,272	204,973	1,225	2,918
1869	69,458	77,271	1,112	2,047	1897	169,591	189,699	1,119	2,650
1870	69,254	85,945	1,241	2,229	1898	175,199	207,208	1,183	2,841
1871	64,999	80,116	1,233	2,025	1899	184,374	213,157	1,156	2,868
1872	68,280	87,401	1,280	2,153	1900	184,101	212,298	1,153	2,794
1873	74,112	80,496	1,086	1,931	1901	184,630	170,634	924	2,199
1874	80,052	76,573	957	1,789	1902	183,777	233,884	1,273	2,952
1875	86,864	106,094	1,221	2,414	1903	181,671	207,615	1.143	2.568
1876	93,920	102,987	1,097	2,282	1904	181,391	219,516	1,210	2,662
1877	93,205	113,424	1,217	2,447	1905	184,265	242,362	1,315	2,882
1878	100,956	120,245	1,191	2,526	1906	184,577	252,737	1,369	2,949
1879	118,632	150,898	1,272	3,088	1907	183,674	215,647	1,174	2,470
1880	120,927	143,706	1,188	2,865	1908	185,901	219,975	1,183	2,473
1881	123,389	106,830	866	2,082	1909	188,577	232,131	1,231	2,563
1882	126,569	140,985	1,114	2,686	1910	198,052	248,844	1,256	2,700
1883	130,634	134,753	1,032	2,510	1911	203,718	218,946	1,075	2,341
1884	136,293	155,067	1,138	2,824	1912	201,302	277,853	1,380	2,929
1885	135,875	154,619	1,138	2,754	1913	205,264	230,265	1,122	2,393
1886	141,859	145,464	1,025	2,534	1914	206,316	252,216	1,222	2,585
1887	141,822	134,439	948	2,291	1915	218,708	293,560	1,342	2,967
1888	146,281	163,960	1,121	2,734	1916	211,893	235,025	1,109	2,344
1889	140,219	169,563	1,209	2,767	1917	219,546	275,278	1,254	2,709
1890	138,993	128,386	924	2,040	1918	225,155	262,864	1,167	2,553
1891	146,732	184,072	1,254	2,883	1919	232,991	273,474	1,174	2,621
1892	147,227	156,557	1,063	2,405	1920	218,971	291,315	1,330	2,756
1893	147,726	149,150	1,010	2,248					

[1] Grain as reported by the Bureau of Crop Estimates, converted to pounds by multiplying corn and rye by 56, wheat by 60, oats by 32, barley and buckwheat by 48. For the years 1879, and 1889 to 1909, revised figures as given in the Yearbook for 1919 are used.

The year 1920 was an unusually favorable year. The yield per acre of the six grain crops was 13 per cent more than in 1919. It was the third highest yield ever grown, being slightly exceeded in 1912 and 1915. The outlook for crop yields in the spring of 1920, however, was not very favorable. This resulted in a tendency to hold the surplus on hand. Unusually favorable weather later and consequent unexpected production were important causes of the severity of the drop in farm prices.

The United States is subject to severe droughts. With the growth in population such droughts become increasingly important. With a sparse population, large numbers of animals are kept. In drought years some of the food that would have gone to animals is eaten by human beings, and more than the usual number of animals themselves are eaten. This lessens the food shortage of a drought year and allows the farmer a larger income than he would otherwise have in drought years, because he then sells some of his animals that represent crops of previous years. In a good year animals are increased and some of the surplus feed is thus made use of. With each reduction in the number of animals this reserve food supply is reduced and the shock of high and low yields is felt more seriously. Thus, the greater the dependence on vegetable foods the worse the effect of surplus years on farm prices, and the worse the effect of poor years on industrial conditions. Additional facilities for storage, and the increased holding of crop surplus on farms to even up the good and lean years are becoming more and more important. In unusually favorable years, like 1920, it is especially important that the reserves held on farms be increased.

PERIODS OF OVER AND UNDER PRODUCTION.

Violent changes in the price level result in violent changes in industry. If the price of a particular product is not favorable, its production is checked, but the price does not fully respond to the reduced effort until the product that is already in the process of production and merchandising is nearly exhausted. Prices then rise and new production begins, but the new efforts at production have only a limited effect on prices until the new goods have passed through the process of production and merchandising. The length of time that the prices of a particular product remain high or low, therefore, depends largely on how long it takes from the beginning to the completion of the product. Other factors are, of course, involved.

The purchasing power of hogs and horses illustrates this principle as shown in Table V and figure 4.

TABLE V.—*Farm value and purchasing power of hogs and horses in the United States.*[1]

Year.	Horses.			Hogs.		
	Value per head in currency Jan. 1.	Index number of value per head (1910–1914=100).	Purchasing power (1910–1914=100).	Value per head in currency Jan. 1.	Index number of value per head (1910–1914=100).	Purchasing power (1910–1914=100).
1867	$79.48	73	45	$5.42	58	36
1868	75.16	69	47	4.56	49	33
1869	84.84	78	56	6.31	67	48
1870	81.79	75	57	7.04	75	57
1871	78.75	72	58	6.21	66	54
1872	73.54	67	55	4.37	47	38
1873	74.82	69	56	4.14	44	36
1874	72.58	67	55	4.43	47	39
1875	68.74	63	54	5.40	58	50
1876	64.62	59	54	6.77	72	66
1877	59.35	54	53	6.02	64	63
1878	57.82	53	56	4.95	53	56
1879	52.36	48	55	3.18	34	39
1880	54.75	50	56	4.28	46	51
1881	58.44	54	57	4.70	50	53
1882	58.53	54	56	5.97	64	67
1883	70.59	65	68	6.75	72	76
1884	74.64	68	75	5.57	60	65
1885	73.70	68	79	5.02	54	63
1886	71.27	65	80	4.26	46	55
1887	72.15	66	81	4.48	48	58
1888	71.82	66	79	4.98	53	64
1889	71.89	66	79	5.79	62	74
1890	68.84	63	76	4.72	50	61
1891	67.00	61	75	4.15	44	54
1892	65.01	60	76	4.60	49	62
1893	61.22	56	73	6.41	68	89
1894	47.83	44	59	5.98	64	87
1895	36.29	33	48	4.97	53	76
1896	33.07	30	44	4.35	46	68
1897	31.51	29	43	4.10	44	66
1898	34.26	31	46	4.39	47	69
1899	37.40	34	47	4.40	47	65
1900	44.61	41	49	5.00	53	64
1901	52.86	48	59	6.20	66	81
1902	58.61	54	65	7.03	75	90
1903	62.25	57	65	7.78	83	95
1904	67.93	62	73	6.15	66	77
1905	70.37	65	75	5.99	64	75
1906	80.72	74	81	6.18	66	73
1907	93.51	86	89	7.62	81	85
1908	93.41	86	90	6.05	65	68
1909	95.64	88	94	6.55	70	75
1910	108.03	99	99	9.17	98	98
1911	111.46	102	105	9.37	100	103
1912	105.94	97	99	8.00	85	87
1913	110.77	102	100	9.86	105	104
1914	109.32	100	99	10.40	111	109
1915	103.33	95	95	9.87	105	106
1916	101.60	93	83	8.40	90	80
1917	102.89	94	62	11.75	126	82
1918	104.24	96	51	19.54	209	111
1919	98.48	90	44	22.04	235	115
1920	94.39	87	34	19.01	203	80
1921	82.45	76	42	12.99	139	77

[1] Prices as reported by the Department of Agriculture are converted to currency during the Civil War period by using the premiums on gold as given by the Treasury Department. The index number of wholesale prices is on a currency basis; therefore the prices of hogs and horses are reduced to a currency basis.

NOTE.—Purchasing power is calculated by dividing the price index by the index number of wholesale prices for January 1. For years before 1900 a January number is not available. The yearly average for the year and preceding year is then used (Tables I and II). (See also footnote 2, Table I.)

If the production of horses is not profitable, the raising of colts is checked, but usually the prices drop moderately for a year or more before prices clearly indicate overproduction. It is a year after the decision is made before there is a decrease in the number of colts, and four years before there is a decrease in 3-year-old colts. For several years the decrease in number of colts raised increases the apparent surplus of horses, for a mare can do more work when she does not raise a colt. By the time the supply of mature horses is so short as to be reflected in prices, there is a shortage in several crops of colts. If colt raising is again begun, it still further increases the apparent shortage of horses, becauses large numbers of mares are bred and they can not then do a full year's work. In 1878 the purchasing power of horses began to rise and continued for 10 years. It then fell for 10 years, rose for 14 years, fell for 9 years, and has now risen 1 year. Apparently the tide has turned. The value per head in dollars still fell in 1921, but the dollars have acquired so much more purchasing power that horses have risen in exchange value.

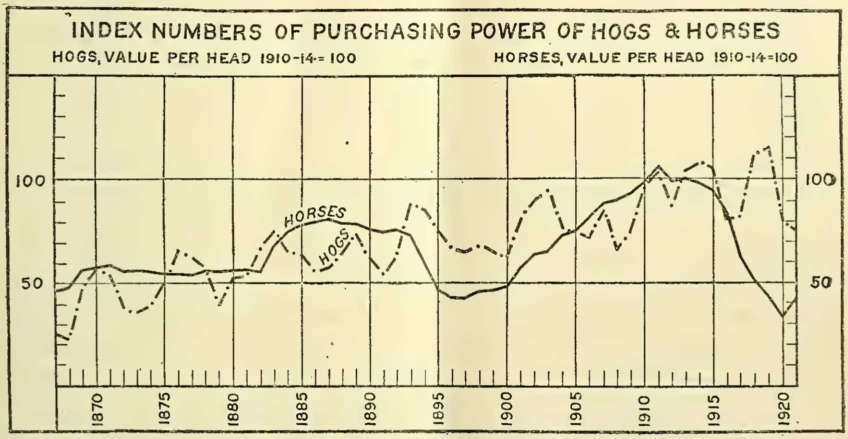

FIG. 4.—Purchasing power of hogs and horses in the United States. Periods of relatively high and low prices for hogs come at frequent intervals. Horses have longer and more violent periods of over and under production.

The primary reason for the decline in the price of horses was overproduction. The decline would undoubtedly have occurred in any event, but trucks, autos, and tractors increased the depression, so that the purchasing power of a horse in January, 1920, was the lowest ever reported. Judging by past experiences, the expectation is that horses will gradually rise in purchasing power; that is, if other prices remain stationary horses will increase in price, or if other prices fall horses will fall less rapidly. Before many years a decided shortage of horses is to be expected.

Hogs multiply very rapidly, so that errors in estimating the supply that can be absorbed are more quickly corrected. Hogs usually fall in price for one to three years and then rise one to three years. The complete cycle from low to low with hogs is about one-fourth as long as with horses. The weights at which hogs are sold can be changed to help in correcting errors as to the numbers needed. A violent change in the corn crop can thus be quickly reflected in hogs. These and other causes make the hog curve less smooth than the horse curve, but at the same time prevent its moving so far from normal at any time. It is to be observed that the horse curve has a much more violent swing than the hog curve. As already noted, the long period of time before errors in production of horses are apparent allows very great overproduction and equally serious underproduction.

With annual crops an error in acreage can be corrected the next year. The acreage of crops is, therefore, subject to less violent fluctuations than is the number of hogs and much less than is the number of horses. The weather is so much more powerful in influencing production than is any ordinary change in acreage that the effect of changes in acreage are often obscured. The response to prices is none the less sure. For example, the cotton acreage for 1921 is 72 per cent of the 1920 acreage. Such an extreme change in acreage of a basic crop rarely occurs and could only be brought about by an extreme change in the purchasing power of cotton. Ordinarily changes in acreage are much less.

Because of the cycles in prices a one-year basis of comparison is not long enough. In this bulletin a five-year average before the war is used as a base, represented by 100. Farm prices by months are not available before 1909. For horses even a five-year base is too short for the five-year period before the war was a high-priced period for horses. The base for timothy seed was only four years and included a year of very high prices. This makes the index numbers for timothy seed too low.

RELATION OF WAGES AND FARM PRICES.

When prices suddenly rise or fall wages lag behind, as is shown in Table VI. When prices rise rapidly, as they did in 1863–64 and in 1916–17, and wages lag, there is a real high cost of living. The usual quantity of labor will not buy the usual quantity of things. Some form of economy must be practiced. One of the things economized on is food. By changing from animal foods to plant foods, a food supply can be purchased at much less cost, although it is much less satisfying food, and if carried to the extent of denying milk and butter to children, may have very serious consequences. When prices suddenly increase and wages do not, the food habits of a more crowded country are temporarily adopted. The increased demand for plant foods usually causes prices of grains to rise faster than does the general price level and causes those of animal food to rise less rapidly than does the general price level. But grains are used in the production of animal foods, so that the animal producer is confronted with unprofitable production, but the public discussion turns to the prices of things that can not be afforded in the usual amount, so that the meat and milk prices are at such times subject to attack, while in fact they are relatively low.

TABLE VI.—*Wages and wholesale prices.*

Year.	Civil War, 1856–1860=100.[1]		Year.	World War, 1910–1914=100.[2]	
	Wholesale prices, all commodities.	Wages.		Wholesale prices, all commodities.	Wages.
1860	95	101	1914	102	105
1861	95	102	1915	102	106
1862	112	104	1916	126	114
1863	141	111	1917	178	131
1864	181	126	1918	200	166
1865	205	144	1919	219	189
1866	181	153	1920	250	240
1867	163	159			
1868	152	160			
1869	145	163			
1870	135	163			
1871	129	165			
1872	132	167			
1873	130	168			
1874	126	163			
1875	121	160			
1876	112	154			
1877	105	146			
1878	96	144			

[1] Wholesale prices, wages, and transportation. Report by Mr. Aldrich, from the Committee on Finance Mar. 3, 1893. Senate Report No. 1394, Fifty-second Congress, second session, Part I, pp. 13 and 91.
[2] Monthly Labor Review, Vol. XII, No. 2, pp. 73–74, February, 1921.

When the five-year average prices before the war are called 100, the general price level in 1917, as indicated by the index number for wholesale prices, was 178. The weighted average price of 31 farm products was 179. Wages lagged behind prices and stood at 131. The index number of the farm price of corn was 218; wheat, 227; rye, 216; buckwheat, 210; beans, 324; cabbage, 220; onions, 236; potatoes, 274. All these were very high. But the index number of butter was only 141; eggs, 160; chickens, 146; beef cattle, 157; hogs, 188. All these except hogs were very low in price and hogs were low in comparison with corn. Hogs had just passed through a period of low prices and consequently were short in supply.

These striking differences in prices were largely owing to shifts made in food habits because wages had not risen as rapidly as the general price level. The short crop in 1916 made the situation worse.

The same process occurred during the Civil War. The animal units per 100 persons decreased from 89 in 1860 to 67 in 1870. (See Table VII.) During the World War wages rose more promptly than they did during the Civil War period. The number of animals has nearly kept up with population. From 1910 to 1920 the animal units per 100 persons decreased from 69 to 65.

When the general price level falls wages again lag behind and there is an increased demand for animal foods provided there is not too much unemployment. After the Civil War wages remained high for a number of years. The prices of animal foods were somewhat above the price level of other farm products for some years and the animals were increased. The prices of animal foods did not drop as rapidly as the prices of crops in 1920. Some recovery in numbers of animals is probable, but the shortage is small compared with the Civil War changes, so that no such decided increase is probable. The long-time tendency is to keep fewer animals per capita as the population becomes more dense.

TABLE VII.—*Relation of population to animals.*[1]

[Animal units per 100 persons.]

Country.	Animal units of cattle, reindeer, sheep, goats, hogs.	Country.	Animal units of cattle, reindeer, sheep, goats, hogs.
Argentine	443	Rumania	
Australia	395	France	33
Canada	82	Netherlands	37
United States:		Denmark	33
1850	92	Germany	33
1860	89	Russia	31
1870	67	British Isles	29
1880	87	Belgium	29
1890	93	Japan	23
1900	73		2
1910	69		
1920	65		

[1] Data for foreign countries are before the war.

One head of grown cattle, 2 young cattle, 7 sheep or goats, 14 lambs, 5 hogs, 10 pigs are each called an animal unit.

These data are necessarily only roughly correct, but they are believed to be sufficiently accurate to indicate correct conclusions.

The effect of wages is not as great as might be inferred from wage rates and wholesale prices. When prices rise rapidly, wages lag behind, but there is full employment, so that the wage earners are not in as serious a condition as the wages indicate. When prices fall rapidly, wages lag behind and remain high, but there is likely to be unemployment, so that the buying power is not as high as the wages suggest.

WHOLESALE PRICES OF FARM PRODUCTS DURING THE CIVIL WAR AND WORLD WAR PERIODS.

Farm prices by months are not available for the Civil War period. Wholesale prices in cities are shown in figures 5 to 11, and Tables XII to XVI. Usually the wholesale prices lag behind farm prices, and usually they do not have such extreme fluctuations as do farm prices.

In all cases the weather has had a very decided influence on grain prices.

Wool is in special demand in war time for soldiers' clothing, so that during each war period the supply has been inadequate and the price has gone very high, much above the general wholesale price level. The reaction is also extreme.

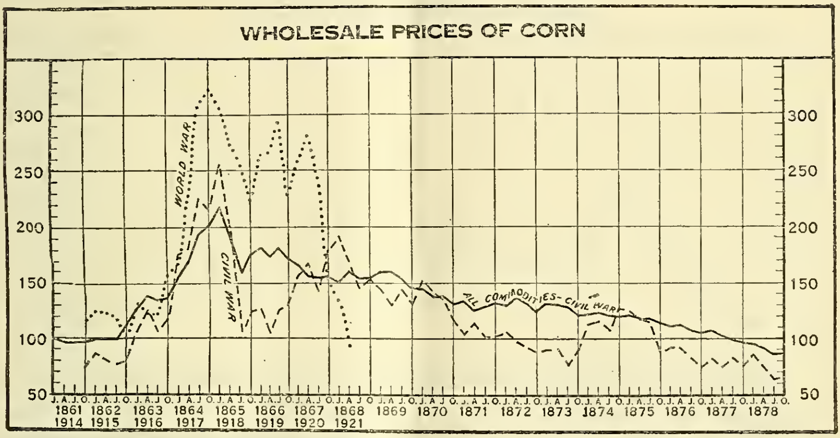

FIG. 5.—Prices of corn, Civil War and World War periods, and wholesale prices of "all commodities" during the Civil War. Five-year average before the war is in all cases 100. When the Civil War corn price is above the line for all commodities corn was relatively high in price. When below that line it was relatively low.

Butter, cheese, and eggs did not rise as soon as did the general price level during the Civil War period. The number of animals per capita was reduced. After the war the high wages caused an increased

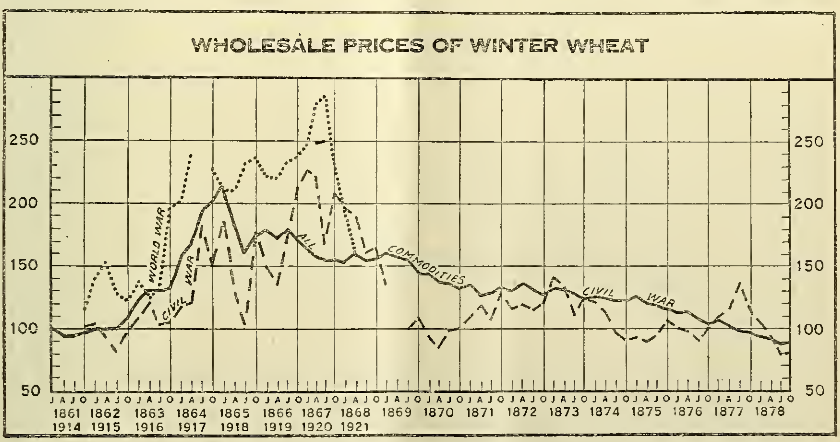

FIG. 6.—Prices of wheat, Civil War and World War periods, and wholesale prices of all commodities during the Civil War. Five-year average before the war is in all cases 100.

demand for the short supply and resulted in relatively high prices for these products for a number of years.

The prices of hogs for the Civil War period (fig. 11) show the cycles of over and under production of hogs varying about the general price level.

PRICES PAID TO FARMERS.

The five-year average prices paid to farmers for each product for each month are shown in Table XVII, pages 37 to 45. For example,

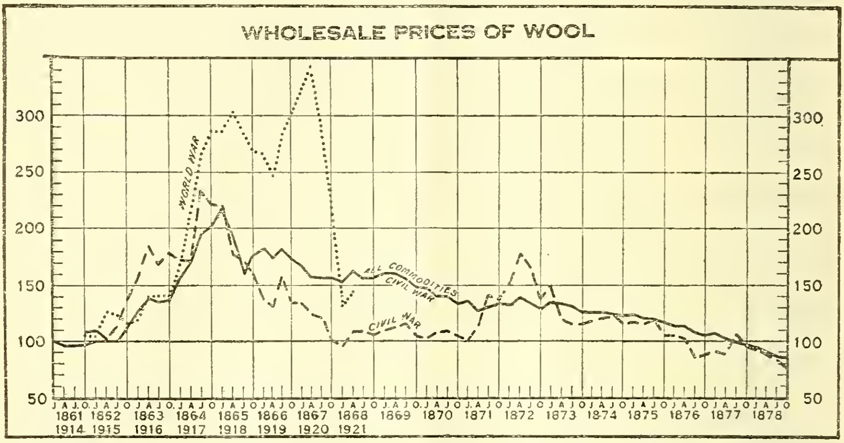

FIG. 7.—Prices of wool, Civil War and World War periods, and wholesale prices of all commodities during the Civil War. Five-year average before the war is in all cases 100. In both war periods wool rose very high in price and in both cases a very violent drop occurred.

the average price paid to farmers for corn on July 1, 1909–1914 was 69.2 cents per bushel. July 1, 1921, it was 62.2 cents. The price in July, 1921, was therefore 90 per cent of the five-year average before the war.

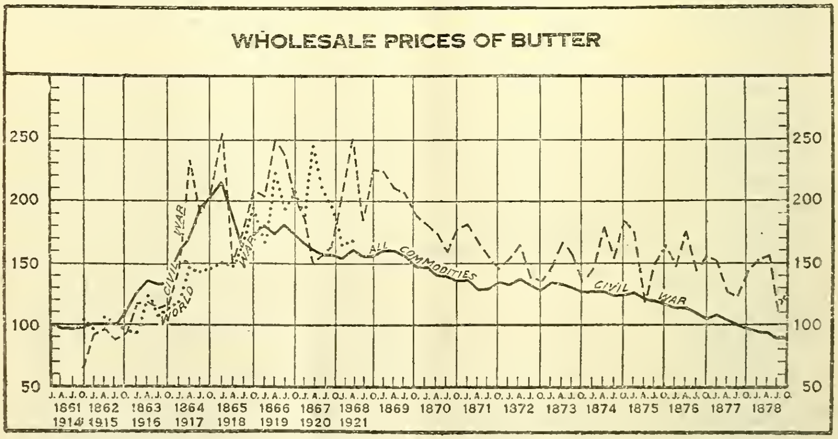

FIG. 8.—Prices of butter, Civil War and World War periods, and wholesale prices of all commodities during the Civil War. Five-year average before the war is in all cases 100. In each war period butter was relatively cheap for several years. After the Civil War a reaction occurred that kept butter relatively high priced for several years.

The average price of cotton on July 1 for five years before the war was 12.7 cents. In July, 1921, it was 9.6 cents or 76 per cent of the average before the war.

The average July 1 price of wheat before the war was 87.4 cents. This year (1921) it was 112.2 cents, or 128 per cent of the average before the war.

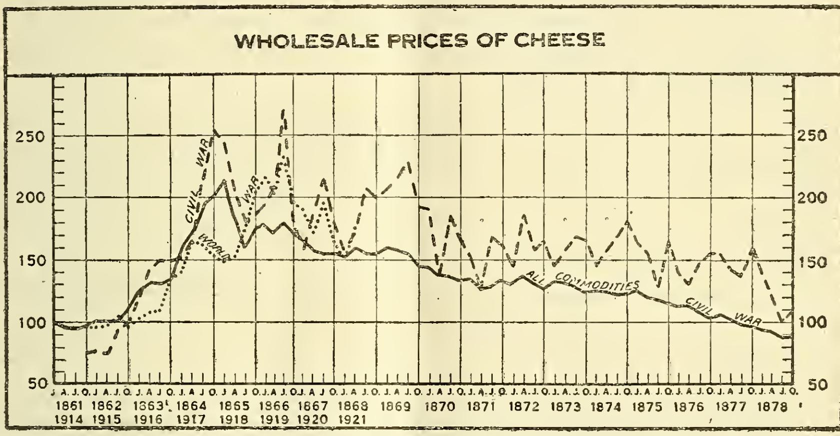

FIG. 9.—Prices of cheese, Civil War and World War periods, and wholesale prices of all commodities during the Civil War. Five-year average before the war is in all cases 100.

Nearly all farm products have decided seasonal variation in price, so that May prices must be compared with May and January with January. This method is followed in all cases (Table XVIII, pp. 47 to 55).

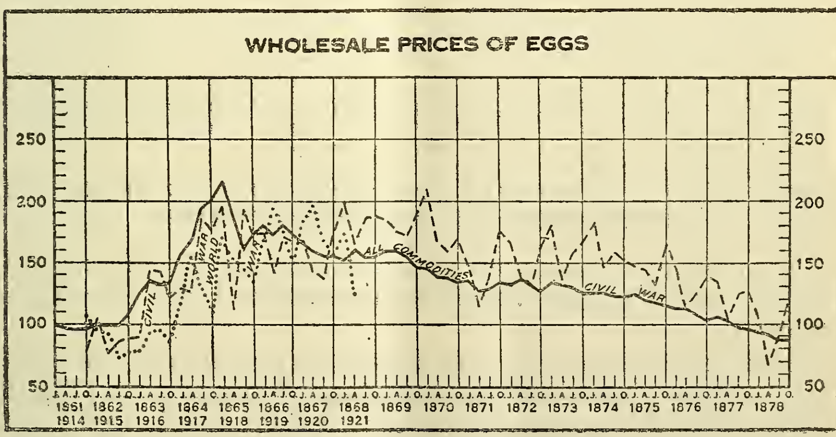

FIG. 10.—Prices of eggs, Civil War and World War periods, and wholesale prices of all commodities during the Civil War. Five-year average before the war is in all cases 100. At each war period eggs were relatively cheap for several years. After the Civil War a reaction to relatively high prices occurred.

The weighted index number for 31 farm products was obtained by multiplying the price index by the approximate percentage that each product represents of the total farm sales. For example, cotton is given a weight of 16.9 and buckwheat 0.2. The unweighted average of the 31 is practically the same as the weighted in nearly all months.

The weighted average price of 31 farm products reached the peak in June, 1920, with a price index of 246. At that time, the wholesale price of "all commodities" was 276. Since May, 1920, the index numbers for farm prices dropped from 246 to 106. The drop each month was as follows:

July	4	January	10
August	17	February	5
September	18	March	6
October	16	April	9
November	23	May	6
December	25	June	1

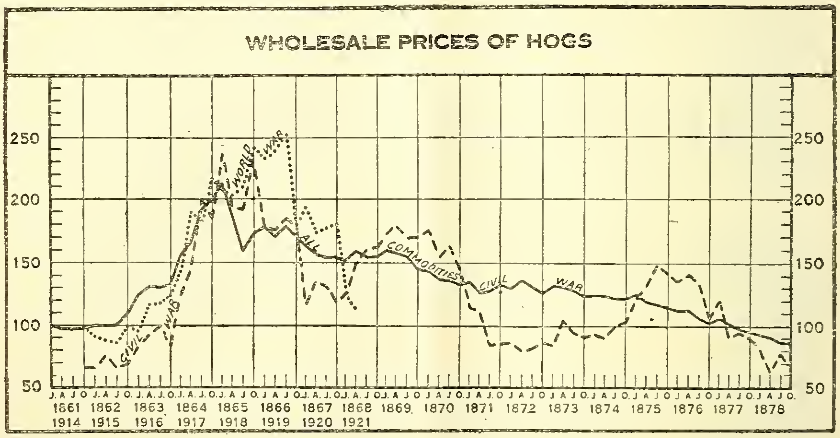

FIG. 11.—Prices of hogs, Civil War and World War periods, and wholesale prices of all commodities during the Civil War. Five-year average before the war is in all cases 100. During each war period hogs were relatively cheap for several years. Following the Civil War the price of hogs swung about the general price level, showing the regular cycles of over and under production.

COMPARISON OF FARM PRICES WITH PRICES OF SOME OTHER BASIC COMMODITIES AND WITH FREIGHT RATES.

The weighted average price paid to farmers for 31 farm products in June was 106, when the five-year average before the war is called 100.

The price of copper was 88 per cent of the prewar price; anthracite coal, 210; Pennsylvania crude oil, 154; Bessemer pig iron, 155. Freight rates for the farm products given in table VIII varied from 158 to 231 per cent of the prewar average. Wholesale prices of "all commodities" were 151 per cent of the prewar average.

If prices of farm products should long remain at such unusual ratios to other prices and charges, the most far-reaching changes in agriculture would take place. The types of farming in different sections of the United States are largely determined by freight rates. Any changes in the ratio of rates to prices causes a readjustment in farming. If the new ratios continue, the most fundamental changes in types of farming will result.

TABLE VIII.—*Index numbers of prices and freight rates.*[1]

	Five-year average June, 1909–July, 1914.	June, 1921.	Percentage that 1921 price or charge is of five-year average.
Weighted average prices paid to farmers for 31 farm products	100		106
Wholesale prices "all commodities"	100		151
Pennsylvania crude oil f. o. b. wells, per barrel	$1.70	$2.625	154
Anthracite egg coal, f. o. b. N. Y. harbor, per ton	4.77	10.034	210
Bessemer pig iron at Pittsburgh, per ton	15.94	24.71	155
Lake copper, New York, per pound	.1453	.1284	88
Freight rates on car loads per 100 pounds:			
Wheat, Kansas City to Galveston—			
Domestic	.355	.56	158
Export	.225	.45	200
Corn, Chicago to New York—			
Domestic, reshipping	.16	.345	216
Export, reshipping	.13	.30	231
Dressed hogs, Chicago to New York	.45	.965	214

[1] Prices of copper and iron as reported by Iron Age. Other prices as reported by the Bureau of Labor Statistics. Freight rates obtained from the Interstate Commerce Commission.

COMPARISONS OF FARM AND WHOLESALE PRICES.

When wholesale prices rise suddenly, retail prices tend to lag behind. Much of the goods in the hands of retailers is sold at or near the old price. When prices fall rapidly retail prices again tend to follow slowly. Prices in small towns are likely to change more slowly than in cities where the stock is turned over more rapidly.

Farmers sell on a quickly moving market and buy on a slow market, hence, when a sudden and violent drop in prices occurs, they sell at low prices long before any great reduction occurs in the price of things that they buy.

Wholesale prices do not show the condition on farms. When prices suddenly fall, farm prices drop much more than wholesale prices and very much more than retail prices. For example, take the case when a product sells for $3 at wholesale and $2 on the farms. If the wholesale price drops 33 per cent, the farm price will drop nearly 50 per cent, or nearly to $1. The reason for this is that freight and many other costs of marketing are based on the physical quantity handled, not on price.

Many apples, potatoes, and cabbages were thrown away during the past year because they would not pay the shipping costs. City wholesale prices rarely go below the costs of shipment and handling, and so do not show real conditions.

Farm prices of products in the surplus States that are farthest from market are much lower than the prices for the United States as a whole, so that even the farm prices as given in this bulletin do not show the true status in States at the centers of production. For example, the United States farm price of corn in June was 92 per cent of the prewar price, but in Iowa it was 79 per cent of the prewar price. On farms in New York State, which is a corn consuming State, the price was 123 per cent of the prewar price. Wholesale prices in New York City were 123 per cent of the prewar price.

Wheat on farms in the United States was 140 per cent of the prewar price; and in New York City it was 174 per cent.

Cotton on farms was 77 per cent of the prewar price, while in New York City it was 95 per cent.

Wool on farms was 88 per cent of the pre-war price; in Boston it was 142 per cent of the prewar price.

A striking difference on farms is shown in the case of horses. In Montana horses in June were worth 43 per cent of the prewar price, in Iowa 76 per cent, and on New York farms 82 per cent of the prewar price. The farther from market the worse the agricultural panic.

TABLE IX.—*Comparison of prices paid to farmers in different States and wholesale prices.*

	5-year average before the war, June, 1910–1914.	June, 1921.	Percentage that 1921 price is of 5-year average.
Corn:			
Farm price—	*Cents.*	*Cents.*	*Per cent.*
United States	67.7	62.5	92
Iowa	55.4	44	79
New York	75.4	93	123
Wholesale price, No. 2, mixed, New York City	71.8	88	123
Wheat:			
Farm price—			
United States	90.8	127.4	140
Washington	83.0	114	137
Kansas	87.6	130	148
New York	101.6	135	133
Wholesale price, No. 2, red winter, New York City	104.8	182.5	174
Cotton:			
Farm price—			
United States	12.7	9.8	77
Texas	12.4	9.9	80
Georgia	13.1	10.5	80
Wholesale price, middling upland, New York City	13.51	12.90	95
Eggs:			
Farm price—			
United States	16.7	19.4	116
Iowa	15.6	16	102
New York	20.2	29	144
Wholesale price, average best fresh, New York City	24.25	26.25	108
Butter:			
Farm price—			
United States	23.5	29.4	125
Minnesota	25	26	104
New York	28	36	129
Wholesale price, creamery extra, New York City	26.48	29	110
Wool:			
United States	17.5	15.4	88
Montana	18	16	89
New York	20.4	18	88
Wholesale price, Ohio fine, unwashed, Boston	21.55	30.5	142
Hogs:			
United States	$7.16	$7.22	101
Iowa	7.32	7.00	96
Indiana	7.42	7.40	100
New York	7.40	7.80	105
Horses:			
Farm price—			
United States	145.00	98.00	68
Montana	139.00	60.00	43
Iowa	165.00	125.00	76
New York	180.00	147.00	82

PURCHASING POWER OF FARM PRODUCTS.

The index number of wholesale prices of "all commodities" prepared by the Bureau of Labor Statistics is taken as a measure of the general price level. These index numbers converted to a five-year base are given in Tables I and II.

In June, 1921, the index number was 151 as compared with the five-year average for June, 1909 to 1914. The general average of all commodities, including farm products, was therefore 51 per cent above the prewar average. If farm products were omitted the average would be higher.

In June, 1921, the price of corn was 92 per cent of its prewar average. Since the general price level was 151 per cent of the prewar average the relation of corn to the general price level was 61 per cent. If a bushel of corn was sold in 1921 at the average price paid to farmers and the money used to buy commodities of all kinds at the wholesale prices of 1921, the quantity purchased would have been 61 per cent of the average amount that could have been purchased as a five-year average before the war. Manifestly the sellers of corn could not buy the usual quantity of other things.

At the average prices paid to farmers in June, 1921, a bale of cotton would have sold for 77 per cent of as many dollars as it would have brought as a five-year average before the war. If the money had been used to buy other things at the wholesale prices for June the quantity purchased would have been 51 per cent as much as the five-year average before the war.

Similarly the purchasing power on June 1 for other farm products was as follows: Corn 61, oats 60, barley 53, wheat 93, rye 101, buckwheat 101, flaxseed 55, beans 81, corn 56, cotton 51, cottonseed 52, hay 68, cabbage 111, onions 73, potatoes 64, sweet potatoes 89, peanuts 48, apples 91, chickens 116, eggs 77, butter 83, milch cows 80, beef cattle 69, veal calves 73, sheep 66, lambs 79, wool 58, hogs 67, horses 45. Practically nothing that the farmer sells can be exchanged for the usual quantity of other things. It is physically impossible for farmers to absorb the products of factories.

The weighted average purchasing power of 31 farm products in June, 1921, was 70 per cent of the five-year average before the war The yield per acre for some crops was above the average so that the buying power of the crops would be higher than this figure would indicate. Offsetting factors are the fact that retail prices lag behind wholesale prices. The farmer usually buys at retail so that he buys on a higher market than the index number of wholesale prices indicates. Also the portion of the income that must go to pay debts and taxes is much greater when prices drop suddenly. Even if prices of all things dropped evenly the buying power would still be reduced.

PURCHASING POWER PER ACRE.

When the crop yield is unusually high or unusually low, the purchasing power per bushel does not give an entirely accurate impression. For example, in December, 1917, winter wheat had a purchasing power of 125 per bushel, or was 25 per cent higher than the general price level. This is the way the price looked to buyers of wheat. But the yield was poor and its purchasing power per acre harvested was only 116. Many acres were abandoned and the purchasing power per acre planted was only 87. Considering all farmers as a whole, the price to them was more nearly represented

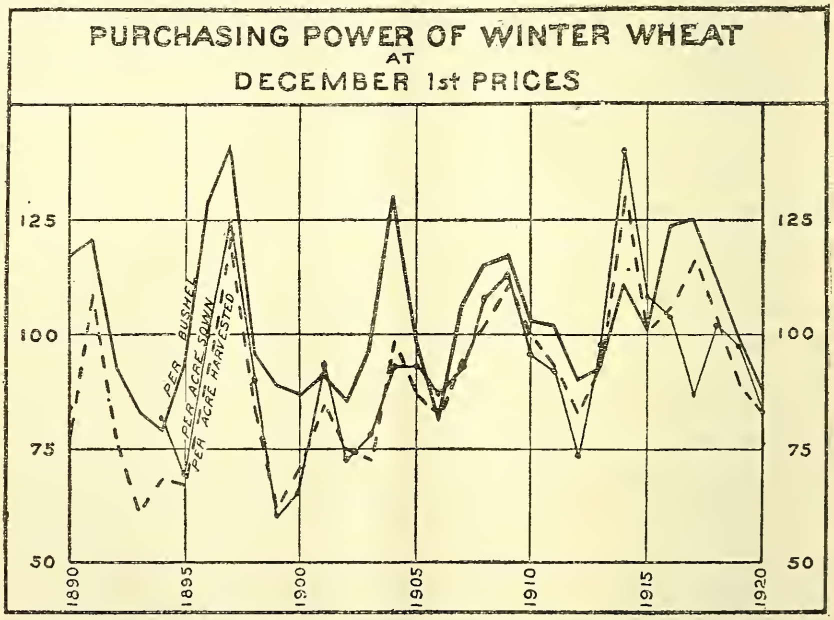

FIG. 12.—Purchasing power of winter wheat per bushel, per acre sown, and per acre harvested. Five-year average 1910-1914 is in each case 100.

by the last figure, but their situation was somewhat better than this because the abandoned acreage did not require the expense of harvesting.

The abandoned acreage for other crops is not known, but it is possible to calculate purchasing power per acre harvested. Farm prices for other months than December are not available before 1908. December prices are therefore used. Since most farm products have declined more than the general price level the figures, Tables XX to XXV, pages 67 to 72, do not show the full extent of the agricultural panic.

The purchasing power of cotton is shown in Table XXIV. At the farm price December 1, 1920, cotton had a purchasing power of 68 per

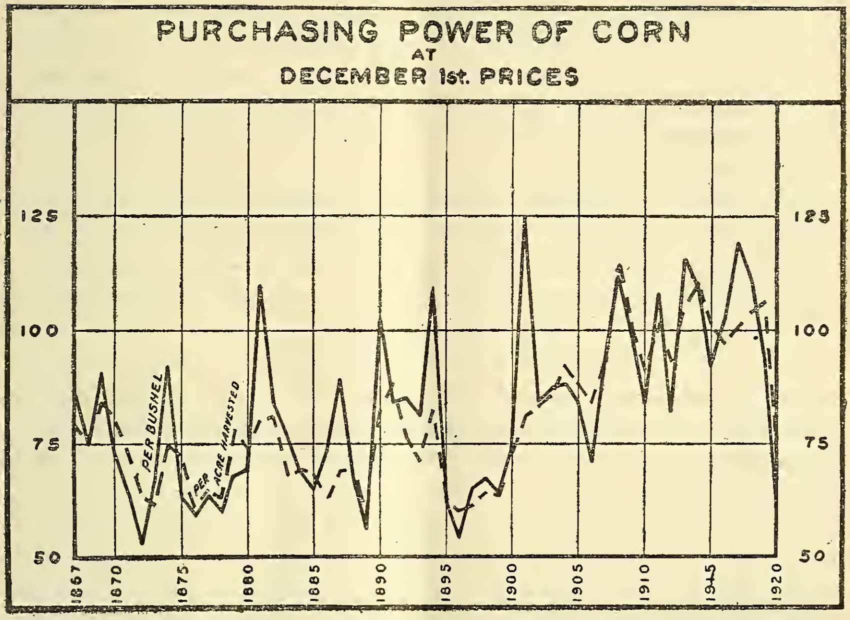

FIG. 14.—Purchasing power of corn per bushel and per acre harvested. Five-year average 1910-1914 is in each case 100. The purchasing power per acre in 1920 was the lowest in 20 years.

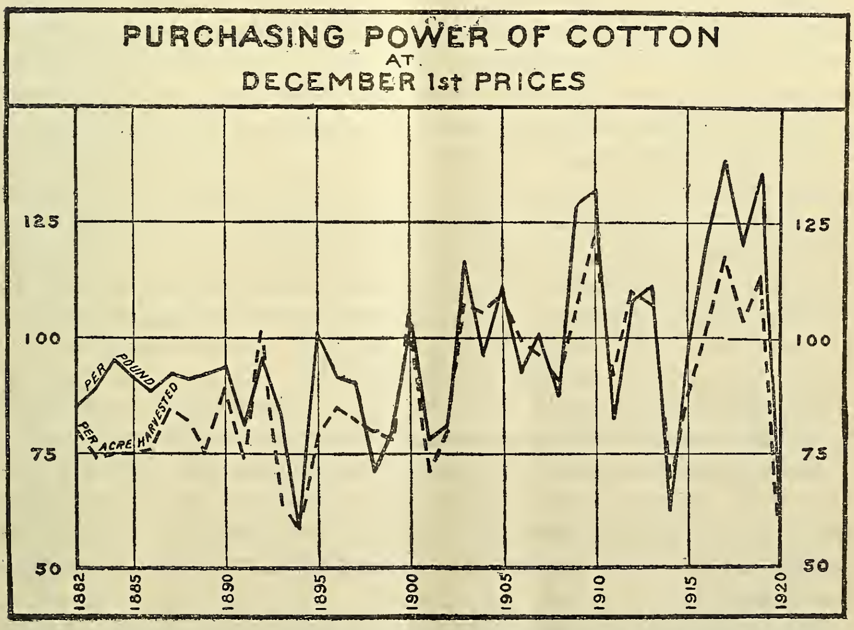

FIG. 15.—Purchasing power of cotton per pound and per acre harvested. Five-year average 1910–1914 is in each case 100. The purchasing power per acre December 1, 1920, was the lowest since 1894. With the drop in prices since December, 1920, it reached the lowest ever reported.

pound and 61 per acre harvested. This is the lowest since 1894. Since December 1 the price of cotton has continued to drop, so that now (1921) the purchasing power of an acre of cotton is the lowest ever reported. Unless there is more reserve capital or credit it would appear that at no time since records have been kept could cotton farmers buy so little.

The 1920 corn crop was a very large crop and its purchasing power at December 1 prices was 60 per bushel and 73 per acre. Both have dropped since that time. Even at December 1 prices there has not been a time in 20 years when an acre of corn or wheat would sell for so little.

EFFECTS ON INDUSTRY.

The Nation is not only confronted with the most violent drop in prices that it has ever experienced, but agricultural prices have dropped so much more than other prices that we have a severe agricultural panic on top of a severe general depression.

At first thought the city consumer of farm things is likely to delight in low prices of farm products and high prices for city products. The farm consumer of city things is equally likely to delight in low prices of city goods and high prices of farm products. But neither can long prosper at the expense of the other.

Even allowing for the drop in wholesale prices, farmers can now (1921) buy only about two-thirds their usual amount. In very large areas at centers of production their buying power is not half of the normal. If farmers can not buy, cities can not sell, and unemployment results. Neither industry nor agriculture can progress in a normal way until the relative prices become adjusted at some comparatively stable price level. This would occur if all prices and wages went to prewar levels, which farm products have nearly reached. The adjustment which seems more likely to occur and the one that would appear to cause the least injustice is to have the very low prices rise and some of the very high prices drop so that adjustment is made at a price level considerably above the prewar price.

WHAT CAN BE DONE?

The primary purpose of this bulletin is to present basic statistics, not to give an extended discussion of causes or of remedies.

The general depression is practically world-wide, but in the countries with an agricultural surplus farm products have dropped in price more than other products. In the countries with an agricultural shortage farm products have dropped in price less than other commodities.

The credit expansion and unusual demands caused the great rise in prices. Very large production, the breakdown in the buying power of European countries, and the fact that the credit limits of our banking system were reached all helped in causing the industrial depression.

The amount by which the agricultural situation is worse than the general condition is largely due to excessive production and the checking of exports.

There would doubtless have been industrial depression in any event, but the serious breakdown in the farmers' purchasing power, due to the extremely low prices of farm products, has had much to do with the severity of the industrial depression.

Many forces are at work to correct the situation. The following are but a few of the many things to be done:

A general adjustment to some fairly stable price level will greatly help toward making it possible for each class of workers to use the output of other workers, and thus open the channels of production and trade. Wages, freight rates, retail prices, farm prices need to become adjusted to the same general price level as quickly as possible. Some important things are yet double the prewar price. Others are cheaper than before the war. Industry can not progress in a normal way with such violent maladjustments. Prices and charges that have not been decidedly reduced should come down. Those that have dropped excessively should rise.

Encouragement of exports of farm products will do much to reestablish the buying power of the farmers, so that they can again absorb the products of factories. Since those countries most in need of food have the least credit, the problem is not easy, but considerable is being done. If European demand is to return, a policy of financing exports is better than a readjustment of farming only to have to change back when the demand returns.

If the countries of Europe are to economize so that they will call for less food and clothing from the United States, or if they develop their colonial possessions or otherwise become more nearly self-sustaninig our farming must be adjusted to the new conditions. For some years a study of world supply and demand for farm products will be of unusual importance to American agriculture. Until the future demands are better known, it seems desirable not to make too violent changes in our agriculture. If European countries turn to a self-sufficing economy, our farming will necessarily have to be readjusted. If our National policy is to be one of a self-sufficing farm economy, we can for example produce more of our wool and sugar, and produce less cotton and pork for export. A settled national policy must precede a settled farm policy.

In any event, the individual farmer may well turn to a more nearly self-sustaining system of farming. Farmers are forced to a policy of retrenchment. Drastic reductions in business costs and living expenses have been necessary. A policy of making the farm produce more of the food for the family and otherwise become more nearly self-sufficient is necessary. This will reserve the income for payment of debts and for necessary purchases.

So far as possible credit should be extended to farmers to enable them to continue to farm in an orderly but conservative manner.

During a period of rising prices all the channels of trade tend to be fully stocked. Every one tends to buy in advance of his needs. Credit needs are large for the wholesale manufacturing and retail agencies. Farmers then need the minimum of credit because they can sell readily. When prices are falling, the tendency to buy for immediate needs only, forces farmers to hold large quantities of produce while waiting for a market. The sudden shift of credit needs accentuated the agricultural panic. While there are likely to be years of rising prices, with the resulting tendency to store in cities, the general tendency for some years will probably be in the direction of requiring the farmers or primary purchasers of farm products to do more of the necessary holding. The tendency to falling prices, uncertainties as to prices, the poverty of Europe, and uncertainties as to exchange are likely to contribute to this general result. For this reason the subject of agricultural credit is of more than usual importance. So much of the farm credit is of long duration that more of it should be furnished as investments, rather than from bank credit. The experience of the past year has accentuated this principle. Farmers who had mortgage payments due this year that were financed from bank credit often found difficulty in obtaining renewals, because the deposits had been withdrawn from the banks. But land bank mortgages financed as investments have caused little trouble either to the owner of the bonds or the farmer. Many agricultural enterprises are of so long duration that it is also desirable that part of the personal credit be financed as investments rather than have so large a part of it financed from deposits or furnished by retailers who depend on short-time credit.

Since farm products are so very cheap, it would seem desirable to increase the supply of live stock. Surplus crops stored in growing animals are a good risk. There is at least a fair chance that the animals will sell when feed is more valuable.

Until Russia again becomes an exporting nation the outlook for the export of wheat and rye is apparently more favorable than for most other farm products.

Ample supplies of grain and hay should be held on farms in each year of excessive production. More attention should be given to the storage and financing of crops in years when the weather is unusually favorable so that the unexpected production which is often a calamity to the farmers may be used to supplement short crops that are now almost equally injurious to industry.

The agriculture of America will recover. But in the meantime many individual farmers have lost all their savings. The injury is most serious for young men who began farming as tenants or owners in the past few years. When prices are high, it is difficult to avoid becoming too optimistic. When prices are low, it is equally difficult to avoid becoming too much discouraged. Many business failures are primarily failures of courage. Many farmers can not avoid failure, but courage and perseverance will carry many others through seemingly impossible conditions and will do much to bring back normal times.

SUMMARY.

There is considerable similarity between the changes in prices during the War of 1812, Civil War, and World War. In each case there has been a close relationship between money and prices.

Crop yields in the United States are exceedingly variable, owing to the variations in rainfall. The total grain production in 1920 was large and contributed to the reduction in prices of farm products.

There is an intimate relationship between industrial conditions and the relative demands for farm produce. When wages do not advance as rapidly as prices, there is an increased demand for grains and vegetables and a lessened demand for animal products.

When the 5-year average price before the war is called 100, the prices paid to farmers in June, 1921, for some farm products were as follows: Corn 92, wheat 140, barley 80, cotton 77, potatoes 97, beef cattle 104, hogs 101.

The index number of wholesale prices in June, 1921, was 151.

The weighted average price of 31 farm products was 106. These farm products therefore had an exchange value or purchasing power of 70 per cent of the 5-year average before the war.

Compared with a 5-year average before the war as 100, the purchasing power of some farm products at prices paid to farmers in June, 1921, were as follows: Corn 61, oats 60, barley 53, wheat 93, rye 101, buckwheat 101, flaxseed 55, beans 81, corn 56, cotton 51, cottonseed 52, hay 68, cabbage 111, onions 73, potatoes 64, sweet potatoes 89, peanuts 48, apples 91, chickens 116, eggs 77, butter 83, milch cows 80, beef cattle 69, veal calves 73, sheep 66, lambs 79, wool 58, hogs 67, horses 45. Practically nothing that the farmer sells can be exchanged for the usual quantity of other things. It is physically impossible for farmers to absorb the products of factories.

Farm prices have dropped much more than wholesale or retail prices of farm products.

The low purchasing power of farm products has made it impossible for farmers to buy the normal amount of other things and has been a contributing cause of unemployment.

NOTES ON FIGURE 13.

The wholesale price of "all commodities" as reported by the United States Bureau of Labor Statistics is indicated by the heavy purple line. The heavy red line shows the weighted average prices paid to farmers for 31 farm products, 20 of which are shown in the chart.

Any product that is higher than the wholesale price of all commodities is high in price. Any product that is lower than the general price level is low in price.

The average of all farm products was about the same as the general price level until October, 1919. At that time a decided rise in wholesale prices of "all commodities" took place, but prices paid to farmers rose less rapidly. Beginning with July, 1920, wholesale prices dropped rapidly, but farm prices dropped much more rapidly. In the spring of 1921 practically everything that farmers sold was lower than the general price level.

Notice that before the war the price of each farm product varied about the general price level in relatively small cycles, but that when the general price level changed the cycles were made much more violent. However, the cycles continue and may be expected to continue. Any product that is much above the general price level is likely to fall in price and any that is lower than the general price level is likely to rise in price, owing to relatively stable conditions as to the amount of human effort involved in production.

During the period of high prices before October, 1919, farm prices averaged about the same as all commodities. Farm prices were neither high nor low. But some farm products were very high and some were very low. It was not possible to describe the condition of farmers as a whole. Some were prosperous and some were the reverse. In the spring of 1921 practically all farm products were far below the general price level. This has caused the agricultural panic. It does not seem possible that such abnormal price ratios can continue. Other things must come down or farm prices must rise.

The data for each product are given in Table XVIII. The data for wholesale prices of all commodities are given in Table II.

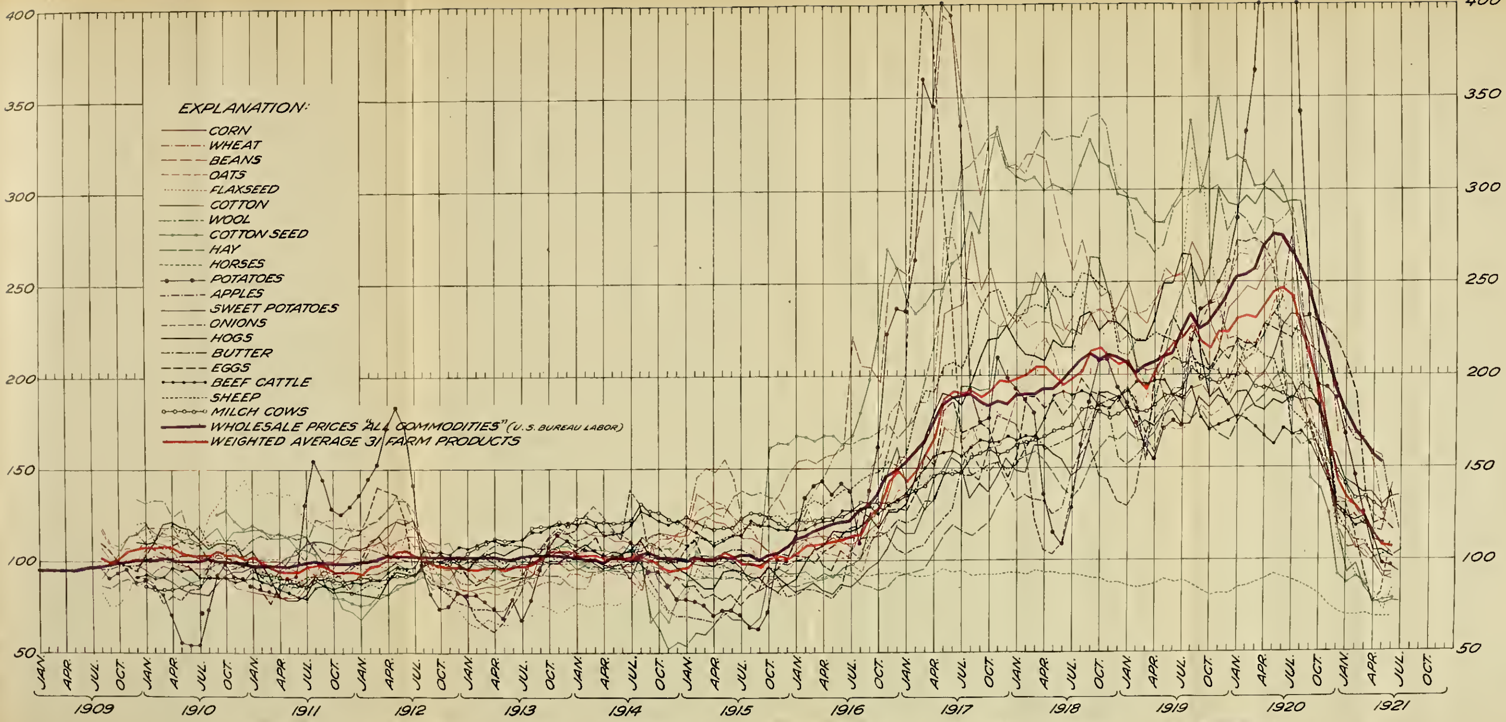

Fig. 13.—Index Numbers of Prices Paid to Producers of Farm Products in the United States. The Five Year Average August 1909 July 1914 for Each Product for Each Month is in All Cases Considered as 100

WHOLESALE PRICES OF FARM PRODUCTS DURING THE CIVIL WAR AND WORLD WAR PERIODS.

Wholesale prices of a few farm products for the two war periods are shown in Tables X to XVI, pages 29 to 35. Curves for some of these are given in figures 5 to 11.

To see whether the Civil War prices for a particular farm product were really high or low they may be compared with the wholesale prices of all commodities for that period, as given in Table I and shown in figures 5 to 11. For the World War comparison may be made with the general price level as shown in Table II. For example, the quotation for No. 2 corn in Chicago in April, 1921, was 94 per cent of the five-year average price before the war. The general price level as shown in Table II was 157 per cent of the five-year average before the war. Corn was very cheap.

As explained on pages 17 to 18, wholesale prices do not show conditions on farms, but since farm prices are not available for the Civil War period, wholesale prices are used.

In times of violent price changes, prices should be compared by months, but the Aldrich report gives prices by quarters only. It would be very desirable to have an index number for wholesale prices and for individual commodities by months for the Civil War period.

The data for the World War period can be continued by using the average of the high and low prices as given in the Monthly Crop Reporter. The index number is obtained by dividing the price for a given month by the five-year average before the war, for the month under consideration as given at the head of each table.

TABLE X.—*Wholesale prices of corn—Civil War and World War.*

Year.	Corn—New York City.[1]		Year.	Corn No. 2—Chicago.[2]	
	Price per bushel.	Index number.		Price per bushel.	Index number.
Average, October, 1856, to July, 1861:	*Cents.*		Average, October, 1909, to July, 1914:	*Cents.*	
January	73.4	100	January	58.02	100
April	72.4	100	April	61.68	100
July	70.1	100	July	66.32	100
October	74.2	100	October	63.08	100
1861:			1914:		
October	54.5	73	October	73.75	117
1862:			1915:		
January	64.5	88	January	72.75	125
April	57.75	80	April	75.5	122
July	55	78	July	78.625	119
October	59.5	80	October	63.375	100
1863:			1916:		
January	79.25	108	January	76.0	131
April	92	127	April	76.875	125
July	75.25	107	July	81.25	123
October	86.75	117	October	99.625	158
1864:			1917:		
January	130	177	January	98.125	169
April	130	180	April	141.5	229
July	158	225	July	204.75	309
October	158	213	October	202.25	321
1865:			1918:		
January	187	255	January	177.5	306
April	142.5	197	April	167.5	272
July	74	106	July	167.5	253
October	91	123	October	140	222
1866:			1919:		
January	92.5	126	January	152.5	263
April	77	106	April	163.8	266
July	87.5	125	July	194.8	294
October	95	128	October	145	230
1867:			1920:		
January	116	158	January	150.3	259
April	121.5	168	April	173.3	281
July	99.5	142	July	161.8	244
October	132.5	179	October	95.8	152
1868:			1921:		
January	141	192	January	76.3	132
April	123	170	April	58	94
July	102	146			
October	113	152			
1869:					
January	108	147			
April	94	130			
July	101	144			
October	97	131			
1870:					
January	111.5	152			
April	103	142			
July	96	137			
October	87	117			
1871:					
January	76.5	104			
April	83	115			
July	71.625	102			
October	76	102			
1872:					
January	78.25	107			
April	71.75	99			
July	64.5	92			
October	64.5	87			
1873:					
January	66.125	90			
April	65	90			
July	54.75	78			
October	66.75	90			
1874:					
January	82.5	112			
April	85.25	118			
July	76.75	109			
October	95.75	129			

[1] Wholesale prices, wages, and transportation. Report by Mr. Aldrich, from the Committee on Finance, Mar. 3, 1893. Senate Report No. 1394, Fifty-second Congress, second session, pt. 2.
[2] As reported by the United States Department of Agriculture.

TABLE XI.—*Wholesale prices of winter wheat—Civil War and World War.*

Winter wheat in New York City.[1]			No. 2 Red winter wheat New York City f. o. b. afloat.[2]		
Year.	Price per bushel.	Index No.	Year.	Price per bushel.	Index No.
Average, October, 1856, to July, 1861:			Average, October, 1909, to July, 1914:		
January	$1.372	100	January	$1.075	100
April	1.437	100	April	1.083	100
July	1.442	100	July	1.023	100
October	1.299	100	October	1.0105	100
1861:			1914:		
October	1.32	102	October	1.168	116
1862:			1915:		
January	1.43	104	January	1.50	140
April	1.345	94	April	1.644	152
July	1.19	83	July	1.316	129
October	1.285	99	October	1.24	123
1863:			1916:		
January	1.485	108	January	1.474	137
April	1.725	120	April	1.364	126
July	1.4925	104	July	1.348	132
October	1.36	105	October	1.976	196
1864:			1917:		
January	1.61	117	January	2.165	201
April	1.74	121	April	2.578	238
July	2.6275	182	July	....	....
October	1.975	152	October	2.29	227
1865:			1918:		
January	2.555	186	January	2.26	210
April	1.85	129	April	2.26	209
July	1.475	102	July	2.365	231
October	2.30	177	October	2.38	236
1866:			1919:		
January	2.05	149	January	2.38	221
April	1.95	136	April	2.38	220
July	2.45	170	July	2.38	233
October	2.75	212	October	2.38	236
1867:			1920:		
January	3.10	226	January	2.65	247
April	3.175	221	April	3.01	278
July	2.40	166	July	2.92	285
October	2.70	208	October	2.34	232
1868:			1921:		
January	2.70	197	January	2.08	193
April	2.725	190	April	1.70	157
July	2.30	160			
October	2.125	164			
1869:					
January	1.85	135			
April	....	....			
July	1.445	100			
October	1.415	109			
1870:					
January	1.285	94			
April	1.225	85			
July	1.42	98			
October	1.30	100			
1871:					
January	1.48	108			
April	1.68	117			
July	1.55	107			
October	1.67	129			
1872:					
January	1.58	115			
April	1.70	118			
July	1.65	114			
October	1.56	120			
1873:					
January	1.925	140			
April	1.925	134			
July	1.575	109			
October	1.615	124			
1874:					
January	1.665	121			
April	1.615	112			
July	1.40	97			
October	1.175	90			

[1] Wholesale prices, wages, and transportation. Report by Mr. Aldrich from the Committee on Finance Mar. 3, 1893. Senate Report No. 1394, Fifty-second Congress, second session, Part II.
[2] As reported by the United States Department of Agriculture.

TABLE XII.—*Wholesale prices of wool—Civil War and World War.*

Ohio washed fleece wool, New York.[1]		
Year.	Price per pound.	Index No.
Average, October, 1856–July, 1861:	*Cents.*	
January	45. 40	100
April	44. 16	100
July	41. 48	100
October	44. 86	100
1861:		
October	48. 3	108
1862:		
January	49. 3	109
April	44. 7	101
July	46. 7	113
October	61	136
1863:		
January	71	156
April	81. 7	185
July	70	169
October	80. 3	179
1864:		
January	78	172
April	75. 7	171
July	96. 7	233
October	99. 3	221
1865:		
January	99. 3	219
April	78. 3	177
July	71. 0	171
October	71. 7	160
1866:		
January	61. 7	136
April	57. 7	131
July	65. 7	158
October	59. 7	133
1867:		
January	60. 3	133
April	55	124
July	49. 7	120
October	44. 7	100
1868:		
January	43	95
April	47. 7	108
July	44. 7	108
October	47	105
1869:		
January	49. 3	109
April	49. 3	112
July	47. 7	115
October	47. 3	105
1870:		
January	46	101
April	47	106
July	44. 7	108
October	46. 7	104
1871:		
January	45. 3	100
April	49. 7	113
July	59	142
October	61	136
1872:		
January	69. 3	153
April	78. 7	178
July	69	166
October	61	136
1873:		
January	67. 7	149
April	52. 3	118
July	47. 3	114
October	51. 3	114
1874:		
January	53	117
April	53	120
July	50. 7	122
October	51. 7	115

Ohio fine unwashed wool, Boston.[2]		
Year.	Price per pound.	Index No.
Average, October, 1909–July, 1914:	*Cents.*	
January	23. 15	100
April	21. 75	100
July	21. 75	100
October	22. 90	100
1914:		
October	24	105
1915:		
January	24	104
April	27. 5	126
July	26. 75	123
October	26. 25	115
1916:		
January	27. 5	119
April	30. 5	140
July	30. 5	140
October	32	140
1917:		
January	39	168
April	46. 5	214
July	57. 5	264
October	65. 5	286
1918:		
January	66	285
April	66	303
July	61. 5	283
October	61. 5	269
1919:		
January	61. 5	266
April	53. 5	246
July	61. 5	283
October	69	301
1920:		
January	71	307
April	75	345
July	62. 5	287
October	51	223
1921:		
January	30. 5	132
April	31	143

[1] Wholesale prices, wages, and transportation. Report by Mr. Aldrich, from the Committee on Finance, Mar. 3, 1893. Senate Report No. 1394, Fifty-second Congress, second session, Part II.
[2] As reported by the United States Department of Agriculture.

TABLE XIII.—*Wholesale prices of butter—Civil War and World War.*

Butter in Boston.[1]			Butter, creamery, extra, New York City.[2]		
Year.	Price per pound.	Index No.	Year.	Price per pound.	Index No.
Average, October 1856–July, 1861:	*Cents.*		Average, October, 1909–July, 1914:	*Cents.*	
January	20.8	100	January	35.0	100
April	21	100	April	28.9	100
July	17.35	100	July	27.1	100
October	20.65	100	October	30.8	100
1861:			1914:		
October	13.5	65	October	31.5	102
1862:			1915:		
January	19	91	January	34	97
April	20.5	98	April	30.5	106
July	15.5	89	July	27.2	100
October	19	92	October	28.5	93
1863:			1916:		
January	24.5	118	January	32.2	92
April	25	119	April	35.6	123
July	19.5	112	July	29.2	108
October	24	116	October	35.2	114
1864:			1917:		
January	30.5	147	January	40.8	117
April	48.5	231	April	42.9	148
July	33	190	July	38.9	144
October	42.5	206	October	44.8	145
1865:			1918:		
January	52.5	252	January	52.4	150
April	31.5	150	April	42.9	148
July	30	173	July	44.8	165
October	43	208	October	59.5	193
1866:			1919:		
January	42.5	204	January	58.75	168
April	52.5	250	April	64.25	222
July	41	236	July	52.5	194
October	41.5	201	October	63.75	207
1867:			1920:		
January	38.5	185	January	65.75	188
April	31.5	150	April	70.25	243
July	27.0	156	July	57	210
October	33.5	162	October	60	195
1868:			1921:		
January	42.5	204	January	57.0	163
April	52.5	250	April	48.8	169
July	31.5	182			
October	45.5	225			
1869:					
January	46.5	224			
April	44	210			
July	36	207			
October	39	189			
1870:					
January	37.5	180			
April	36.5	174			
July	27.5	159			
October	37	179			
1871:					
January	37.5	180			
April	35	167			
July	26.5	153			
October	30	145			
1872:					
January	32	154			
April	34	162			
July	24	138			
October	27.5	133			
1873:					
January	30.5	147			
April	35	167			
July	27	156			
October	27.5	133			
1874:					
January	30.5	147			
April	37.5	179			
July	26.5	153			
October	37.5	182			

[1] Wholesale prices, wages, and transportation. Report by Mr. Aldrich from the Committee on Finance, Mar. 3, 1893. Senate Report No. 1394, Fifty-second Congress, second session, Part II.
[2] As reported by the United States Department of Agriculture.

TABLE XIV.—*Wholesale prices of cheese, Civil War and World War.*

Cheese, Boston.[1]

Year.	Price per pound.	Index No.
Average, October, 1856–July, 1861:	*Cents.*	
January	9.22	100
April	10.22	100
July	7.00	100
October	8.06	100
1861:		
October	6.0	74
1862:		
January	7.0	76
April	7.5	73
July	6.5	93
October	8.0	99
1863:		
January	11.0	119
April	14.5	142
July	10.5	150
October	12.0	149
1864:		
January	14.0	152
April	17.0	166
July	15.0	214
October	20.5	254
1865:		
January	22.5	244
April	21.0	205
July	12.5	179
October	15.0	186
1866:		
January	18.0	195
April	21.5	210
July	19.0	271
October	14.5	180
1867:		
January	14.5	157
April	19.0	186
July	15.0	214
October	14.5	180
1868:		
January	14.5	157
April	16.5	161
July	14.5	207
October	16.0	199
1869:		
January	19.0	206
April	22.0	215
July	16.0	229
October	15.5	192
1870:		
January	17.5	190
April	14.0	137
July	13.0	186
October	13.3	165
1871:		
January	14.0	152
April	13.0	127
July	11.8	169
October	13.0	161
1872:		
January	13.3	144
April	19.0	186
July	11.0	157
October	13.3	165
1873:		
January	13.3	144
April	16.0	157
July	11.8	169
October	13.3	65
1874:		
January	13.3	144
April	16.0	157
July	11.8	169
October	14.5	180

Cheese, colored, New York.[2]

Year.	Price per pound.	Index No.
Average, October, 1909–July, 1914:	*Cents.*	
January	16.6	100
April	15.7	100
July	13.9	100
October	15.6	100
1914:		
October	15.0	96
1915:		
January	16.0	96
April	15.4	98
July	14.6	105
October	15.0	96
1916:		
January	17.1	103
April	16.9	108
July	15.1	109
October	20.9	134
1917:		
January	23.3	140
April	25.9	165
July	22.6	163
October	23.9	153
1918:		
January	24.8	149
April	24.0	153
July	24.9	179
October	31.8	204
1919:		
January	36.0	217
April	31.75	202
July	32.375	233
October	30.625	196
1920:		
January	31.5	190
April	27.0	172
July	27.25	196
October	25.75	165
1921:		
January	25.0	151
April	26.0	166

[1] Wholesale prices, wages, and transportation. Report by Mr. Aldrich from the Committee on Finance, Mar. 3, 1893. Senate Report No. 1394. Fifty-second Congress, second session, Part II.
[2] As reported by the United States Department of Agriculture.

TABLE XV.—*Wholesale prices of eggs—Civil War and World War.*

Eggs in Boston.[1]			Eggs, best fresh, New York City.[2]		
Year.	Price per dozen.	Index No.	Year.	Price per dozen.	Index No.
Average, October, 1856–July, 1861:	Cents.		Average, October, 1909–July, 1914:	Cents.	
January	22.5	100	January	38.6	100
April	16.7	100	April	22.2	100
July	13.8	100	July	27.2	100
October	16.5	100	October	40.6	100
1861:			1914:		
October	13	79	October	43	106
1862:			1915:		
January	23.5	104	January	37	96
April	13	78	April	20.75	94
July	12	87	July	19.5	72
October	14.5	88	October	30.5	75
1863:			1916:		
January	20	89	January	30.5	79
April	23.5	141	April	20.5	92
July	19.5	141	July	25.625	94
October	20	121	October	34.75	86
1864:			1917:		
January	29	129	January	46	119
April	21	126	April	34.25	154
July	25.5	185	July	35	129
October	29	176	October	41	110
1865:			1918:		
January	44	196	January	65.5	170
April	18.5	111	April	34	153
July	26.5	192	July	39.5	145
October	28.5	173	October	55	135
1866:			1919:		
January	39	173	January	64.5	167
April	23.5	141	April	43.5	196
July	23.5	170	July	46.5	171
October	27.5	167	October	61	150
1867:			1920:		
January	37.5	167	January	70.5	183
April	24	144	April	43.75	197
July	19	138	July	46	169
October	29	176	October	63	155
1868:			1921:		
January	45	200	January	66	171
April	27.5	165	April	27.8	125
July	25.5	185			
October	30.5	185			
1869:					
January	41.5	184			
April	29	174			
July	23.5	170			
October	31	188			
1870:					
January	47	209			
April	28	168			
July	22	159			
October	28	170			
1871:					
January	33.5	149			
April	19	114			
July	19	138			
October	28.5	173			
1872:					
January	37.5	167			
April	23	138			
July	18	130			
October	26.5	161			
1873:					
January	40.5	180			
April	22.5	135			
July	21.5	156			
October	27.5	167			
1874:					
January	40.5	180			
April	24.5	147			
July	22	159			
October	25	152			

[1] Wholesale prices, wages, and transportation. Report by Mr. Aldrich from the Committee on Finance, Mar. 3, 1893. Senate Report No. 1394, Fifty-second Congress, second session, Part II.
[2] As reported by the United States Department of Agriculture.

TABLE XVI.—*Wholesale prices of hogs—Civil War and World War.*

Hogs, New York City (good to prime, live weight).[1]

Year.	Price per pound.	Index No.
Average, October, 1856 to July, 1861:	*Cents.*	
January	5.75	100
April	6.088	100
July	5.512	100
October	6.062	100
1861:		
October	3.9375	65
1862:		
January	3.75	65
April	4.625	76
July	3.5625	65
October	4.1875	69
1863:		
January	4.6875	82
April	5.50	90
July	5.50	100
October	4.9375	81
1864:		
January	7.125	124
April	8.75	144
July	11.05	200
October	11.25	186
1865:		
January	13.75	239
April	12.00	197
July	10.625	193
October	14.375	237
1866:		
January	10.375	180
April	10.75	177
July	10.375	188
October	10.875	179
1867:		
January	6.625	115
April	8.375	138
July	7.25	132
October	7.1875	119
1868:		
January	7.4375	129
April	9.375	154
July	8.875	161
October	9.9375	164
1869:		
January	10.25	178
April	11.00	181
July	9.4375	171
October	10.375	171
1870:		
January	10.25	178
April	9.50	156
July	9.1875	167
October	9.0625	149
1871:		
January	6.75	117
April	7.00	115
July	4.75	86
October	5.1875	86
1872:		
January	5.00	87
April	4.875	80
July	4.50	82
October	5.25	87
1873:		
January	4.75	83
April	6.50	107
July	5.125	93
August	5.375	89
1874:		
January	5.28	92
April	5.50	90
July	5.50	100
October	6.25	103

Live hogs (bulk of sales), Chicago.[2]

Year.	Price per pound.	Index No.
Average, October, 1909 to July, 1914:	*Cents.*	
January	7.655	100
April	8.26	100
July	8.316	100
October	7.82	100
1914:		
October	7.775	99
1915:		
January	6.80	89
April	7.20	87
July	7.10	85
October	7.725	99
1916:		
January	7.25	95
April	9.625	117
July	9.725	117
October	9.55	122
1917:		
January	10.80	141
April	15.675	190
July	15.25	183
October	17.125	219
1918:		
January	15.975	209
April	16.85	204
July	17.625	212
October	19.125	245
1919:		
January	17.75	232
April	19.75	239
July	21.05	253
October	14.00	179
1920:		
January	15.10	197
April	14.38	174
July	14.75	177
October	14.12	181
1921:		
January	9.45	123
April	9.27	112

[1] Wholesale prices, wages, and transportation. Report by Mr. Aldrich from the Committee on Finance, Mar. 3, 1893. Senate Report No. 1394, Fifty-second Congress, second session, Part II.
[2] As reported by the United States Department of Agriculture.

PRICES PAID TO FARMERS

The average prices paid to farmers for 31 farm products in the United States are shown in Table XVII, pages 37 to 45.

To determine accurately the conditions in a particular State, prices for that State must be used. Prices for the United States include many States that are importers of the product, rather than exporters of it. For example, New York farms consume much more corn than they produce. For this reason, the New York farm price is a consumer's price. It is determined by the price in surplus States plus the cost, profits, and trouble of getting it shipped. United States farm prices include a mixture of some prices that are characteristic of city wholesale prices and some that are farmers' selling prices. The fact that wholesale prices do not show farm conditions is discussed on pages 17 to 18. This principle holds with most farm products, but does not apply to wool or cotton, because neither of these is consumed on farms without going through the process of manufacture. Wherever produced these are for sale.

Any change in freight rates also makes it impossible to determine the status of a particular State from United States figures. During the period when prices were rapidly rising, but while freight rates were held down, freight constantly became a less important factor. Farm prices at distant points rose much more rapidly that did prices near the centers of consumption. Also great quantities of bulky products, like hay, were shipped long distances from regions that naturally do not ship any. This stimulated types of farming not permanently adapted to such regions and handicapped farmers in near-by States who had developed types of farming to supply city markets near them. Freight rates were raised after prices had begun to fall very rapidly. This made the farm prices in distant States fall much more rapidly than farm prices in near-by States. The stimulated shipment due to low freight rates combined with high prices was all stopped and much of the normal shipment was likewise checked. Farm prices in distant States then fell excessively. For example, horses in Montana are 43 per cent of the prewar price, while on New York farms to which horses are shipped, the price is 82 per cent of the prewar price. (See pp. 17 to 18.)

The data in Table XVII can be brought up-to-date by adding figures as published by the Monthly Crop Reporter.

For convenience in calculating index numbers, the prices for the five years August, 1909, to July, 1914, are given separately, followed by five-year average, for each month. Yearly averages are given at the end of the table. The yearly averages are higher than the average price received by farmers, because in the months when sales are largest, prices are lowest.

TABLE XVII.—*Prices paid to producers of farm products in the United States.*

Year and month.	Corn, per bu.	Oats, per bu.	Wheat, per bu.	Barley, per bu.	Rye, per bu.	Buckwheat, per bu.	Flaxseed, per bu.	Beans, per bu.	Broom corn, per ton.	Cotton, per lb.	Cotton seed, per ton.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*			*Cents.*	
1909—August	75.2	50.0	107.1	61.2	78.5	82.9	137.0	......	......	11.3	......
September	71.0	42.3	95.2	54.6	72.4	76.9	123.1	......	......	11.7	......
October	67.1	41.0	94.6	53.4	72.8	75.0	122.8	......	......	12.6	......
November	62.2	41.0	99.9	53.3	73.6	71.6	139.8	......	......	13.7	......
December	57.9	40.2	98.6	54.0	71.8	70.1	152.9	$2.14	......	13.9	......
1910—January	62.3	42.8	103.4	57.6	74.8	70.0	171.2	2.23	$190.00	14.6	......
February	65.2	45.0	105.0	59.3	76.1	72.0	192.9	2.23	197.00	14.0	......
March	65.9	46.0	105.1	60.2	76.5	70.6	193.1	2.17	200.00	14.0	......
April	65.5	45.6	104.5	59.7	76.6	73.4	193.9	2.16	204.00	14.1	......
May	63.5	43.3	99.9	56.5	74.9	71.0	209.5	2.17	199.00	14.0	......
June	65.2	43.0	97.6	55.7	74.8	73.7	195.5	2.29	151.00	14.2	......
July	66.2	42.1	95.3	53.9	74.6	78.0	183.5	2.34	180.00	13.9	......
August	67.2	41.7	98.9	54.7	74.4	74.8	209.7	2.27	142.00	14.3	......
September	66.3	38.4	95.8	57.2	74.1	72.6	220.0	2.28	139.00	14.4	$26.23
October	61.1	36.2	93.7	56.1	72.8	71.3	234.3	2.25	108.00	13.3	26.86
November	52.6	34.9	90.5	55.3	71.6	65.9	229.4	2.14	96.00	14.0	25.36
December	48.0	34.4	88.3	57.8	71.5	66.1	231.7	2.20	93.00	14.1	25.65
1911—January	48.2	33.2	88.6	59.8	73.3	65.8	221.1	2.20	81.00	14.4	26.35
February	49.0	33.1	89.8	64.1	73.1	64.4	233.9	2.23	80.00	14.3	25.61
March	48.9	32.8	85.4	63.0	71.9	64.1	240.7	2.17	78.00	13.9	25.49
April	49.7	32.3	83.8	69.1	75.4	65.3	234.6	2.20	74.00	13.9	26.12
May	51.8	33.2	84.6	74.0	75.8	65.8	241.9	2.17	81.00	14.2	25.46
June	55.1	34.7	86.3	73.8	77.9	70.1	225.0	2.19	69.00	14.6	23.38
July	60.0	37.5	84.3	70.1	76.9	72.4	205.6	2.23	68.00	14.4	22.70
August	65.8	40.2	82.7	69.3	75.5	76.0	199.2	2.20	72.00	13.2	20.45
September	65.9	40.4	84.8	77.0	76.9	74.0	203.6	2.26	92.00	11.8	18.09
October	65.7	42.5	88.4	81.7	79.7	69.6	205.0	2.27	121.00	10.2	16.73
November	64.7	43.8	91.5	84.9	83.1	73.0	210.6	2.34	124.00	8.9	16.69
December	61.8	45.0	87.4	86.9	83.2	72.6	182.1	2.42	108.00	8.8	16.70
1912—January	62.2	45.1	88.0	86.4	82.7	73.7	187.1	2.38	100.00	8.4	16.57
February	64.6	47.5	90.4	91.2	84.4	73.6	190.8	2.38	86.00	9.0	16.81
March	66.6	49.8	90.7	91.0	84.0	76.9	183.9	2.42	99.00	9.8	18.21
April	71.1	52.0	92.5	92.3	85.1	76.9	191.3	2.37	101.00	10.1	18.62
May	79.4	56.0	99.7	96.2	84.6	79.9	181.0	2.52	83.00	10.9	19.21
June	82.5	55.3	102.8	91.1	86.1	84.8	205.0	2.62	79.00	11.0	19.24
July	81.1	52.5	99.0	81.9	83.6	86.2	198.4	2.47	85.00	11.2	19.04
August	79.3	44.3	89.7	66.8	77.9	83.6	175.2	2.40	83.00	12.0	18.02
September	77.6	35.0	85.8	53.5	70.8	76.6	162.6	2.38	77.00	11.3	17.61
October	70.2	33.6	83.4	54.8	70.1	69.7	147.7	2.34	70.00	11.2	18.04
November	58.4	33.6	83.8	53.8	68.8	65.5	133.4	2.25	69.00	10.9	18.57
December	48.7	31.9	76.0	50.5	66.3	66.1	114.7	2.31	57.00	11.9	21.42
1913—January	48.9	32.2	76.2	49.9	63.8	66.8	106.2	2.26	49.00	12.2	21.98
February	50.6	32.4	79.9	51.4	68.9	69.4	109.3	2.19	56.00	11.9	22.01
March	52.2	33.1	80.6	49.0	63.2	67.0	119.0	2.10	57.00	11.8	21.55
April	53.7	33.1	79.1	48.5	62.9	68.3	113.6	2.11	58.00	11.8	21.89
May	56.8	34.2	80.9	48.3	62.4	71.4	114.3	2.18	53.00	11.6	21.88
June	60.6	36.0	82.7	52.7	64.1	70.8	115.8	2.23	61.00	11.5	21.54
July	63.2	37.7	81.4	53.7	63.2	72.9	113.4	2.22	57.00	11.6	21.37
August	65.4	37.6	77.1	50.8	60.7	72.4	118.6	2.11	91.00	11.5	20.24
September	75.4	39.3	77.1	55.2	63.0	70.0	127.8	2.08	106.00	11.8	21.07
October	75.3	39.6	77.9	56.8	64.8	74.1	122.6	2.25	102.00	13.3	22.01
November	70.7	37.9	77.0	54.7	63.2	75.5	118.7	2.20	100.00	13.0	22.46
December	69.1	39.2	79.9	53.7	63.4	75.5	119.9	2.12	92.00	12.2	23.48
1914—January	69.6	39.1	81.0	52.2	62.5	76.6	124.2	2.17	94.00	11.7	22.70
February	68.3	39.3	81.6	52.4	61.7	75.6	127.8	2.09	95.00	11.9	23.37
March	69.1	38.9	83.1	51.1	61.9	75.1	132.5	2.05	91.00	12.6	23.60
April	70.7	39.5	84.2	51.7	63.0	76.9	132.8	2.11	89.00	11.9	24.17
May	72.1	39.5	83.9	49.3	62.9	77.3	134.7	2.31	85.00	12.2	23.56
June	75.0	40.0	84.4	49.1	64.4	79.0	136.8	2.23	88.00	12.4	23.62
July	75.5	38.8	76.9	47.5	63.1	85.5	136.0	2.22	88.00	12.4	22.78

TABLE XVII.—*Prices paid to producers of farm products in the United States*—Contd.

Year and month.	Hay, per ton.	Timothy seed, per bu.	Clover seed, per bu.	Cabbage, per cwt.	Onions, per lb.	Potatoes, per bu.	Sweet potatoes, per bu.	Peanuts, per lb.	Apples, per bu.	Chickens, per lb.	Eggs, per doz.
					Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1909—August	$9.74	......	......	......	......	85.1	......	......	......	11.2	19.2
September	9.67	......	......	......	......	71.5	......	......	......	11.1	20.2
October	10.03	......	......	......	......	64.3	......	......	......	11.3	22.1
November	10.35	......	......	......	......	57.8	......	......	......	10.9	24.8
December	10.50	......	......	......	91	54.1	69.8	......	98.2	10.8	28.4
1910—January	10.45	......	$8.26	$1.87	94	56.0	74.8	4.9	106.4	10.9	30.5
February	11.34	......	8.26	2.05	100	56.2	76.8	5.4	108.8	11.1	28.9
March	11.61	......	8.15	2.14	92	54.6	79.4	5.0	112.6	11.6	22.9
April	11.53	......	7.91	2.29	103	47.4	82.4	5.4	114.2	11.9	18.6
May	11.08	......	7.47	2.77	103	38.4	83.4	5.2	120.7	12.4	18.6
June	10.84	......	7.24	2.19	106	37.4	79.4	5.4	119.6	12.4	18.3
July	10.75	......	7.17	2.27	104	40.1	75.1	5.2	94.4	12.3	18.2
August	10.75	......	7.53	1.89	100	64.9	78.2	4.5	75.4	12.2	17.6
September	11.21	$3.77	8.27	1.94	99	72.9	81.2	4.5	73.7	11.9	19.4
October	11.12	4.03	8.13	1.58	93	67.8	77.6	4.6	75.5	11.6	22.4
November	11.20	4.08	7.70	1.36	95	55.7	71.8	4.7	83.4	11.3	25.3
December	12.14	4.11	7.94	1.49	99	55.7	67.1	4.5	89.6	10.6	29.0
1911—January	11.69	4.12	8.27	1.56	101	54.1	75.0	4.4	108.0	10.5	30.4
February	11.80	4.51	8.37	1.48	104	55.1	80.4	5.0	117.2	10.6	22.1
March	11.57	4.93	8.56	1.26	105	55.3	84.4	4.8	121.6	10.6	16.5
April	11.36	5.17	8.79	1.33	119	55.5	91.2	4.9	131.8	10.8	14.9
May	11.69	5.24	8.74	1.38	129	62.5	99.3	4.8	139.2	11.0	14.7
June	12.38	5.24	8.80	2.46	134	63.3	98.7	5.2	137.5	11.0	14.5
July	13.19	5.48	8.83	2.93	122	96.3	99.0	5.0	115.1	11.2	14.2
August	13.83	6.52	9.65	2.47	116	136.0	105.8	5.3	83.9	11.2	15.5
September	13.63	6.65	10.19	1.94	104	113.7	102.6	5.1	71.6	11.1	17.4
October	13.53	6.91	10.33	1.58	102	88.3	91.8	4.6	68.0	10.9	20.0
Novemner	13.61	6.90	10.37	1.51	103	76.3	80.9	4.4	69.4	10.3	23.5
December	14.29	6.72	10.62	1.83	113	79.9	75.5	4.4	72.1	9.6	28.7
1912—January	13.75	6.99	10.89	1.89	117	84.5	83.0	4.3	89.4	9.8	29.5
February	14.39	7.26	12.22	2.24	140	94.4	90.2	4.7	95.8	10.3	29.1
March	14.66	7.33	12.89	2.88	167	102.0	98.0	5.0	101.2	10.5	24.5
April	15.64	7.27	12.91	3.17	175	117.1	109.9	4.9	109.2	10.8	17.8
May	16.31	7.16	12.53	2.98	177	127.3	118.0	4.9	121.8	11.1	17.1
June	16.22	6.68	11.69	2.67	155	119.7	115.0	5.2	118.4	11.1	16.7
July	14.32	5.96	10.64	2.29	114	103.6	112.2	4.9	95.2	11.0	16.7
August	12.03	3.20	9.80	1.88	100	86.5	107.8	5.0	75.0	11.3	17.4
September	11.21	2.09	9.39	1.25	89	65.0	95.7	4.8	64.8	11.3	19.1
October	11.02	1.95	9.37	1.08	85	51.1	84.4	4.7	61.8	11.5	22.0
November	11.08	1.82	9.06	1.04	84	45.5	76.8	4.7	62.4	11.2	25.9
December	11.79	1.79	9.00	1.15	84	50.5	72.6	4.6	66.3	10.8	29.7
1913—January	11.11	1.79	9.41	1.26	82	50.6	80.4	4.6	73.4	10.7	26.8
February	10.86	1.78	10.28	1.17	78	53.1	85.4	4.5	76.4	10.9	22.8
March	10.61	1.72	10.42	1.03	77	52.0	88.9	4.7	80.4	11.1	19.4
April	10.43	1.74	11.00	1.15	79	50.3	92.6	4.8	83.7	11.6	16.4
May	10.42	1.76	10.74	1.58	87	48.2	93.8	4.7	89.5	11.8	16.1
June	10.55	1.77	9.77	2.18	96	55.2	92.0	5.0	97.6	12.0	16.9
July	10.47	1.94	9.78	2.64	102	49.8	90.1	5.1	93.6	12.1	17.0
August	10.43	2.01	9.37	2.15	105	69.2	94.1	4.9	80.6	12.4	17.2
September	11.04	2.13	7.31	1.79	104	75.3	94.3	4.9	75.8	12.4	19.5
October	11.45	2.02	7.00	1.69	110	73.9	83.9	4.8	81.0	12.5	23.4
November	11.51	2.08	7.33	1.58	115	69.6	75.7	4.4	90.0	12.1	27.4
December	12.43	2.10	7.70	1.75	115	68.7	72.6	4.8	98.1	11.5	33.0
1914—January	11.70	2.07	7.99	1.87	121	68.4	79.2	4.7	107.1	11.5	30.7
February	11.67	2.12	8.07	2.07	141	69.7	84.3	4.7	116.8	11.7	28.4
March	11.69	2.30	8.17	2.03	155	70.7	86.7	4.7	126.0	12.1	24.2
April	11.52	2.28	8.06	2.24	159	70.0	89.6	4.9	133.0	12.3	17.6
May	11.63	2.38	7.87	2.05	153	71.4	94.5	5.1	141.8	12.5	16.8
June	11.64	2.23	7.96	2.61	141	71.3	94.2	5.1	141.0	12.5	17.3
July	11.29	2.32	8.12	2.66	170	81.5	82.6	5.2	113.4	12.7	17.6

TABLE XVII.—*Prices paid to producers of farm products in the United States*—Contd.

Year and month.	Butter, per pound.	Milk cows, per head.	Beef cattle, per hundred pounds.	Veal calves, per hundred pounds.	Sheep, per hundred pounds.	Lambs, per hundred pounds.	Wool, per pound.	Hogs, per hundred pounds.	Horses, per head.
	Cents.						*Cents.*		
1909—August	22.4								
September	23.3								
October	25.0								
November	26.2								
December	27.4		$4.54		$5.43	$7.51	25.0	$7.72	
1910—January	28.7	$41.18	4.71	$6.41	5.63	5.82	24.5	7.76	$140.00
February	27.9	40.35	4.64	6.28	5.09	6.62	24.6	7.87	147.00
March	26.3	41.75	4.87	6.59	5.64	7.37	24.9	8.93	150.00
April	25.8	42.22	5.31	6.54	6.10	7.47	22.3	9.26	154.00
May	25.5	42.38	5.23	6.30	5.79	7.26	22.8	8.59	148.00
June	24.1	43.46	5.20	6.57	5.44	7.13	19.5	8.46	151.00
July	23.3	42.86	4.84	6.37	5.47	6.71	19.0	8.15	148.00
August	23.8	42.77	4.64	6.29	4.68	5.70	19.5	7.78	148.00
September	25.2	42.68	4.65	6.43	4.81	5.85	17.7	8.27	145.00
October	26.2	43.20	4.64	6.41	4.68	5.78	18.1	8.08	144.00
November	27.1	43.34	4.48	6.39	4.63	5.54	17.9	7.61	143.00
December	27.8	43.41	4.45	6.38	4.54	5.60	17.8	7.16	141.00
1911—January	27.8	44.70	4.58	6.50	4.47	5.71	17.3	7.44	143.00
February	24.1	44.48	4.57	6.38	4.34	5.44	17.3	7.04	144.00
March	22.7	45.42	4.66	6.48	4.45	5.49	16.8	6.74	145.00
April	22.6	44.81	4.67	5.96	4.55	5.77	15.7	6.17	147.00
May	21.4	44.54	4.59	5.68	4.51	5.74	14.7	5.72	146.00
June	20.3	43.86	4.43	5.72	4.24	5.51	15.5	5.66	145.00
July	20.4	42.44	4.28	5.74	4.19	5.42	15.4	5.92	139.00
August	21.7	42.26	4.39	5.93	3.98	5.25	16.0	6.54	141.00
September	23.1	42.22	4.43	6.11	3.91	5.02	15.6	6.53	139.00
October	23.8	42.69	4.32	6.15	3.68	4.68	15.5	6.09	137.00
November	25.2	42.70	4.36	6.10	3.65	4.68	15.6	5.86	136.00
December	27.4	42.72	4.37	5.98	3.71	4.93	15.5	5.72	134.00
1912—January	28.1	42.89	4.46	6.06	3.89	5.22	16.2	5.74	134.00
February	29.0	43.40	4.61	6.07	4.01	5.15	16.3	5.79	137.00
March	27.2	44.09	4.75	6.11	4.12	5.38	16.9	5.94	140.00
April	26.1	45.14	5.15	6.22	4.57	5.98	17.3	6.78	142.00
May	26.0	45.63	5.36	6.23	4.74	6.16	17.8	6.79	144.00
June	24.8	45.84	5.23	6.33	4.52	6.02	18.7	6.65	145.00
July	23.4	45.41	5.17	6.33	4.21	5.74	18.9	6.64	142.00
August	23.7	46.11	5.37	6.62	4.26	5.60	18.8	7.11	142.00
September	24.2	46.79	5.35	6.83	4.11	5.49	18.7	7.47	141.00
October	25.6	47.30	5.36	6.90	4.19	5.42	18.5	7.70	140.00
November	26.9	47.38	5.22	6.77	4.05	5.37	18.6	7.05	139.00
December	28.8	48.62	5.33	6.88	4.21	5.70	18.6	6.89	139.00
1913—January	28.4	49.51	5.40	7.06	4.35	6.03	18.6	6.77	140.00
February	27.6	51.42	5.55	7.23	4.63	6.34	18.7	7.17	146.00
March	27.5	54.02	5.88	7.49	4.97	6.56	18.4	7.62	146.00
April	27.6	55.34	6.08	7.38	5.16	6.59	17.7	7.94	148.00
May	27.0	54.80	6.01	7.17	4.91	6.66	16.3	7.45	145.00
June	25.5	55.20	6.02	7.53	4.84	6.36	15.6	7.61	146.00
July	24.7	54.80	5.98	7.46	4.20	6.05	15.9	7.81	143.00
August	24.9	54.78	5.91	7.53	4.32	5.50	15.8	7.79	141.00
September	25.9	55.78	5.92	7.73	4.23	5.51	15.8	7.68	141.00
October	27.5	56.47	6.05	7.72	4.16	5.51	15.5	7.60	138.00
November	28.2	57.71	5.99	7.70	4.27	5.64	15.6	7.33	136.00
December	29.2	57.19	5.96	7.74	4.46	5.85	16.1	7.16	135.00
1914—January	29.2	57.99	6.04	7.89	4.67	6.16	15.7	7.45	137.00
February	27.4	59.09	6.16	7.90	4.67	6.18	15.7	7.75	139.00
March	26.0	59.23	6.28	7.92	4.77	6.31	16.4	7.80	138.00
April	24.9	59.60	6.29	7.68	4.96	6.47	16.8	7.80	138.00
May	23.8	59.85	6.33	7.59	4.87	6.49	17.2	7.60	139.00
June	22.8	59.82	6.32	7.69	4.70	6.47	18.4	7.43	136.00
July	22.9	59.67	6.38	7.80	4.75	6.55	18.5	7.72	137.00

TABLE XVII.—*Prices paid to producers of farm products in the United States*—Contd.

Year and month.	Corn, per bu.	Oats, per bu.	Wheat, per bu.	Barley, per bu.	Rye, per bu.	Buckwheat, per bu.	Flaxseed, per bu.	Beans, per bu.	Broom corn, per ton.	Cotton, per lb.	Cotton seed, per ton.
5-year average, August, 1909, to July, 1914:	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*			*Cents.*	
January	58.2	38.5	87.4	61.2	71.4	70.6	162.0	$2.25	$103.00	12.3	$21.90
February	59.5	39.5	89.3	63.7	72.8	71.0	170.9	2.22	103.00	12.2	21.95
March	60.5	40.1	89.0	62.9	71.5	70.7	173.8	2.18	105.00	12.4	22.21
April	62.1	40.5	88.8	64.3	72.6	72.2	173.2	2.19	105.00	12.4	22.70
May	64.7	41.2	89.8	64.9	72.1	73.1	176.3	2.27	100.00	12.6	22.53
June	67.7	41.8	90.8	64.5	73.5	75.7	175.6	2.31	90.00	12.7	21.94
July	69.2	41.7	87.4	61.4	72.3	79.0	167.4	2.30	96.00	12.7	21.47
August	70.6	42.8	91.1	60.6	73.4	77.9	167.9	2.24	97.00	12.5	19.57
September	71.2	39.1	87.7	59.5	71.4	74.0	167.4	2.25	104.00	12.2	20.75
October	67.9	38.6	87.6	60.6	72.0	71.9	166.5	2.28	100.00	12.1	20.91
November	61.7	38.2	88.5	60.4	72.1	70.3	166.4	2.23	97.00	12.1	20.77
December	57.1	38.1	86.0	60.6	71.2	70.1	160.3	2.24	88.00	12.2	21.81
1914—August	76.8	36.7	76.5	45.1	61.0	81.2	150.7	2.54	91.00	12.4	20.16
September	81.5	42.3	93.3	52.5	75.4	79.8	139.3	2.46	77.00	8.7	13.88
October	78.2	43.3	93.5	51.8	79.0	78.7	127.4	2.17	67.00	7.8	15.28
November	70.6	42.9	97.2	51.7	80.1	78.0	118.7	2.28	66.00	6.3	14.01
December	64.4	43.8	98.6	54.3	86.5	76.4	126.0	2.40	58.00	6.8	17.73
1915—January	66.2	45.0	107.8	54.3	90.2	77.9	134.8	2.63	66.00	6.6	19.14
February	72.8	50.1	129.9	62.9	100.6	83.7	163.7	3.02	78.00	7.4	23.33
March	75.1	52.1	133.6	67.7	105.4	85.5	157.9	2.89	68.60	7.4	22.32
April	75.1	53.4	131.7	64.7	100.4	85.3	167.7	2.81	71.00	8.1	22.69
May	77.7	53.4	139.6	63.8	101.9	84.6	169.6	2.93	75.00	9.1	22.07
June	77.9	51.3	131.5	62.0	98.1	86.9	169.5	2.87	77.00	8.6	20.82
July	77.7	46.7	102.8	55.8	93.7	92.1	152.5	2.75	79.00	8.6	20.05
August	78.9	45.4	106.5	56.7	89.0	89.2	144.6	2.67	83.00	8.1	20.14
September	77.3	38.5	95.0	51.9	85.5	81.4	143.5	2.70	75.00	8.5	20.98
October	70.5	34.5	90.9	46.8	81.7	73.7	148.1	2.93	86.00	11.2	33.73
November	61.9	34.9	93.1	50.1	85.7	78.5	162.9	3.03	92.00	11.6	34.01
December	57.5	36.1	91.9	51.6	83.4	78.7	174.0	3.30	101.00	11.3	35.54
1916—January	62.1	39.1	102.8	54.9	85.3	81.5	185.9	3.47	104.00	11.4	36.85
February	66.7	44.6	113.9	61.7	88.3	80.7	210.9	3.43	104.00	11.5	36.75
March	68.2	42.7	102.9	59.6	85.6	83.2	202.5	3.34	104.00	11.1	36.56
April	70.3	42.0	98.6	57.2	83.6	83.1	202.1	3.42	96.00	11.5	38.13
May	72.3	42.6	102.5	59.6	83.7	84.9	191.8	3.56	101.00	11.5	37.91
June	74.1	42.1	100.0	59.6	83.8	87.0	176.5	3.72	102.00	12.2	35.79
July	75.4	40.4	93.0	59.3	83.3	93.1	163.2	5.09	103.00	12.5	36.06
August	79.4	40.1	107.1	59.3	83.4	89.0	178.1	4.59	120.00	12.6	35.22
September	83.6	43.1	131.2	72.9	99.7	86.4	190.2	4.60	129.00	14.6	41.13
October	82.3	44.5	136.3	76.5	104.1	90.4	199.2	4.47	168.00	15.5	47.19
November	85.0	49.0	158.4	83.2	115.3	102.9	234.7	5.53	173.00	18.0	55.82
December	88.9	52.4	160.3	88.1	122.1	112.7	248.6	5.77	172.00	19.6	56.35
1917—January	90.0	51.4	150.3	87.1	118.5	117.2	250.7	5.71	184.00	17.1	52.53
February	95.8	55.2	164.8	92.7	123.5	114.6	253.7	6.07	201.00	16.8	51.43
March	100.9	56.9	164.4	96.9	126.0	124.8	253.1	6.49	212.00	15.9	53.18
April	113.4	61.5	180.0	102.3	135.6	128.3	266.1	7.37	227.00	18.0	55.94
May	150.6	71.0	245.9	120.1	164.1	150.6	300.6	8.94	252.00	18.9	55.61
June	160.1	69.9	248.5	119.3	183.0	183.7	298.8	8.99	223.00	20.2	57.19
July	164.6	68.9	220.1	106.6	177.1	209.2	278.0	8.07	194.00	24.7	56.90
August	196.6	73.7	228.9	114.5	178.1	189.3	271.6	7.29	308.00	24.3	56.61
September	175.5	61.7	209.7	110.0	161.9	164.3	302.8	6.69	240.00	23.4	57.58
October	175.1	62.3	200.6	113.9	169.8	154.4	308.5	7.48	270.00	23.3	65.02
November	146.0	61.7	200.0	111.3	168.8	154.2	295.9	7.33	296.00	27.3	69.38
December	127.9	66.6	200.8	113.7	166.0	160.0	296.6	7.00	280.00	27.7	68.29

TABLE XVII.—*Prices paid to producers of farm products in the United States*—Contd.

	Hay, per ton.	Timothy seed, per bushel.	Clover seed, per bushel.	Cabbage, per cwt.	Onions, per bushel.	Potatoes, per bushel.	Sweet potatoes, per bushel.	Peanuts, per pound.	Apples, per bushel.	Chickens, per pound.	Eggs, per dozen.
5-year average, August, 1909, to July, 1914:					*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	$11.74	$3.74	$8.96	$1.69	103	62.7	78.5	4.6	96.9	10.7	29.6
February	12.01	3.92	9.44	1.80	113	65.7	83.4	4.9	103.0	10.9	26.3
March	12.03	4.07	9.64	1.87	119	66.9	87.5	4.8	108.4	11.2	21.5
April	12.10	4.12	9.73	2.04	127	68.1	93.1	5.0	114.4	11.5	17.1
May	12.23	4.14	9.47	2.15	130	69.6	97.8	4.9	122.6	11.8	16.7
June	12.33	3.98	9.09	2.42	126	69.4	95.9	5.2	122.8	11.8	16.7
July	12.00	3.92	8.91	2.56	122	74.3	91.8	5.1	102.3	11.9	16.7
August	11.36	3.91	9.09	2.10	105	88.3	96.5	4.9	78.7	11.7	17.4
September	11.35	3.66	8.79	1.73	99	79.7	93.4	4.8	71.5	11.6	19.1
October	11.43	3.73	8.71	1.48	98	69.1	84.4	4.7	71.6	11.6	22.0
November	11.55	3.72	8.62	1.37	99	61.0	76.3	4.6	76.3	11.2	25.4
December	12.23	3.68	8.82	1.56	100	61.8	71.5	4.6	84.9	10.7	29.8
1914—August	10.76	2.43	8.76	1.74	138	87.1	97.5	4.9	79.9	12.8	18.2
September	11.10	2.46	9.10	1.50	103	74.9	92.8	5.0	65.1	12.7	21.0
October	10.96	2.34	8.24	1.31	88	64.7	87.3	4.5	58.8	12.5	23.5
November	10.78	2.34	8.02	1.14	84	52.8	76.3	4.4	56.6	11.9	25.3
December	11.12	2.18	8.12	1.26	92	48.7	73.0	4.3	59.4	11.3	29.7
1915—January	10.47	2.63	8.51	1.36	89	49.7	79.0	4.5	68.0	11.2	31.6
February	10.83	2.66	8.60	1.41	98	50.4	82.0	4.4	71.2	11.5	29.2
March	10.89	2.78	8.55	1.38	95	50.4	84.7	4.2	73.2	11.7	21.3
April	10.98	2.69	8.36	1.99	104	47.8	90.7	4.5	76.8	11.9	16.6
May	11.03	2.75	8.14	2.53	103	50.5	95.6	4.8	85.4	12.1	17.1
June	11.16	2.65	7.90	2.34	103	50.8	96.7	4.8	90.4	12.2	16.6
July	10.85	2.57	7.96	1.95	93	52.1	88.9	4.7	84.4	12.2	16.8
August	10.19	2.56	7.94	1.61	86	56.3	85.8	4.5	70.1	12.2	17.0
September	9.95	2.62	8.49	1.24	83	50.5	84.6	4.4	59.9	12.1	18.7
October	9.83	2.72	9.70	1.00	95	48.8	72.7	4.3	62.0	12.0	22.3
November	9.98	2.91	9.67	.97	95	60.8	63.7	4.2	69.2	11.8	26.3
December	10.63	2.86	10.01	1.07	100	61.7	62.1	4.2	69.0	11.5	30.6
1916—January	10.07	3.05	10.27	1.17	113	70.6	64.9	4.3	79.7	11.4	30.6
February	10.55	3.19	10.47	1.21	126	88.0	71.2	4.4	88.0	11.9	26.8
March	10.75	3.28	10.76	1.38	130	94.4	77.3	4.4	92.0	12.2	21.2
April	10.85	3.51	10.58	1.50	124	97.6	78.0	4.6	94.9	12.6	17.9
May	11.27	3.33	9.98	1.93	123	94.8	80.5	4.6	98.0	13.2	18.1
June	11.47	3.26	9.47	2.27	134	98.8	83.4	4.7	105.4	13.5	19.0
July	11.10	3.08	9.15	2.15	147	102.3	79.4	4.6	108.1	13.8	19.7
August	9.89	2.36	9.12	2.26	134	95.4	87.1	4.6	80.4	13.8	20.7
September	9.72	2.22	8.65	2.17	123	109.3	89.9	4.4	77.7	13.9	23.3
October	9.65	2.27	8.54	2.40	131	112.0	83.7	4.4	83.1	14.3	28.1
November	9.99	2.25	9.20	2.61	154	135.7	80.6	4.4	87.6	14.3	32.2
December	11.22	2.31	9.40	3.04	176	146.1	84.8	4.7	91.2	14.2	38.1
1917—January	10.86	2.44	9.60	3.95	208	147.3	90.1	4.9	101.1	13.9	37.7
February	11.34	2.46	9.87	5.65	358	172.4	95.8	5.3	110.0	14.7	35.8
March	11.54	2.70	10.32	6.77	476	240.7	110.7	5.5	123.3	15.5	33.8
April	12.53	2.76	10.41	7.61	496	234.7	124.0	6.2	133.0	16.1	25.9
May	13.94	3.09	10.40	7.53	398	279.6	141.3	7.2	149.8	17.5	30.0
June	14.68	3.09	10.29	5.10	308	274.0	149.4	7.7	157.2	17.5	31.1
July	13.96	3.04	10.50	3.23	201	247.9	140.5	7.6	151.1	17.3	28.3
August	12.90	3.23	10.53	2.19	155	170.8	129.3	7.2	127.0	17.1	29.8
September	13.26	3.31	10.89	1.76	143	139.1	132.6	6.6	107.8	17.2	33.2
October	13.83	3.61	11.92	1.79	158	122.1	116.1	6.1	106.8	18.1	37.4
November	15.16	3.25	12.91	2.66	177	127.8	111.2	7.1	117.5	17.7	39.4
December	17.09	3.37	13.53	2.28	177	122.8	110.8	7.1	121.5	17.5	43 3

TABLE XVII.—*Prices paid to producers of farm products in the United States*—Contd.

Year and month.	Butter, per pound.	Milch cows, per head.	Beef cattle, per cwt.	Veal calves, per cwt.	Sheep, per cwt.	Lambs, per cwt.	Wool, per pound.	Hogs, per cwt.	Horses, per head.
Five-year average, August, 1909, to July, 1914:	*Cents.*						*Cents.*		
January	28.4	$47.25	$5.04	$6.78	$4.60	$5.79	18.5	$7.03	$139
February	27.2	47.75	5.11	6.77	4.55	5.95	18.5	7.12	143
March	25.9	48.90	5.29	6.92	4.79	6.22	18.7	7.41	144
April	25.4	49.42	5.50	6.76	5.07	6.46	18.0	7.59	146
May	24.7	49.44	5.50	6.59	4.96	6.46	17.8	7.23	144
June	23.5	49.64	5.44	6.77	4.75	6.30	17.5	7.16	145
July	22.9	49.04	5.33	6.74	4.56	6.09	17.5	7.25	142
August	23.3	46.48	5.08	6.59	4.31	5.51	17.5	7.30	143
September	24.3	46.87	5.09	6.78	4.26	5.47	17.0	7.49	142
October	25.6	47.42	5.09	6.80	4.18	5.35	16.9	7.37	140
November	26.7	47.78	5.01	6.74	4.15	5.31	16.9	6.96	138
December	28.1	47.98	4.93	6.74	4.47	5.92	18.6	6.93	137
1914—August	23.7	60.72	6.47	8.08	4.87	6.26	18.7	8.11	135
September	25.3	59.58	6.38	8.06	4.80	6.27	18.6	8.11	132
October	26.0	59.53	6.23	7.97	4.81	6.09	18.0	7.43	131
November	26.3	58.77	6.02	7.78	4.68	6.14	18.1	7.00	130
December	28.4	58.23	6.01	7.61	4.95	6.33	18.6	6.67	130
1915—January	28.7	58.47	5.99	7.66	4.95	6.47	18.6	6.57	130
February	27.9	57.99	5.93	7.62	5.14	6.67	20.2	6.34	132
March	26.8	58.00	5.92	7.50	5.36	6.06	22.8	6.33	132
April	25.8	57.78	5.96	7.31	5.60	7.35	22.7	6.48	132
May	25.7	58.29	6.13	7.35	5.54	7.32	22.0	6.77	133
June	24.8	58.59	6.20	7.53	5.43	7.26	23.7	6.80	132
July	24.2	60.31	6.07	7.87	5.35	7.21	24.2	6.84	134
August	24.2	58.34	6.18	7.75	5.16	6.70	23.8	6.61	131
September	24.5	58.38	6.06	7.80	5.06	6.71	23.3	6.79	131
October	25.3	58.76	6.04	7.91	5.18	6.70	22.7	7.18	129
November	26.4	57.35	5.85	7.69	5.18	6.76	22.7	6.35	127
December	27.6	56.79	5.75	7.61	5.38	7.02	23.3	6.02	126
1916—January	28.3	57.79	5.85	7.67	5.52	7.29	23.3	6.32	128
February	27.6	57.99	5.99	7.87	5.90	7.78	24.2	7.07	129
March	27.1	59.51	6.37	8.11	6.35	8.10	25.9	7.86	131
April	27.6	60.68	6.66	8.00	6.61	8.58	26.3	8.21	133
May	27.9	60.98	6.73	8.08	6.66	8.49	28.0	8.37	134
June	26.5	61.63	6.91	8.39	6.54	8.36	28.7	8.21	132
July	25.7	62.04	6.78	8.54	6.33	8.16	28.6	8.40	133
August	26.1	61.32	6.51	8.59	6.22	8.15	29.0	8.61	131
September	27.4	61.41	6.55	8.77	6.25	8.22	28.4	9.22	131
October	29.0	62.19	6.37	8.59	6.20	8.02	28.7	8.67	130
November	31.1	62.67	6.44	8.60	6.41	8.41	29.4	8.74	129
December	34.4	63.18	6.56	8.79	6.77	8.72	30.8	8.76	129
1917—January	34.0	63.92	6.86	9.15	7.33	9.59	31.8	9.16	129
February	33.5	65.93	7.36	9.88	8.17	10.51	32.7	10.33	131
March	34.1	68.46	7.91	9.94	9.21	11.46	36.7	12.32	133
April	33.5	72.09	8.57	10.49	9.69	12.03	38.8	13.61	136
May	36.1	72.78	8.70	10.48	10.15	12.51	43.7	13.72	138
June	35.0	72.87	8.65	10.60	9.84	12.64	49.8	13.50	137
July	33.5	72.81	8.30	10.77	9.32	11.19	54.3	13.35	135
August	34.0	72.53	8.17	10.56	9.33	12.08	54.8	14.24	132
September	36.1	73.93	8.40	11.08	10.05	13.06	54.2	15.69	132
October	38.9	75.79	8.35	11.10	10.24	14.09	55.5	16.15	130
November	40.9	75.00	8.21	10.66	10.20	13.79	55.9	15.31	129
December	41.9	76.16	8.24	10.98	10.44	13.81	58.2	15.73	129

TABLE XVII.—*Prices paid to producers of farm products in the United States*—Contd.

Year and month.	Corn, per bu.	Oats, per bu.	Wheat, per bu.	Barley, per bu.	Rye, per bu.	Buckwheat, per bu.	Flaxseed, per bu.	Beans, per bu.	Broom corn, per ton.	Cotton, per lb.	Cotton seed, per ton.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*			*Cents.*	
1918—January	134.8	73.9	201.9	126.5	170.3	162.7	310.8	$7.00	$249.00	28.9	$67.51
February	138.8	78.7	201.2	131.9	174.8	161.9	326.7	7.08	254.00	29.7	66.95
March	154.3	86.2	202.7	161.1	201.0	168.2	349.8	6.95	242.00	30.2	68.27
April	153.6	88.9	202.6	170.2	235.1	170.1	379.7	6.95	222.00	31.8	68.08
May	155.7	86.0	203.6	158.5	221.1	176.0	373.3	6.67	206.00	28.5	68.16
June	152.5	78.1	202.5	135.4	187.6	191.0	363.6	6.28	222.00	27.4	66.03
July	153.7	76.3	203.2	118.4	169.9	200.8	349.3	5.88	235.00	28.6	64.11
August	159.7	73.0	204.5	110.0	163.9	192.7	410.5	6.11	232.00	27.8	61.34
September	165.7	70.3	205.6	100.9	159.3	190.3	381.2	5.67	300.00	32.2	67.90
October	159.5	71.0	205.8	95.5	154.0	180.0	380.9	5.52	265.00	31.8	65.85
November	140.3	68.2	206.0	94.9	152.6	173.0	333.8	5.46	205.00	29.3	64.97
December	136.5	70.9	204.2	91.7	151.6	166.5	340.1	4.86	172.00	27.6	65.05
1919—January	144.7	70.8	204.8	91.3	150.7	162.9	327.7	4.98	169.00	28.7	64.93
February	138.1	64.3	207.5	86.8	140.4	158.1	310.1	4.52	141.00	24.9	64.65
March	137.2	62.6	208.0	85.4	132.2	148.4	327.4	4.40	174.00	24.0	64.00
April	149.6	65.8	214.2	92.7	145.8	149.6	348.7	4.44	149.00	24.5	64.28
May	162.6	70.9	231.1	103.9	155.5	147.3	361.4	4.19	152.00	26.0	63.83
June	171.2	71.2	228.4	109.2	143.7	165.6	389.3	4.39	106.00	29.5	63.80
July	176.5	70.9	222.0	108.4	138.6	160.8	444.1	4.25	119.00	31.1	64.24
August	191.2	75.3	217.2	118.7	149.7	165.9	540.6	4.30	124.00	32.5	66.23
September	185.4	71.7	205.7	115.6	138.3	159.8	517.5	4.36	154.00	30.3	62.13
October	153.9	68.4	209.6	115.3	135.8	162.0	438.2	4.27	162.00	31.3	66.95
November	133.4	68.7	213.2	117.1	129.8	151.0	382.3	4.42	161.00	36.5	72.65
December	134.9	71.7	215.1	120.9	134.5	147.4	438.9	4.41	163.00	35.7	69.07
1920—January	140.4	78.2	231.8	130.2	152.3	150.7	433.6	4.70	163.00	35.9	69.88
February	146.8	82.7	235.7	137.1	154.5	154.9	456.5	4.47	123.00	36.2	69.34
March	148.5	84.5	226.6	129.3	145.0	155.7	472.7	4.32	130.00	36.2	67.18
April	158.6	90.7	234.0	140.0	156.1	163.1	455.7	4.41	145.00	37.3	68.71
May	169.6	98.3	251.3	146.4	183.1	168.8	448.2	4.36	146.00	37.7	69.83
June	185.2	102.9	258.3	148.3	183.9	180.2	421.1	4.49	145.00	37.2	66.16
July	185.6	104.5	253.6	142.0	189.0	202.7	359.6	4.47	113.00	37.4	61.64
August	163.7	81.9	232.2	121.0	168.6	181.3	303.7	4.17	142.00	36.8	43.22
September	155.7	70.2	218.7	105.0	168.9	176.3	290.3	3.83	125.00	31.1	29.96
October	121.3	60.7	214.3	91.2	162.3	159.4	279.7	3.47	126.00	25.5	28.94
November	87.3	54.5	188.0	81.7	142.1	131.0	240.1	3.27	123.00	19.4	26.00
December	67.7	47.2	144.3	70.7	127.8	129.1	176.6	2.99	88.00	14.0	19.83
1921—January	66.7	45.6	149.2	64.4	124.7	125.4	163.7	2.95	70.00	11.5	18.96
February	62.4	41.8	149.3	57.2	131.5	118.7	156.3	2.85	71.00	11.8	19.76
March	64.5	41.9	147.2	56.8	126.1	116.3	150.4	2.89	72.00	10.3	18.92
April	63.0	39.3	133.5	54.4	118.7	109.3	142.6	2.69	69.00	9.4	17.23
May	59.5	36.8	110.7	49.2	105.3	115.9	125.7	2.73	66.00	9.4	17.28
June	62.5	37.9	127.4	51.6	112.2	116.1	145.7	2.82	76.00	9.8	17.06
July	62.2	35.6	112.2	50.6	103.8	115.3	145.8	......	....	9.6	......
Yearly averages:											
1910	62.4	41.1	98.2	57.0	74.4	71.6	205.4	2.23	158.00	14.1	......
1911	57.2	37.4	86.5	72.8	76.9	69.4	216.9	2.24	87.00	12.7	21.98
1912	70.1	44.7	90.2	75.8	78.7	76.1	172.6	2.40	82.00	10.6	18.45
1913	61.8	36.0	79.2	52.1	63.6	71.2	116.6	2.17	74.00	12.0	21.79
1914	72.7	40.3	86.2	50.7	68.5	78.3	132.2	2.25	82.00	10.6	20.41
1915	72.4	45.1	112.9	57.4	93.0	83.1	157.4	2.88	79.00	8.9	24.57
1916	75.7	43.6	117.3	66.0	93.2	89.6	193.6	4.25	123.00	13.5	41.15
1917	141.4	63.4	201.2	107.4	156.0	154.2	281.4	7.29	241.00	21.5	58.31
1918	150.4	76.8	203.7	124.6	178.4	177.8	358.3	6.29	234.00	29.5	66.19
1919	156.6	69.4	214.7	105.4	141.3	156.6	402.2	4.41	148.00	29.6	65.56
1920	144.2	79.7	224.1	120.2	161.1	162.8	361.5	4.08	131.00	32.1	51.73

TABLE XVII.—*Prices paid to producers of farm products in the United States*—Contd.

Year and month.	Hay, per ton.	Timothy seed, per bu.	Clover seed, per bu.	Cabbage, per cwt.	Onions, per bu.	Potatoes, per bu.	Sweet potatoes, per bu.	Peanuts, per lb.	Apples, per bu.	Chickens, per lb.	Eggs, per doz.
					Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1918—January	$18.09	$3.57	$14.48	$2.74	179	121.0	117.2	7.0	128.8	17.9	46.3
February	18.88	3.78	16.46	3.26	183	122.9	123.1	7.2	140.1	18.8	49.4
March	19.14	3.84	17.49	2.86	147	120.3	142.7	7.4	145.3	19.9	40.4
April	18.68	3.74	17.86	2.98	134	92.6	151.6	8.3	151.9	19.8	31.2
May	17.97	3.84	16.56	3.23	135	80.1	155.0	8.2	154.8	19.8	31.0
June	17.13	3.56	15.88	3.55	139	75.5	148.8	7.9	158.2	20.0	29.8
July	16.07	3.67	14.71	3.41	163	94.9	134.3	7.8	150.4	21.2	30.7
August	15.92	3.87	15.20	2.96	165	141.6	144.7	7.9	128.1	22.6	34.4
September	17.42	3.79	16.61	2.45	163	148.8	156.2	8.3	123.7	22.8	36.4
October	18.45	4.08	19.01	2.16	143	143.6	160.6	6.9	133.5	23.1	41.6
November	19.27	4.26	20.03	1.99	143	127.2	146.0	6.6	138.6	22.4	47.2
December	20.13	4.21	20.67	2.05	132	119.3	135.2	6.1	132.8	21.8	55.0
1919—January	19.92	4.34	21.55	2.19	134	116.1	142.1	6.0	147.7	21.7	57.2
February	19.79	4.51	21.79	2.33	155	114.4	143.1	6.9	160.4	21.6	48.3
March	19.82	4.54	22.61	2.71	200	109.4	153.7	7.0	175.4	22.2	33.1
April	20.52	4.69	24.81	3.79	202	105.4	160.7	6.9	201.6	23.5	34.3
May	22.31	5.05	24.48	4.97	230	118.9	174.6	7.2	224.5	25.2	36.8
June	23.30	4.63	23.37	4.68	234	121.4	173.7	7.7	237.3	25.7	38.6
July	21.73	4.49	23.25	4.23	232	128.4	159.8	8.2	197.7	25.2	36.8
August	20.16	4.58	24.33	3.73	226	192.8	167.9	8.1	174.7	25.9	39.3
September	20.52	4.55	25.38	3.08	195	187.5	175.4	8.3	162.0	25.7	41.0
October	19.79	4.78	26.47	2.88	196	164.2	154.7	8.1	171.1	24.2	44.7
November	19.36	4.67	26.53	2.74	212	152.8	143.9	9.1	182.8	22.9	54.0
December	20.15	4.98	27.63	3.49	246	161.4	133.3	9.1	186.8	22.3	61.9
1920—January	20.55	5.35	28.06	4.31	281	178.6	138.2	9.9	213.8	22.6	64.8
February	21.76	5.62	31.21	5.05	307	217.6	156.6	10.5	214.7	24.1	56.9
March	22.31	5.61	31.88	5.25	326	243.5	172.2	11.2	231.8	25.4	46.6
April	22.94	5.63	32.23	5.59	344	295.6	185.8	10.9	260.1	26.8	38.8
May	24.22	5.61	29.84	6.75	338	393.6	205.2	11.2	285.5	27.4	37.4
June	24.85	5.46	26.21	5.47	264	421.3	216.6	11.2	297.0	27.2	37.0
July	23.62	5.14	25.52	4.71	205	386.0	213.6	11.0	280.7	27.0	36.7
August	20.89	4.44	19.97	3.28	176	302.9	223.5	8.5	198.4	27.4	40.0
September	19.88	3.52	17.77	2.03	173	184.9	200.7	8.0	137.4	26.7	44.2
October	18.94	3.25	13.18	1.95	159	134.8	160.8	5.8	132.8	26.4	50.1
November	17.45	3.09	11.64	1.67	144	118.3	122.1	5.3	130.0	23.3	56.9
December	17.70	3.18	10.03	1.78	131	116.4	112.7	4.7	113.1	22.1	65.0
1921—January	16.16	3.04	10.82	1.91	135	105.6	113.0	4.4	118.6	20.7	61.1
February	15.24	2.75	10.61	1.86	131	95.6	117.8	4.1	128.4	21.9	49.6
March	14.28	2.97	10.98	1.71	114	84.0	119.8	4.0	130.5	22.1	29.2
April	13.61	2.84	10.80	2.03	98	77.8	127.4	3.5	134.4	22.2	20.4
May	13.08	2.90	10.71	3.10	107	68.0	127.2	3.4	142.2	21.7	20.2
June	12.52	2.99	10.20	4.04	138	67.1	128.8	3.8	169.2	20.7	19.4
July	12.61	......	......	......	......	69.9	125.0	......	170.0	21.1	22.0
Yearly average:											
1910	11.16	......	7.84	1.99	99	53.9	77.3	4.9	97.9	11.7	22.5
1911	12.71	5.70	9.29	1.81	113	78.0	90.4	4.8	103.0	10.7	19.4
1912	13.54	4.96	10.87	2.04	124	87.3	97.0	4.8	88.4	10.9	22.1
1913	10.94	1.90	9.18	1.66	96	59.7	87.0	4.8	85.0	11.8	21.3
1914	11.32	2.29	8.21	1.87	129	69.3	86.5	4.8	99.9	12.2	22.5
1915	10.57	2.70	8.65	1.57	95	52.5	82.2	4.5	73.3	11.9	22.0
1916	10.54	2.84	9.63	2.01	135	103.8	80.1	4.5	90.5	13.3	24.6
1917	13.42	3.03	10.93	4.21	271	189.9	121.0	6.5	125.5	16.7	33.8
1918	18.10	3.85	17.08	2.80	152	115.7	143.0	7.5	140.5	20.8	39.5
1919	20.61	4.65	24.35	3.40	205	139.4	156.9	7.7	185.2	23.8	43.8
1920	21.26	4.66	23.13	3.99	237	249.5	175.7	9.0	207.9	25.5	47.9

TABLE XVII.—*Prices paid to producers of farm products in the United States*—Contd.

Year and month.	Butter, per pound.	Milk cows, per head.	Beef cattle, per cwt.	Veal calves, per cwt.	Sheep, per cwt.	Lambs, per cwt.	Wool, per pound.	Hogs, per cwt.	Horses, per head.
	Cents.						*Cents.*		
1918—January	43.1	$76.54	$8.33	$11.16	$10.55	$13.83	58.1	$15.26	$130
February	43.7	78.36	8.55	11.17	10.75	13.77	57.1	15.03	133
March	43.4	80.71	8.85	11.33	11.41	14.11	60.0	15.58	137
April	40.7	82.45	9.73	11.71	11.98	15.34	60.0	15.76	137
May	39.9	84.11	10.38	11.62	12.32	15.39	58.2	15.84	136
June	38.6	84.74	10.40	11.88	11.56	14.98	57.4	15.37	135
July	38.2	84.97	10.07	12.33	11.04	14.20	57.5	15.58	132
August	39.7	84.06	9.71	12.22	10.99	14.20	57.4	16.89	131
September	41.4	85.21	9.63	12.57	10.79	13.73	57.7	17.50	128
October	47.2	85.41	9.33	12.35	10.35	13.20	57.7	16.50	126
November	49.7	84.51	9.14	11.94	10.11	12.54	56.4	15.92	122
December	52.7	85.78	9.28	12.31	9.46	12.44	56.2	15.82	121
1919—January	54.9	86.10	9.65	12.39	9.68	12.71	55.2	15.69	120
February	49.6	86.15	10.02	12.18	9.95	13.17	51.1	15.53	121
March	43.8	88.15	10.34	12.65	10.45	14.03	51.3	16.13	124
April	47.6	90.91	10.81	12.78	11.33	14.61	47.9	17.39	127
May	50.3	93.43	10.84	12.11	10.93	14.34	48.0	18.00	129
June	49.1	93.84	10.20	12.40	10.34	13.89	50.5	17.80	127
July	47.2	94.51	9.96	13.38	9.25	13.09	51.8	19.22	127
August	48.2	94.72	9.82	13.43	9.06	12.91	52.2	19.30	125
September	49.7	93.42	9.02	13.39	8.69	12.25	51.3	15.81	119
October	51.5	93.43	8.65	12.87	8.46	11.47	50.6	13.88	114
November	56.0	93.27	8.65	12.65	8.35	11.45	51.0	13.36	113
December	60.0	95,54	8.63	12.67	8.53	11.85	51.6	12.66	113
1920—January	61.3	94.42	8.99	12.89	9.34	12.91	53.3	13.36	118
February	57.8	95.27	8.98	13.12	9.97	14.08	52.5	13.62	123
March	55.9	94.94	9.08	12.98	10.25	14.17	51.5	13.59	127
April	56.1	95.36	9.20	12.72	10.66	14.63	51.3	13.73	131
May	57.6	94.56	8.97	11.69	10.34	14.26	50.3	13.44	132
June	53.5	94.56	9.32	11.68	9.13	12.82	38.6	13.18	130
July	51.6	91.23	8.93	11.44	8.21	11.79	29.5	13.65	127
August	52.0	90.50	8.56	11.64	7.54	10.84	28.3	13.59	124
September	52.3	89.40	8.29	11.88	7.24	10.31	28.0	13.98	119
October	54.1	85.90	7.77	11.64	6.62	9.65	27.5	13.57	112
November	54.3	77.56	7.15	10.77	6.20	9.37	24.9	11.64	103
December	54.7	70.83	6.38	9.31	5.54	8.45	22.0	8.90	97
1921—January	49.0	66.82	6.32	9.34	5.30	8.44	19.6	8.72	96
February	45.0	63.44	6.02	9.08	5.01	7.76	19.8	8.58	98
March	42.1	65.37	6.36	9.05	5.27	7.90	18.9	9.13	101
April	40.4	64.35	6.08	7.73	5.11	7.55	17.9	7.96	100
May	38.6	62.63	5.98	7.55	5.11	7.78	16.0	7.62	98
June	29.4	59.89	5.65	7.43	4.74	7.59	15.4	7.22	98
July	29.0	....	....	....	....	....	....	....	....
Yearly averages:									
1910	26.0	42.47	4.81	6.41	5.21	6.40	20.7	8.16	147
1911	23.4	43.57	4.47	6.06	4.14	5.30	15.9	6.29	141
1912	26.2	45.72	5.11	6.45	4.24	5.60	17.9	6.71	140
1913	27.0	54.75	5.90	7.48	4.54	6.05	16.7	7.49	142
1914	25.6	59.34	6.24	7.83	4.79	6.31	17.6	7.57	135
1915	26.0	58.25	6.01	7.63	5.28	6.85	22.5	6.59	131
1916	28.2	60.95	6.48	8.33	6.31	8.19	27.6	8.20	131
1917	36.0	71.86	8.14	10.47	9.50	12.23	47.2	13.59	133
1918	43.2	83.07	9.45	11.88	10.94	13.98	57.8	15.92	131
1919	50.7	91.96	9.72	12.74	9.59	12.98	51.0	16.23	122
1920	55.1	89.54	8.47	11.81	8.42	11.94	38.1	13.02	120

INDEX NUMBERS OF PRICES PAID TO PRODUCERS OF FARM PRODUCTS IN THE UNITED STATES.

The price of each farm product in each month as given in Table XVII is divided by the five-year average before the war for that product. The resulting index numbers are given in Table XVIII, pages 47 to 55.

These index numbers may be compared directly with the general price level as shown in Table II, page 3, and may be compared with each other, or with prices of any other commodities. They are used in making the curves shown in figure 13. Yearly averages are given at the end of the table.

Table XVIII may be continued by obtaining the price of the farm product in question from the Monthly Crop Reporter and dividing by the five-year average for the same month before the war, as given in Table XVII.

The weighted average is obtained by multiplying the index number for each farm product by the figures given below, adding the results, and dividing by 100: Corn, 6.1; oats, 2.5; wheat, 12.7; barley, 1; rye, 0.4; buckwheat, 0.2; flaxseed, 0.6; beans, 0.7; broom corn, 0.1; cotton, 16.9; cotton seed, 2.3; hay, 2.5; timothy seed, 0.1; clover seed, 0.2; cabbage, 0.2; onions, 0.2; potatoes, 3.2; sweet potatoes, 0.7; peanuts, 0.4; apples, 3.5; chickens, 1.8; eggs, 4.3; butter, 11.3; milk cows, 2.4; beef cattle, 7.1; veal calves, 1.2; sheep, 0.8; lambs, 0.8; wool, 1.5; hogs, 9.5; horses, 4.8. These weights are based on sales as indicated by the Census of 1909. Deductions were made for seed and farm use. In some cases one product representative of a class of products is given a weight representative of the class. To be exact, the weighting should change each year and each month, but the weighted average figure is little affected by differences in the weights. In fact, the unweighted average is nearly always practically the same as the weighted.

TABLE XVIII.—*Index numbers of prices paid to producers of farm products in the United States.*

[August, 1909, to July, 1914=100.]

Year and month.	Corn.	Oats.	Wheat.	Barley.	Rye.	Buckwheat.	Flaxseed.	Beans.	Broom corn.	Cotton.	Cotton seed.
1909—August	107	117	118	101	107	106	82	......	......	90	......
September	100	108	109	92	101	104	74	......	......	96	......
October	99	106	108	88	101	104	74	......	......	104	......
November	101	107	113	88	102	102	84	......	......	113	......
December	101	106	115	89	101	100	95	96	......	114	......
1910—January	107	111	118	94	105	99	106	99	184	119	......
February	110	114	118	93	105	101	113	100	191	115	......
March	109	115	118	96	107	100	111	100	190	113	......
April	105	113	118	93	106	102	112	99	194	114	......
May	98	105	111	87	104	97	119	96	199	111	......
June	96	103	107	86	102	97	111	99	168	112	......
July	96	101	109	88	103	99	110	102	187	109	......
August	95	97	109	90	101	96	125	101	146	114	......
September	93	98	109	96	104	98	131	101	134	118	126
October	90	94	107	93	101	99	141	99	108	110	128
November	85	91	102	92	99	94	138	96	99	116	122
December	84	90	103	95	100	94	145	98	106	116	118
1911—January	83	86	101	98	103	93	136	98	79	117	120
February	82	84	101	101	100	91	137	100	78	117	117
March	81	82	96	100	101	91	138	100	74	112	115
April	80	80	94	107	104	90	135	100	70	112	115
May	80	81	94	114	105	90	137	96	81	113	113
June	81	83	95	114	106	93	128	95	77	115	107
July	87	90	96	114	106	92	123	97	71	113	106
August	93	94	91	114	103	98	119	98	74	106	104
September	93	103	97	129	108	100	122	100	88	97	87
October	97	110	101	135	111	97	123	100	121	84	80
November	105	115	103	141	115	104	127	105	128	74	80
December	108	118	102	143	117	104	114	108	123	72	77
1912—January	107	117	101	141	116	104	115	106	97	68	76
February	109	120	101	143	116	104	112	107	83	74	77
March	110	124	102	145	117	109	106	111	94	79	82
April	114	128	104	144	117	107	110	108	96	81	82
May	123	136	111	148	117	109	103	111	83	87	85
June	122	132	113	141	117	112	117	113	88	87	88
July	117	126	113	133	116	109	118	107	89	88	89
August	112	104	98	110	106	107	104	107	86	96	92
September	109	90	98	90	99	104	97	106	74	93	85
October	103	87	95	90	97	97	89	103	70	93	86
November	95	88	95	89	95	93	80	101	71	90	89
December	85	84	88	83	93	94	72	103	65	98	98
1913—January	84	84	87	82	89	95	66	100	48	99	100
February	85	82	89	81	95	98	64	99	54	98	100
March	86	83	91	78	88	95	68	96	54	95	97
April	86	82	89	75	87	95	66	96	55	95	96
May	88	83	90	74	87	98	65	96	53	92	97
June	90	86	91	82	87	94	66	97	68	91	98
July	91	90	93	87	87	92	68	97	59	91	100
August	93	88	85	84	83	93	71	94	94	92	103
September	106	101	88	93	88	95	76	92	102	97	102
October	111	103	89	94	90	103	74	99	102	110	105
November	115	99	87	91	88	107	71	99	103	107	108
December	121	103	93	89	89	108	75	95	105	100	108
1914—January	120	102	93	85	88	108	77	96	91	95	104
February	115	99	91	82	85	106	75	94	92	98	106
March	114	97	93	81	87	106	76	94	87	102	106
April	114	98	95	80	87	107	77	96	85	96	106
May	111	96	93	76	87	106	76	102	85	97	105
June	111	96	93	76	88	104	78	97	98	98	108
July	109	93	88	77	87	108	81	97	92	98	106

TABLE XVIII.—*Index numbers of prices paid to producers of farm products in the United States*—Continued.

Year and month.	Hay.	Timothy seed.	Clover seed.	Cabbage.	Onions.	Potatoes.	Sweet potatoes.	Peanuts.	Apples.	Chickens.	Eggs.
1909—August	86	......	......	......	......	96	......	......	......	96	110
September	85	......	......	......	......	90	......	......	......	96	106
October	88	......	......	......	......	93	......	......	......	97	100
November	90	......	......	......	......	95	......	......	......	97	98
December	86	......	......	......	91	88	98	......	116	101	95
1910—January	89	......	92	111	91	89	95	107	110	102	103
February	94	......	88	114	88	86	92	110	106	102	110
March	97	......	85	114	77	82	91	104	104	104	107
April	95	......	81	112	81	70	89	108	100	103	109
May	91	......	79	129	79	55	85	106	98	105	111
June	88	......	80	90	84	54	83	104	97	105	110
July	90	......	80	89	85	54	82	102	92	103	109
August	95	......	83	90	95	73	81	92	96	104	101
September	99	103	94	112	100	91	87	94	103	103	102
October	97	108	93	107	95	98	92	98	105	100	102
November	97	110	89	99	96	91	94	102	109	101	100
December	99	112	90	96	99	90	94	98	106	99	97
1911—January	100	110	92	92	98	86	96	96	111	98	103
February	98	115	89	82	92	84	96	102	114	97	84
March	96	121	89	67	88	83	96	100	112	95	77
April	94	125	90	65	94	81	98	98	115	94	87
May	96	127	92	64	99	90	102	98	114	93	88
June	100	132	97	102	106	91	103	100	112	93	87
July	110	140	99	114	100	130	108	98	113	94	85
August	122	167	106	118	110	154	110	108	107	96	89
September	120	182	116	112	105	143	110	106	100	96	91
October	118	185	119	107	104	128	109	98	95	94	91
November	118	185	120	110	104	125	106	96	91	92	93
December	117	183	120	117	113	129	106	96	85	90	96
1912—January	117	187	122	112	114	135	106	93	92	92	100
February	120	185	129	124	124	144	108	96	93	94	111
March	122	180	134	154	140	152	112	104	93	94	114
April	129	176	133	155	138	172	118	98	95	94	104
May	133	173	132	139	136	183	121	100	99	94	102
June	132	168	129	110	123	172	120	100	96	94	100
July	119	152	119	89	93	139	122	96	93	92	100
August	106	82	108	90	95	98	112	102	95	97	100
September	99	57	107	72	90	82	102	100	91	97	100
October	96	52	108	73	87	74	100	100	86	99	100
November	96	49	105	76	85	75	101	102	82	100	102
December	96	49	102	74	84	82	102	100	78	101	100
1913—January	95	48	105	75	80	81	102	100	76	100	91
February	90	45	109	65	69	81	102	92	74	100	87
March	88	42	108	55	65	78	102	98	74	99	90
April	86	42	113	56	62	74	99	96	73	101	96
May	85	43	113	73	67	69	96	96	73	100	96
June	86	44	107	90	76	80	96	96	79	102	101
July	87	49	110	103	84	67	98	100	91	102	102
August	92	51	103	102	100	78	98	100	102	106	99
September	97	58	83	103	105	94	101	102	106	107	102
October	100	54	80	114	112	107	99	102	113	108	106
November	100	56	85	115	116	114	99	96	118	108	108
December	102	57	87	112	115	111	102	104	116	107	111
1914—January	100	55	89	111	117	109	101	102	111	107	104
February	97	54	85	115	125	106	101	96	113	107	108
March	97	57	85	109	130	106	99	98	116	108	113
April	95	55	83	110	125	103	96	98	116	107	103
May	95	57	83	95	118	103	97	104	116	106	101
June	94	56	88	108	112	103	98	98	115	106	104
July	94	59	91	104	139	110	90	102	111	107	105

TABLE XVIII.—*Index numbers of prices paid to producers of farm products in the United States*—Continued.

Year and month.	Butter.	Milk cows.	Beef cattle.	Veal calves.	Sheep.	Lambs.	Wool.	Hogs.	Horses.	Weighted average of 31 products.
1909—August	96	....	....	....	....	....	....	....	....	101
September	96	....	....	....	....	....	....	....	....	99
October	98	....	....	....	....	....	....	....	....	101
November	98	....	....	....	....	....	....	....	....	105
December	98	....	92	....	121	127	134	111	....	106
1910—January	101	87	93	95	122	101	132	110	101	107
February	103	85	91	93	112	111	133	111	103	107
March	102	85	92	95	118	118	133	121	104	108
April	102	85	97	97	120	116	124	122	105	107
May	103	86	95	96	117	112	128	119	103	104
June	103	88	96	97	115	113	111	118	104	103
July	102	87	91	95	120	110	109	112	104	102
August	102	92	91	95	109	103	111	107	103	102
September	104	91	91	95	113	107	104	110	102	105
October	102	91	91	94	112	108	107	110	103	103
November	101	91	89	95	112	104	106	109	104	103
December	99	90	90	95	102	95	96	103	103	101
1911—January	98	95	91	96	97	99	94	106	103	102
February	89	93	89	94	95	91	94	99	101	99
March	88	93	88	94	93	88	90	91	101	96
April	89	91	85	88	90	89	87	81	101	94
May	87	90	83	86	91	89	83	79	101	94
June	86	88	81	84	89	87	89	79	100	98
July	89	87	80	85	92	89	88	82	98	94
August	93	91	86	90	92	95	91	90	99	97
September	95	90	87	90	92	92	92	87	98	97
October	93	90	85	90	88	87	92	83	98	94
November	94	89	87	91	88	88	92	84	99	94
December	98	89	89	89	83	83	83	83	98	94
1912—January	99	91	88	89	85	90	88	82	96	93
February	107	91	90	90	88	87	88	81	96	97
March	105	90	90	88	86	86	90	80	97	98
April	103	91	94	92	90	93	96	89	97	101
May	105	92	97	95	96	95	100	94	100	105
June	106	92	96	94	95	96	107	93	100	105
July	102	93	97	94	92	94	108	92	100	102
August	102	99	106	100	99	102	107	97	99	100
September	100	100	105	101	96	100	110	100	99	98
October	100	100	105	101	100	101	109	104	100	97
November	101	99	104	100	98	101	110	101	101	96
December	102	101	108	102	94	96	100	99	101	96
1913—January	100	105	107	104	95	104	101	96	101	95
February	101	108	109	107	102	107	101	101	102	95
March	106	110	111	108	104	105	98	103	101	96
April	109	112	111	109	102	102	98	105	101	96
May	109	111	109	109	99	103	92	103	101	95
June	109	111	111	111	102	101	89	106	101	97
July	108	112	112	111	92	99	91	108	101	97
August	107	118	116	114	100	100	90	107	99	98
September	107	119	116	114	99	101	93	103	99	101
October	107	119	119	114	100	103	92	103	99	105
November	106	121	120	114	103	106	92	105	99	105
December	104	119	121	115	100	99	87	103	99	105
1914—January	103	123	120	116	102	106	85	106	99	103
February	101	124	121	117	103	104	85	109	97	103
March	100	121	119	114	100	101	98	105	96	103
April	98	121	114	114	98	100	93	103	95	101
May	96	121	115	115	98	100	97	105	97	101
June	97	121	116	114	99	103	105	104	94	101
July	100	122	120	116	104	108	106	106	96	102

TABLE XVIII.—*Index numbers of prices paid to producers of farm products in the United States*—Continued.

Year and month.	Corn.	Oats.	Wheat.	Barley.	Rye.	Buckwheat.	Flaxseed.	Beans.	Broom corn.	Cotton.	Cotton seed.
1914—August	109	86	84	74	83	104	90	113	94	99	103
September	114	108	106	88	106	108	83	109	74	71	67
October	115	112	107	85	110	109	77	95	67	64	73
November	114	112	110	86	111	111	71	102	68	52	67
December	113	115	115	90	121	109	79	107	66	56	81
1915—January	114	117	123	89	126	110	83	117	64	54	87
February	122	127	145	99	138	118	96	136	76	61	106
March	124	130	150	108	147	121	91	133	65	60	100
April	121	132	148	101	138	118	97	128	68	65	100
May	120	130	155	98	141	116	96	129	75	72	98
June	115	123	145	96	133	115	97	124	86	68	95
July	112	112	118	91	130	117	91	120	82	68	93
August	112	106	117	94	121	115	86	119	86	65	103
September	109	98	108	87	120	110	86	120	72	70	101
October	104	89	104	77	113	103	89	129	86	93	161
November	100	91	105	83	119	112	98	136	95	96	164
December	101	95	107	85	117	112	109	147	115	93	163
1916—January	107	102	118	90	119	115	115	154	101	93	168
February	112	113	128	97	121	114	123	155	101	94	167
March	113	106	116	95	120	118	117	153	99	90	165
April	113	104	111	89	115	115	117	156	91	93	168
May	112	103	114	92	116	116	109	157	101	91	168
June	109	101	110	92	114	115	101	161	113	96	163
July	109	97	106	97	115	118	97	221	107	98	168
August	112	94	118	98	114	114	106	205	124	101	180
September	117	110	150	123	140	117	114	204	124	120	198
October	121	115	156	126	145	126	120	196	168	128	226
November	138	128	179	138	160	146	141	248	178	149	269
December	156	138	186	145	171	161	155	258	195	161	258
1917—January	155	134	172	142	166	166	155	254	179	139	240
February	161	140	185	146	170	161	148	273	195	138	234
March	167	142	185	154	176	177	146	298	202	128	239
April	183	152	203	159	187	178	154	337	216	145	246
May	233	172	274	185	228	206	171	394	252	150	247
June	236	167	274	185	249	243	170	389	248	159	231
July	238	165	252	174	245	265	166	351	202	194	255
August	278	172	251	189	243	243	162	325	318	194	289
September	246	158	239	185	227	222	181	297	231	192	277
October	258	161	229	188	236	215	185	328	270	193	311
November	237	162	226	184	234	219	178	329	305	226	334
December	224	175	233	188	233	228	185	312	318	227	313

TABLE XVIII.—*Index numbers of prices paid to producers of farm products in the United States*—Continued.

Year and month.	Hay.	Timothy seed.	Clover seed.	Cabbage.	Onions.	Potatoes.	Sweet potatoes.	Peanuts.	Apples.	Chickens.	Eggs.
1914—August	95	62	96	83	131	99	101	100	102	109	105
September	98	67	104	87	104	94	99	104	91	109	110
October	96	63	95	89	90	94	103	96	82	108	107
November	93	63	93	83	85	87	100	96	74	106	100
December	91	59	92	81	92	79	102	93	70	106	100
1915—January	89	70	95	80	86	79	101	98	70	105	107
February	90	68	91	78	87	77	98	90	69	106	111
March	91	68	89	74	80	75	97	88	68	104	99
April	91	65	86	98	82	70	97	90	67	103	97
May	90	66	86	118	79	73	98	98	70	103	102
June	91	67	87	97	82	73	101	92	74	103	99
July	90	66	89	76	76	70	97	92	83	103	101
August	90	65	87	77	82	64	89	92	89	104	98
September	88	72	97	72	84	63	91	92	84	104	98
October	86	73	111	68	97	71	86	91	87	103	101
November	86	78	112	71	96	100	83	91	91	105	104
December	87	78	113	69	100	100	87	91	81	107	103
1916—January	86	82	115	69	110	113	83	93	82	107	103
February	88	81	111	67	112	134	85	90	85	109	102
March	89	81	112	74	109	141	88	92	85	109	99
April	90	85	109	74	98	143	84	92	83	110	105
May	92	80	105	90	95	136	82	94	80	112	108
June	93	82	104	94	106	142	87	90	86	114	114
July	92	79	103	84	120	138	86	90	106	116	118
August	87	60	100	108	128	108	90	94	102	118	119
September	86	61	98	125	124	137	96	92	109	120	122
October	84	61	98	162	134	162	99	94	116	123	128
November	86	60	107	191	156	222	106	96	115	128	127
December	92	63	107	195	176	236	119	102	107	133	128
1917—January	93	65	107	234	202	235	115	107	104	130	127
February	94	63	105	314	317	262	115	108	107	135	136
March	96	66	107	362	400	360	127	115	114	138	157
April	104	67	107	373	391	345	133	124	116	140	151
May	114	75	110	350	306	402	144	147	122	148	180
June	119	78	113	211	244	395	156	148	128	148	186
July	116	78	118	126	165	334	153	149	148	145	169
August	114	83	116	104	148	193	134	147	161	146	171
September	117	90	124	102	144	175	142	138	151	148	174
October	121	97	137	121	161	177	138	130	149	156	170
November	131	87	150	194	179	210	146	154	154	158	155
December	140	92	153	146	177	199	155	154	143	164	145

TABLE XVIII.—*Index numbers of prices paid to producers of farm products in the United States*—Continued.

Year and month.	Butter.	Milk cows.	Beef cattle.	Veal calves.	Sheep.	Lambs.	Wool.	Hogs.	Horses.	Weighted average of 31 products.
1914—August	102	131	127	123	113	114	107	111	94	102
September	104	127	125	119	113	115	109	108	93	100
October	102	126	122	117	115	114	107	101	94	97
November	99	123	120	115	113	116	107	101	94	94
December	101	121	122	113	111	107	100	96	95	95
1915—January	101	124	119	113	108	112	101	93	94	96
February	103	121	116	113	113	112	109	89	92	101
March	103	119	112	108	112	97	122	85	92	100
April	102	117	108	108	110	114	126	85	90	100
May	104	118	111	112	112	113	124	94	92	104
June	106	118	114	111	114	115	135	95	91	102
July	106	123	114	117	117	118	138	94	94	98
August	104	126	122	118	120	122	136	91	92	98
September	101	125	119	115	119	123	137	91	92	96
October	99	124	119	116	124	125	134	97	92	101
November	99	120	117	114	125	127	134	91	92	102
December	98	118	117	113	120	119	125	87	92	101
1916—January	100	122	116	113	120	126	126	90	92	104
February	101	121	117	116	130	131	131	99	90	108
March	105	122	120	117	133	130	139	106	91	108
April	109	123	121	118	130	133	146	108	91	109
May	113	123	122	123	134	131	157	116	93	110
June	113	124	127	124	138	133	164	115	91	111
July	112	127	127	127	139	134	163	116	94	113
August	112	132	128	130	144	148	166	118	92	114
September	113	131	129	129	147	150	167	123	92	125
October	113	131	125	126	148	150	170	118	93	129
November	116	131	129	128	154	158	174	126	93	142
December	122	132	133	130	151	147	166	126	94	148
1917—January	120	135	136	135	159	166	172	130	93	143
February	123	138	144	146	180	177	177	145	92	149
March	132	140	150	144	192	184	196	166	92	157
April	132	146	156	155	191	186	216	179	93	166
May	146	147	158	159	205	194	246	190	96	188
June	149	147	159	157	207	201	285	189	94	191
July	146	148	156	160	204	184	310	184	95	190
August	146	156	161	160	216	219	313	195	92	191
September	149	158	165	163	236	239	319	209	93	188
October	152	160	164	163	245	263	328	219	93	191
November	153	157	164	158	246	260	331	220	93	197
December	149	159	167	163	234	233	313	227	94	196

TABLE XVIII.—*Index numbers of prices paid to producers of farm products in the United States*—Continued.

Year and month.	Corn.	Oats.	Wheat.	Barley.	Rye.	Buck-wheat.	Flax seed.	Beans.	Broom corn.	Cotton.	Cotton seed.
1918—January	232	192	231	207	239	230	192	311	242	235	308
February	233	199	225	207	240	228	191	319	247	243	305
March	255	215	228	256	281	238	201	319	230	244	307
April	247	220	228	265	324	236	219	317	211	256	300
May	241	209	227	244	307	241	212	294	206	226	303
June	225	187	223	210	255	252	207	272	247	216	301
July	222	183	232	193	235	254	209	256	245	225	299
August	226	171	224	182	223	247	244	273	239	222	313
September	233	180	234	170	223	257	228	252	288	264	327
October	235	184	235	158	214	250	229	242	265	263	315
November	227	179	233	157	212	246	201	245	211	242	313
December	239	186	237	151	213	238	212	217	195	226	298
1919—January	249	184	234	149	211	231	202	221	164	233	296
February	232	163	232	136	193	223	181	204	137	204	295
March	227	156	234	136	185	210	188	202	166	194	288
April	241	162	241	144	201	207	201	203	142	198	283
May	251	172	257	160	216	202	205	185	152	206	283
June	253	170	252	169	196	219	222	190	118	232	291
July	255	170	254	177	192	204	265	185	124	245	299
August	271	176	238	196	204	213	322	192	128	260	338
September	260	183	235	194	194	216	309	194	148	248	299
October	227	177	239	190	189	225	263	187	162	259	320
November	216	180	241	194	180	215	230	198	166	302	350
December	236	188	250	200	189	210	274	197	185	293	317
1920—January	241	203	265	213	213	213	268	209	158	292	319
February	247	209	264	215	212	218	267	201	119	297	316
March	245	211	255	206	203	220	272	198	124	292	302
April	255	224	264	218	215	226	263	201	138	301	303
May	262	239	280	226	254	231	254	192	146	299	310
June	274	246	284	230	250	238	240	194	161	293	302
July	268	251	290	231	261	257	215	194	118	294	287
August	232	191	255	200	230	233	181	186	146	294	221
September	219	180	249	176	237	238	173	170	120	255	144
October	179	157	245	150	225	222	168	152	126	211	138
November	141	143	212	135	197	186	144	147	127	160	125
December	119	124	168	117	179	184	110	133	100	115	91
1921—January	115	118	171	105	175	178	101	131	68	93	87
February	105	106	167	90	181	167	91	128	69	97	90
March	107	104	165	90	176	164	87	133	69	83	85
April	101	97	150	85	163	151	82	123	66	76	76
May	92	89	123	76	146	159	71	120	66	75	77
June	92	91	140	80	153	153	83	122	84	77	78
July	90	85	128	82	144	146	87	......	....	76	....
Yearly averages:											
1910	97	103	111	92	103	98	122	99	159	114	....
1911	89	94	98	118	107	95	128	100	89	103	102
1912	109	111	102	121	109	104	102	107	83	86	86
1913	96	90	89	84	88	98	69	97	75	97	101
1914	113	101	97	82	95	107	78	100	83	86	94
1915	113	113	127	92	129	114	93	128	81	72	114
1916	118	109	133	107	129	123	118	189	125	110	192
1917	218	158	227	173	216	210	167	324	245	174	271
1918	235	192	230	200	247	243	212	276	236	239	307
1919	243	173	242	170	196	215	239	197	149	240	305
1920	224	198	253	193	223	222	213	181	132	259	238

TABLE XVIII.—*Index numbers of prices paid to producers of farm products in the United States*—Continued.

Year and month.	Hay.	Timothy seed.	Clover seed.	Cabbage.	Onions.	Potatoes.	Sweet potatoes.	Peanuts.	Apples.	Chickens.	Eggs.
1918—January	154	95	162	162	174	193	149	152	133	167	156
February	157	96	174	181	162	187	148	147	136	172	188
March	159	94	181	153	124	180	163	154	134	178	188
April	154	91	184	146	106	136	163	166	133	172	182
May	147	93	175	150	104	115	158	167	126	168	186
June	139	89	175	147	110	109	155	152	129	169	178
July	134	94	165	133	134	128	146	153	147	178	184
August	140	99	167	141	157	160	150	161	163	193	198
September	153	104	189	142	165	187	167	173	173	197	191
October	161	109	218	146	146	208	190	147	186	199	189
November	167	115	232	145	144	209	191	143	182	200	186
December	165	114	234	131	132	193	189	133	156	204	185
1919—January	170	116	241	130	130	185	181	130	152	203	193
February	165	115	231	129	137	174	172	141	156	198	184
March	165	112	235	145	168	164	176	146	162	198	154
April	170	114	255	186	159	155	173	138	176	204	201
May	182	122	259	231	177	171	179	147	183	214	220
June	189	116	257	193	186	175	181	148	193	218	231
July	181	115	261	165	190	173	174	161	193	212	220
August	177	117	268	178	215	218	174	165	222	221	226
September	181	124	289	178	197	235	188	173	227	222	215
October	173	128	304	195	200	238	183	172	239	209	203
November	168	126	308	200	214	250	189	198	240	204	213
December	165	135	313	224	246	261	186	198	220	208	208
1920—January	175	143	313	255	273	285	176	215	221	211	219
February	181	143	331	281	272	331	188	214	208	221	216
March	185	138	331	281	274	364	197	233	214	227	217
April	190	137	331	274	271	434	200	218	227	233	227
May	198	136	315	314	260	566	210	229	233	232	224
June	202	137	288	226	210	607	226	215	242	231	222
July	197	131	286	184	168	520	233	216	274	227	220
August	184	114	220	156	168	343	232	173	252	234	230
September	175	96	202	117	175	232	215	167	192	230	231
October	166	87	151	132	162	195	191	123	185	228	228
November	151	83	135	122	145	194	160	115	170	208	224
December	145	86	114	114	131	188	158	102	133	207	218
1921—January	138	81	121	113	131	168	144	96	122	193	206
February	127	70	112	103	116	146	141	84	125	201	189
March	119	73	114	91	96	126	137	83	120	197	136
April	112	69	111	100	77	114	137	70	117	193	119
May	107	70	113	144	82	98	130	69	116	184	121
June	102	75	112	167	110	97	134	73	138	175	116
July	105	......	......	......	......	94	136	......	166	177	132
Yearly averages:											
1910	94	......	86	105	89	78	89	102	102	103	105
1911	107	148	102	96	101	110	103	100	106	94	89
1912	114	126	119	106	109	126	110	99	91	96	103
1913	92	49	100	89	88	86	100	99	91	103	99
1914	95	59	90	98	114	99	99	99	101	107	105
1915	89	70	95	82	86	76	94	92	78	104	102
1916	89	73	106	111	122	151	92	93	96	117	114
1917	113	78	121	220	236	274	138	135	133	146	160
1918	153	99	188	148	138	167	164	154	150	183	184
1919	174	120	268	180	185	200	180	160	197	209	206
1920	179	119	251	205	209	355	199	185	213	224	223

TABLE XVIII.—*Index numbers of prices paid to producers of farm products in the United States*—Continued.

Year and month.	Butter.	Milk cows.	Beef cattle.	Veal calves.	Sheep.	Lambs.	Wool.	Hogs.	Horses.	Weighted average of 31 products.
1918—January	152	162	165	165	229	239	314	217	94	198
February	161	164	167	165	236	231	309	211	93	200
March	168	165	167	164	238	227	321	210	95	204
April	160	167	177	173	236	237	333	208	94	204
May	162	170	189	176	248	238	327	219	94	199
June	164	171	191	175	243	238	328	215	93	194
July	167	173	189	183	242	233	329	215	93	198
August	170	181	191	185	255	258	328	231	92	202
September	170	182	189	185	253	251	339	234	90	213
October	184	180	183	182	248	247	341	224	90	214
November	186	177	182	177	244	236	334	229	88	209
December	188	179	188	183	212	210	302	228	88	205
1919—January	193	182	191	183	210	220	298	223	86	207
February	182	180	196	180	219	221	276	218	85	197
March	169	180	195	183	218	226	274	218	86	192
April	187	184	197	189	223	226	266	229	87	201
May	204	189	197	184	220	222	270	249	90	211
June	209	189	188	183	218	220	289	249	88	217
July	206	193	187	199	203	215	296	265	89	220
August	207	204	193	204	210	234	298	264	87	227
September	205	199	177	197	204	224	302	211	84	217
October	201	197	170	189	202	214	299	188	81	214
November	210	195	173	188	201	216	302	192	82	223
December	214	199	175	188	191	200	277	183	82	223
1920—January	216	200	178	190	203	223	288	190	85	229
February	212	200	176	194	219	237	284	191	86	231
March	216	194	172	188	214	228	275	183	88	230
April	221	193	167	188	210	226	285	181	90	237
May	233	191	163	177	208	221	283	186	92	244
June	228	190	171	173	192	203	221	184	90	246
July	225	186	168	170	180	194	169	188	89	242
August	223	195	169	177	176	197	162	186	87	225
September	215	191	163	175	170	188	165	187	84	207
October	211	181	153	171	158	180	163	184	80	191
November	203	162	143	160	149	176	147	167	75	168
December	195	148	129	138	124	143	118	128	71	143
1921—January	173	141	125	138	115	146	106	124	69	133
February	165	133	118	134	110	130	107	121	69	128
March	163	134	120	131	110	127	101	123	70	122
April	159	130	111	114	101	117	99	105	68	113
May	156	127	109	115	103	120	90	105	68	107
June	125	121	104	110	100	120	88	101	68	106
July	127	......	......	......	......	......	......	......	......	......
Yearly averages:										
1910	102	88	92	95	114	108	116	113	103	104
1911	92	91	86	90	91	90	90	87	100	96
1912	103	95	98	96	93	95	101	93	99	99
1913	106	114	114	111	100	103	94	104	100	99
1914	100	123	120	116	106	107	99	105	95	100
1915	102	121	116	113	116	116	127	91	92	100
1916	111	127	125	123	139	139	156	113	92	118
1917	141	149	157	155	210	209	267	188	93	179
1918	169	173	182	176	240	237	325	220	92	203
1919	199	191	187	189	210	220	287	224	86	212
1920	217	186	163	175	184	201	213	180	85	216

PURCHASING POWER OF FARM PRODUCTS.

Unchangeable measures of length and weight are now in use, so that no further calculation is necessary after the inches, pounds, or grams are known, but there is no unchangeable measure of value. The value of gold itself changes and money itself follows the law of supply and demand.

Probably the best measure of the general price level is the index number of wholesale prices of all commodities as given by the Bureau of Labor Statistics. (See Table II.)

If the index number for the price of a particular farm product is compared with the index number of wholesale prices of all commodities, it is possible to determine whether or not the price is relatively high. The index numbers for each farm product are given in Table XVIII. If these are divided by the index numbers of wholesale prices as given on page 3, the purchasing power is obtained. If the purchasing power is 100, it means that the product can be exchanged for the usual quantity of other things. That is, if a farmer sold a given quantity of this product and used the money to buy all kinds of other commodities at wholesale he would be able to buy the normal quantity. If the purchasing power is 50, it means that he would be able to buy half the normal amount.

TABLE XIX.—*Purchasing power of farm products at prices paid to producers in the United States.*

[Five-year average, August, 1909, to July, 1914=100.]

Year and month.	Corn.	Oats.	Wheat.	Barley.	Rye.	Buckwheat.	Flaxseed.	Beans.	Broom corn.	Cotton.	Cotton seed.
1909—August	111	122	123	105	111	110	85	......	......	94	......
September	103	111	112	95	104	107	76	......	......	99	......
October	101	108	110	90	103	106	76	......	......	106	......
November	102	108	114	89	103	103	85	......	......	114	......
December	101	106	115	89	101	100	95	96	......	114	......
1910—January	107	111	118	94	105	99	106	99	184	119	......
February	110	114	118	93	105	101	113	100	191	115	......
March	108	114	117	95	106	99	110	99	188	112	......
April	105	113	118	93	106	102	112	99	194	114	......
May	99	106	112	88	105	98	120	97	201	112	......
June	97	104	108	87	103	98	112	100	170	113	......
July	97	102	110	89	104	100	111	103	189	110	......
August	95	97	109	90	101	96	125	101	146	114	......
September	94	99	110	97	105	99	132	102	135	119	127
October	91	95	108	94	102	100	142	100	109	111	129
November	87	93	104	94	101	96	141	98	101	118	124
December	86	92	105	97	102	96	148	100	108	118	120
1911—January	86	89	104	101	106	96	140	101	81	121	124
February	85	87	104	104	103	94	141	103	80	121	121
March	84	85	99	103	104	94	142	103	76	115	119
April	82	82	97	110	107	93	130	103	72	115	119
May	83	84	98	119	109	94	143	100	84	118	118
June	84	86	98	118	109	96	132	98	79	119	110
July	89	92	98	116	108	94	126	99	72	115	108
August	94	95	92	115	104	99	120	99	75	107	105
September	95	105	99	132	110	102	124	102	90	99	89
October	99	112	103	138	113	99	126	102	123	86	82
November	107	117	105	144	117	106	130	107	131	76	82
December	110	120	104	146	119	106	116	110	126	73	79
1912—January	108	118	102	142	117	105	116	107	98	69	77
February	110	121	102	144	117	105	113	108	84	75	78
March	110	124	102	145	117	109	106	111	94	79	82
April	112	125	102	141	115	105	108	106	94	79	80
May	121	133	109	145	115	107	101	109	81	85	83
June	120	129	111	138	115	110	115	111	86	85	86
July	115	124	111	130	114	107	116	105	87	86	87
August	110	102	96	108	104	105	102	105	84	94	90
September	107	88	96	88	97	102	95	104	73	91	83
October	101	85	93	88	95	95	87	101	69	91	84
November	93	86	93	87	93	91	78	99	70	88	87
December	83	82	86	81	91	92	71	101	64	96	96
1913—January	82	82	85	80	87	93	65	98	47	97	98
February	83	80	87	79	93	96	63	97	53	96	98
March	84	81	89	76	86	93	67	94	53	93	95
April	84	80	87	74	85	93	65	94	54	93	94
May	87	82	89	73	86	97	64	95	52	91	96
June	89	85	90	81	86	93	65	96	67	90	97
July	89	88	91	85	85	90	67	95	58	89	98
August	90	85	83	82	81	90	69	91	91	89	100
September	103	98	85	90	85	92	74	89	99	94	99
October	108	100	86	91	87	100	72	96	99	107	102
November	112	96	84	88	85	104	69	96	100	104	105
December	119	101	91	87	87	106	74	93	103	98	106
1914—January	118	100	91	83	86	106	75	94	89	93	102
February	114	98	90	81	84	105	74	93	91	97	105
March	113	96	92	80	86	105	75	93	86	101	105
April	115	99	96	81	88	108	78	97	86	97	107
May	109	94	91	75	85	104	75	100	83	95	103
June	110	95	92	75	87	103	77	96	97	97	107
July	109	93	88	77	87	108	81	97	92	98	106

NOTE.—Index number of prices as given in Table XVIII divided by index numbers of wholesale prices as given in Table II.

TABLE XIX.—*Purchasing power of farm products at prices paid to producers in the United States*—Continued.

Year and month.	Hay.	Timothy seed.	Clover seed.	Cabbage.	Onions.	Potatoes.	Sweet potatoes.	Peanuts.	Apples.	Chickens.	Eggs.
1909—August	90	......	......	......	......	100	......	......	......	100	115
September	88	......	......	......	......	93	......	......	......	99	69
October	90	......	......	......	......	95	......	......	......	99	102
November	91	......	......	......	......	96	......	......	......	98	100
December	86	......	......	......	91	88	98	......	116	101	95
1910—January	89	......	92	111	91	89	95	107	110	102	103
February	94	......	88	114	88	86	92	110	106	102	110
March	96	......	84	113	76	81	90	103	103	103	106
April	95	......	81	112	81	70	89	108	100	103	109
May	92	......	80	130	80	56	86	107	99	106	112
June	89	......	81	91	85	55	84	105	98	106	111
July	91	......	81	90	86	55	83	103	93	104	110
August	95	......	83	90	95	73	81	92	96	104	101
September	100	104	95	113	101	92	88	95	104	104	103
October	98	109	94	108	96	99	93	99	106	101	103
November	99	112	91	101	98	93	96	104	111	103	102
December	101	114	92	98	101	92	96	100	108	101	99
1911—January	103	113	95	95	101	89	99	99	114	101	106
February	101	119	92	85	95	87	99	105	118	100	87
March	99	125	92	69	91	86	99	103	115	98	79
April	97	129	93	67	97	84	101	101	119	97	90
May	100	132	96	67	103	94	106	102	119	97	92
June	103	136	100	105	109	94	106	103	115	96	90
July	112	143	101	116	102	133	110	100	115	96	87
August	123	169	107	119	111	156	111	109	108	97	90
September	122	186	118	114	107	146	112	108	102	98	93
October	120	189	121	109	106	131	111	100	97	96	93
November	120	189	122	112	106	128	108	98	93	94	95
December	119	187	122	119	115	132	103	98	87	92	98
1912—January	118	189	123	113	115	136	107	94	93	93	101
February	121	187	130	125	125	145	109	97	94	95	112
March	122	180	134	154	140	152	112	104	93	94	114
April	126	173	130	152	135	169	116	96	93	92	102
May	130	170	129	136	133	179	119	98	97	92	100
June	129	165	126	108	121	169	118	98	94	92	98
July	117	149	117	87	91	136	120	94	91	90	98
August	104	80	106	88	93	96	110	100	93	95	98
September	97	56	105	71	88	80	100	98	89	95	98
October	94	51	106	72	85	73	98	98	84	97	98
November	94	48	103	75	83	74	99	100	80	98	100
December	94	48	100	73	82	80	100	98	76	99	98
1913—January	93	47	103	74	78	79	100	98	75	98	89
February	88	44	107	64	68	79	100	90	73	98	85
March	86	41	106	54	64	76	100	96	73	97	88
April	84	41	111	55	61	73	97	94	72	99	94
May	84	43	112	72	66	68	95	95	72	99	95
June	85	44	106	89	75	79	95	95	78	101	100
July	85	48	108	101	82	66	96	98	89	100	100
August	89	50	100	99	97	76	95	97	99	103	96
September	94	56	81	100	102	91	98	99	103	104	99
October	97	52	78	111	109	104	96	99	110	105	103
November	97	54	83	112	113	111	96	93	115	105	105
December	100	56	85	110	113	109	100	102	114	105	109
1914—January	98	54	87	109	115	107	99	100	109	105	102
February	96	53	84	114	124	105	100	95	112	106	107
March	96	56	84	108	129	105	98	97	115	107	112
April	96	56	84	111	126	104	97	99	117	108	104
May	93	56	81	93	116	101	95	102	114	104	99
June	93	55	87	107	111	102	97	97	114	105	103
July	94	59	91	104	139	110	90	102	111	107	105

TABLE XIX.—*Purchasing power of farm products at prices paid to producers in the United States*—Continued.

Year and month.	Butter.	Milch cows.	Beef cattle.	Veal calves.	Sheep.	Lambs.	Wool.	Hogs.	Horses.	Weighted average of 31 products.
1909—August	100	......	......	......	......	......	......	......	......	105
September	99	......	......	......	......	......	......	......	......	102
October	100	......	......	......	......	......	......	......	......	103
November	100	......	......	......	......	......	......	......	......	106
December	98	......	92	......	121	127	134	111	......	106
1910—January	101	87	93	95	122	101	132	110	101	107
February	103	85	91	93	112	111	133	111	103	107
March	101	84	91	94	117	117	132	120	103	107
April	102	85	97	97	120	116	124	122	105	107
May	104	87	96	97	118	113	129	120	104	105
June	104	89	97	98	116	114	112	119	105	104
July	103	88	92	96	121	111	110	113	105	103
August	102	92	91	95	109	103	111	107	103	102
September	105	92	92	96	114	108	105	111	103	106
October	103	92	92	95	113	109	108	111	104	104
November	103	93	91	97	114	106	108	111	106	105
December	101	92	92	97	104	97	98	105	105	103
1911—January	101	98	94	99	100	102	97	109	106	105
February	92	96	92	97	98	94	97	102	104	102
March	91	96	91	97	96	91	93	94	104	99
April	92	94	88	91	93	92	90	84	104	97
May	91	94	86	90	95	93	86	82	105	98
June	89	91	84	87	92	90	92	81	103	97
July	91	89	82	87	94	91	90	84	100	99
August	94	92	87	91	93	96	92	91	100	99
September	97	92	89	92	94	94	94	89	100	99
October	95	92	87	92	90	89	94	85	100	96
November	96	91	89	93	90	90	94	86	101	96
December	100	91	91	91	85	85	85	85	100	96
1912—January	100	92	89	90	86	91	89	83	97	94
February	108	92	91	91	89	88	89	82	97	98
March	105	90	90	88	86	86	90	80	97	98
April	101	89	92	90	88	91	94	87	95	99
May	103	90	95	93	94	93	98	92	98	103
June	104	90	94	92	93	94	105	91	98	103
July	100	91	95	92	90	92	106	90	98	100
August	100	97	104	98	97	100	105	95	97	98
September	98	98	103	99	94	98	108	98	97	96
October	98	98	103	99	98	99	107	102	98	95
November	99	97	102	98	96	99	108	99	99	94
December	100	99	106	100	92	94	98	97	99	94
1913—January	98	103	105	102	93	102	99	94	99	93
February	99	106	107	105	100	105	99	99	100	93
March	104	108	109	106	102	103	96	101	99	94
April	107	110	109	107	100	100	96	103	99	94
May	108	110	108	108	98	102	91	102	100	94
June	108	110	110	110	101	100	88	105	100	96
July	106	110	110	109	90	97	89	106	99	95
August	104	115	113	111	97	97	87	104	96	95
September	104	116	113	111	96	98	90	100	96	98
October	104	116	116	111	97	100	89	100	96	102
November	103	117	117	111	100	103	89	102	96	102
December	102	117	119	113	98	97	85	101	97	103
1914—January	101	121	118	114	100	104	83	104	97	101
February	100	123	120	116	102	103	84	108	96	102
March	99	120	118	113	99	100	87	104	95	102
April	99	122	115	115	99	101	94	104	96	102
May	94	119	113	113	96	98	95	103	95	99
June	96	120	115	113	98	102	104	103	93	100
July	100	122	120	116	104	108	106	106	96	102

TABLE XIX.—*Purchasing power of farm products at prices paid to producers in the United States*—Continued.

Year and month.	Corn.	Oats.	Wheat.	Barley.	Rye.	Buckwheat.	Flaxseed.	Beans.	Broom corn.	Cotton	Cotton seed.
1914—August	106	83	82	72	81	101	87	110	91	96	100
September	110	104	102	85	102	104	80	105	71	68	64
October	113	110	105	83	108	107	75	93	66	63	72
November	112	110	108	84	109	109	70	100	67	51	66
December	112	114	114	89	120	108	78	106	65	55	80
1915—January	114	117	123	89	126	110	83	117	64	54	87
February	120	125	142	97	135	116	94	133	75	60	104
March	123	129	149	107	146	120	90	132	64	59	99
April	120	131	147	100	137	117	96	127	67	64	99
May	118	127	152	96	138	114	94	126	74	71	96
June	114	122	144	95	132	114	96	123	85	67	94
July	109	109	115	88	126	114	88	117	80	66	90
August	109	103	114	91	117	112	83	116	83	63	100
September	109	98	108	87	120	110	85	120	72	70	101
October	101	86	101	75	110	100	86	125	83	90	156
November	96	88	101	80	114	108	94	131	91	92	158
December	94	89	100	79	109	105	102	137	107	87	152
1916—January	96	91	105	80	106	103	103	138	90	83	150
February	99	100	113	86	107	101	109	137	89	83	148
March	97	91	100	82	103	102	101	132	85	78	142
April	96	88	94	75	97	97	99	132	77	79	142
May	93	86	95	77	97	97	91	131	84	76	140
June	90	83	91	76	94	95	83	133	93	79	135
July	89	80	87	80	94	97	80	181	88	80	138
August	88	74	93	77	90	90	83	161	98	80	142
September	90	85	115	95	108	90	88	157	95	92	152
October	89	85	115	93	107	93	88	144	124	94	166
November	95	88	123	95	110	100	97	170	122	102	184
December	105	93	125	97	115	108	104	173	131	108	173
1917—January	101	88	112	93	108	108	101	166	117	91	157
February	102	89	117	92	108	102	94	173	123	87	148
March	102	87	113	94	108	109	90	183	124	79	147
April	105	87	117	91	107	102	89	194	124	83	141
May	127	93	149	101	124	112	93	214	137	82	134
June	126	89	146	98	132	129	90	207	132	85	139
July	126	87	133	92	130	140	88	186	107	103	140
August	146	91	132	99	128	128	85	171	167	102	152
September	132	85	128	99	122	119	97	160	124	103	149
October	140	88	124	102	128	117	101	178	147	105	169
November	127	87	122	99	126	118	96	177	164	122	180
December	121	95	126	102	126	123	100	169	172	123	169

TABLE XIX.—*Purchasing power of farm products at prices paid to producers in the United States*—Continued.

Month and year.	Hay.	Timothy seed.	Clover seed.	Cabbage.	Onions.	Potatoes.	Sweet potatoes.	Peanuts.	Apples.	Chickens.	Eggs.
1914—August	92	60	93	81	127	96	98	97	99	106	102
September	94	64	100	84	100	90	95	100	88	105	106
October	94	62	93	87	88	92	101	94	80	106	105
November	91	62	91	81	83	85	98	94	73	104	98
December	90	58	91	80	91	78	101	92	69	105	99
1915—January	89	70	95	80	86	79	101	98	70	105	107
February	88	67	89	76	85	75	96	88	68	104	109
March	90	67	88	73	79	74	96	87	67	103	98
April	90	64	85	97	81	69	96	89	66	102	96
May	88	65	84	116	77	72	96	96	69	101	100
June	90	66	86	96	81	72	100	91	73	102	98
July	87	64	86	74	74	68	94	89	81	100	98
August	87	63	84	75	80	62	86	89	86	101	95
September	88	72	97	72	84	63	91	92	84	104	98
October	83	71	108	66	94	69	83	88	84	100	98
November	83	75	108	68	92	96	80	88	88	101	100
December	81	73	106	64	93	93	81	85	76	100	96
1916—January	77	73	103	62	98	101	74	83	73	96	92
February	78	72	98	59	99	119	75	80	75	96	90
March	77	70	97	64	94	122	76	79	73	94	85
April	76	72	92	63	83	121	71	78	70	93	89
May	77	67	88	75	79	113	68	78	67	93	90
June	77	68	86	78	88	117	72	74	71	94	94
July	75	65	84	69	98	113	70	74	87	95	97
August	69	47	79	85	101	85	71	74	80	93	94
September	66	47	75	96	95	105	74	71	84	92	94
October	62	45	72	119	99	119	73	69	85	90	94
November	59	41	73	131	107	152	73	66	79	88	87
December	62	42	72	131	118	158	80	68	72	89	86
1917—January	61	42	70	153	132	154	75	70	68	85	83
February	59	40	66	199	201	166	73	68	68	85	86
March	59	40	66	222	245	221	78	71	70	85	96
April	60	39	61	214	225	198	76	71	67	80	87
May	62	41	60	190	166	218	78	80	66	80	98
June	63	41	60	112	130	210	83	79	68	79	99
July	61	41	62	67	87	177	81	79	78	77	89
August	60	44	61	55	78	102	71	77	85	77	90
September	63	48	67	55	77	94	76	74	81	80	94
October	66	53	74	66	88	96	75	71	81	85	92
November	70	47	81	104	96	113	78	83	83	85	83
December	76	50	83	79	96	108	84	83	77	89	78

TABLE XIX.—*Purchasing power of farm products at prices paid to producers in the United States*—Continued.

Year and month.	Butter.	Milk cows.	Beef cattle.	Veal calves.	Sheep.	Lambs.	Wool.	Hogs.	Horses.	Weighted average of 31 products.
1914—August	99	127	123	119	110	111	104	108	91	99
September	100	122	120	114	109	111	105	104	89	96
October	100	124	120	115	113	112	105	99	92	95
November	97	121	118	113	111	114	105	99	92	92
December	100	120	121	112	110	106	99	95	94	94
1915—January	101	124	119	113	108	112	101	93	94	96
February	101	119	114	111	111	110	107	87	90	99
March	102	118	111	107	111	96	121	84	91	99
April	101	116	107	107	109	113	125	84	89	99
May	102	116	109	110	110	111	122	92	90	102
June	105	117	113	110	113	114	134	94	90	101
July	103	119	111	114	114	115	134	91	91	95
August	101	122	118	115	117	118	132	88	89	95
September	101	125	119	115	119	123	137	91	92	96
October	96	120	116	113	120	121	130	94	89	98
November	95	115	113	110	120	122	129	88	88	98
December	92	110	109	106	112	111	117	81	86	94
1916—January	89	109	104	101	107	113	113	80	82	93
February	89	107	104	103	115	116	116	88	80	96
March	91	105	103	101	115	112	120	91	78	93
April	92	104	103	100	110	113	124	92	77	92
May	94	103	102	103	112	109	131	97	78	92
June	93	102	105	102	114	110	136	95	75	92
July	92	104	104	104	114	110	134	95	77	93
August	88	104	101	102	113	117	131	93	72	90
September	87	101	99	99	113	115	128	95	71	96
October	83	96	92	93	109	110	125	87	68	95
November	79	90	88	88	105	108	119	86	64	97
December	82	89	89	87	101	99	111	85	63	99
1917—January	78	88	89	88	104	108	112	85	61	93
February	78	87	91	92	114	112	112	92	58	94
March	81	86	92	88	118	113	120	102	56	96
April	76	84	90	89	110	107	124	103	53	95
May	79	80	86	86	111	105	134	103	52	102
June	79	78	85	84	110	107	152	101	50	102
July	77	78	83	85	108	97	164	97	50	101
August	77	82	85	84	114	115	165	103	48	101
September	80	85	89	88	127	128	172	112	50	101
October	83	87	89	89	133	143	178	119	51	104
November	82	84	88	85	132	140	178	118	50	106
December	81	86	90	88	126	126	169	123	51	106

TABLE XIX.—*Purchasing power of farm products at prices paid to producers in the United States*—Continued.

Year and month.	Corn.	Oats.	Wheat.	Barley.	Rye.	Buckwheat.	Flaxseed.	Beans.	Broom corn.	Cotton.	Cotton seed.
1918—January	123	102	122	110	126	122	102	165	128	124	163
February	123	105	118	109	126	120	101	168	130	128	161
March	134	113	120	135	148	125	106	168	121	128	162
April	128	114	118	137	168	122	113	164	109	133	155
May	125	108	118	126	159	125	110	152	107	117	157
June	114	95	113	107	129	128	105	138	125	110	153
July	109	90	114	95	116	125	103	126	121	111	147
August	109	82	108	88	107	119	117	131	115	107	150
September	110	85	110	80	105	121	108	119	136	125	154
October	112	88	112	76	102	120	110	116	127	126	151
November	108	85	110	74	100	117	95	116	100	115	148
December	114	89	113	72	101	113	101	103	93	108	142
1919—January	120	89	113	72	102	112	98	107	79	113	143
February	115	81	115	68	96	111	90	101	68	101	147
March	111	76	114	66	90	102	92	99	81	95	140
April	116	78	116	70	97	100	97	98	69	96	137
May	120	81	122	76	103	96	98	88	72	98	135
June	119	80	119	80	92	103	105	90	56	109	137
July	114	76	114	79	86	91	119	83	56	110	134
August	116	76	102	84	88	91	138	82	55	112	145
September	116	81	104	86	86	96	137	86	66	110	133
October	100	78	105	83	83	99	115	82	71	114	140
November	92	77	103	83	77	91	98	84	71	129	149
December	97	77	103	82	78	86	113	81	76	121	130
1920—January	95	80	105	84	84	84	106	83	62	115	126
February	97	82	104	85	83	86	105	79	47	117	124
March	95	82	99	80	79	86	106	77	48	114	118
April	94	83	98	81	80	84	97	74	51	111	112
May	95	87	101	82	92	84	92	70	53	108	112
June	100	89	103	84	91	87	87	71	59	107	110
July	100	94	108	86	97	96	80	72	44	110	107
August	90	74	99	78	89	90	70	72	57	114	86
September	88	73	100	71	96	96	70	69	48	103	58
October	78	68	107	65	98	97	73	66	55	92	60
November	67	67	100	64	93	88	68	69	60	75	59
December	62	64	87	61	93	95	57	69	52	60	47
1921—January	64	65	94	58	97	98	56	72	38	51	48
February	61	62	98	53	106	98	53	75	40	57	53
March	65	63	100	55	107	99	53	81	42	50	52
April	64	62	96	54	104	96	52	78	42	48	48
May	60	58	80	50	95	104	46	78	43	49	50
June	61	60	93	53	101	101	55	81	56	51	52
Yearly average:											
1910	98	103	111	93	104	99	123	100	160	115	......
1911	92	96	100	121	109	98	132	102	91	105	105
1912	108	110	100	120	108	103	101	106	82	85	84
1913	94	88	87	82	86	96	68	95	73	95	99
1914	112	100	96	80	94	106	77	99	82	84	93
1915	111	110	125	90	126	112	91	125	79	70	111
1916	94	87	105	84	102	98	94	149	98	86	151
1917	121	89	127	97	121	117	94	182	137	97	152
1918	117	96	115	101	124	121	106	139	118	119	154
1919	111	79	111	77	90	98	108	90	68	109	139
1920	88	79	101	77	90	89	84	73	53	102	93

TABLE XIX.—*Purchasing power of farm products at prices paid to producers in the United States*—Continued.

Year and month.	Hay.	Timothy seed.	Clover seed.	Cabbage.	Onions.	Potatoes.	Sweet potatoes.	Peanuts.	Apples.	Chickens.	Eggs.
1918—January	81	50	86	86	92	102	79	80	70	88	83
February	83	51	92	95	85	98	78	77	72	91	99
March	84	49	95	81	65	95	86	81	71	94	99
April	80	47	95	76	55	70	84	86	69	89	94
May	76	48	91	78	54	60	82	87	65	87	96
June	71	45	89	75	56	55	79	77	65	86	90
July	66	46	81	66	66	63	72	75	72	88	91
August	67	48	80	68	75	77	72	77	78	93	95
September	72	49	89	67	78	88	79	82	82	93	90
October	77	52	104	70	70	100	91	70	89	95	90
November	79	55	110	69	68	99	91	68	86	95	88
December	79	54	111	62	63	92	90	63	74	97	88
1919—January	82	56	116	63	63	89	87	63	73	98	93
February	82	57	115	64	68	87	86	70	78	99	92
March	80	55	115	71	82	80	86	71	79	97	75
April	82	55	123	90	77	75	84	67	85	99	97
May	87	58	123	110	84	81	85	70	87	102	105
June	89	55	121	91	88	83	85	70	91	103	109
July	81	52	117	74	85	78	78	72	87	95	99
August	76	50	115	76	92	94	75	71	95	95	97
September	80	55	128	79	88	104	84	77	101	99	96
October	76	56	133	86	88	104	80	75	105	92	89
November	71	54	131	85	91	106	80	84	102	87	91
December	68	56	129	92	101	107	77	81	91	86	86
1920—January	69	57	124	101	108	113	70	85	87	83	87
February	71	56	130	111	107	130	74	84	82	87	85
March	72	54	129	109	107	142	77	91	83	88	84
April	70	51	123	101	100	161	74	81	84	86	84
May	72	49	114	114	94	205	76	83	84	84	81
June	73	50	105	82	76	221	82	78	88	84	81
July	74	49	107	69	63	194	87	81	102	85	82
August	71	44	85	60	65	133	90	67	98	91	89
September	71	39	81	47	71	94	87	67	77	93	93
October	72	38	66	57	70	85	83	53	80	99	99
November	71	39	64	58	68	92	75	54	80	98	106
December	75	45	59	59	68	97	82	53	69	107	113
1921—January	76	45	67	62	72	93	80	53	67	107	114
February	74	41	65	60	68	85	82	49	73	118	111
March	72	44	69	55	58	76	83	50	73	119	82
April	71	44	71	64	49	73	87	45	75	123	76
May	70	46	74	94	54	64	85	45	76	120	79
June	68	50	74	111	73	64	89	48	91	116	77
Yearly average:											
1910	95	......	87	106	90	78	89	103	103	103	106
1911	110	151	105	98	104	113	106	102	109	97	92
1912	112	125	117	105	108	124	109	98	90	94	101
1913	90	48	98	87	86	84	97	96	89	101	97
1914	94	58	89	97	112	98	97	97	100	106	104
1915	87	68	93	80	84	74	92	90	76	102	99
1916	71	59	85	86	97	119	73	75	76	93	91
1917	63	44	68	126	135	155	77	76	74	82	90
1918	76	50	94	74	69	83	82	77	74	91	92
1919	80	55	122	82	84	91	82	73	90	96	94
1920	72	48	99	81	83	139	80	73	85	90	90

TABLE XIX.—*Purchasing power of farm products at prices paid to producers in the United States*—Continued.

Year and month.	Butter.	Milch cows.	Beef cattle.	Veal calves.	Sheep.	Lambs.	Wool.	Hogs.	Horses.	Weighted average, 31 products.
1918—January	80	86	87	87	121	126	166	115	50	105
February	85	86	88	87	124	122	163	111	49	105
March	88	87	88	86	125	119	169	111	50	107
April	83	87	92	90	122	123	173	108	49	106
May	84	88	98	91	128	123	169	113	49	103
June	83	87	97	89	123	121	166	109	47	98
July	82	85	93	90	119	115	162	106	46	98
August	82	87	92	89	123	124	158	111	44	97
September	80	86	89	87	119	118	160	110	42	100
October	88	86	88	87	119	118	163	107	43	102
November	88	84	86	84	116	112	158	109	42	99
December	90	85	90	87	101	100	144	109	42	98
1919—January	93	88	92	88	101	106	144	108	42	100
February	91	90	98	90	109	110	137	108	42	98
March	82	88	95	89	106	110	134	106	42	94
April	90	89	95	91	108	109	129	111	42	97
May	97	90	94	88	105	106	129	119	43	100
June	99	89	89	86	103	104	136	117	42	102
July	92	87	84	89	91	96	133	119	40	99
August	89	88	83	88	90	100	128	113	37	97
September	91	88	79	88	91	100	134	94	37	96
October	88	86	75	83	89	94	131	82	36	94
November	89	83	74	80	86	92	129	82	35	95
December	88	82	72	77	79	82	114	75	34	92
1920—January	85	79	70	75	80	88	114	75	34	91
February	83	79	69	76	86	93	112	75	34	91
March	84	75	67	73	83	89	107	71	34	89
April	82	71	62	70	78	84	106	67	33	88
May	84	69	59	64	75	80	103	67	33	88
June	83	69	62	63	70	74	80	67	33	89
July	84	69	63	63	67	72	63	70	33	90
August	86	76	66	69	68	76	63	72	34	87
September	87	77	66	71	69	76	67	75	34	83
October	92	79	67	74	69	78	71	80	35	83
November	96	76	67	75	70	83	69	79	35	79
December	101	77	67	72	64	74	61	66	37	74
1921—January	96	78	69	76	64	81	59	69	38	73
February	96	78	69	78	64	76	63	71	40	75
March	99	81	73	79	67	77	61	75	42	74
April	101	83	71	73	64	75	63	67	43	72
May	102	83	71	75	67	78	59	69	44	70
June	83	80	69	73	66	79	58	67	45	70
Yearly averages:										
1910	103	89	93	96	115	109	117	113	104	105
1911	94	93	88	92	93	92	92	89	102	99
1912	101	94	97	94	92	94	100	91	98	98
1913	104	112	111	109	98	100	92	101	98	97
1914	99	122	118	114	104	106	98	103	94	99
1915	100	118	113	111	114	114	124	89	90	98
1916	88	101	100	99	111	111	124	90	74	94
1917	79	84	88	87	117	117	148	105	53	100
1918	84	86	91	88	120	118	163	110	46	102
1919	91	87	86	86	97	101	132	103	39	97
1920	87	75	65	70	73	81	85	72	34	86

PURCHASING POWER PER ACRE.

Farm prices are not available before 1908 except for December 1. The purchasing power for crops at December 1 prices are given on pages 67 to 71.

Purchasing power per acre harvested is also included. If the crop is an average one, the purchasing power per bushel and per acre is the same, but in a year of high yields, the purchasing power per acre is higher than the price suggests and in a year of low yield, the purchasing power per acre is much less than prices indicate. These facts lead to much misunderstanding between city and country in a short crop year. Farmers are, of course, concerned with the returns per acre, whereas consumers are concerned with price per bushel. The farmer's situation, therefore, is not what it appears to be to the consumers.

Purchasing power per acre sown is given for winter wheat on page 72. This can not be calculated for other crops, because the abandoned acreage is not reported. The abandoned acreage for other crops is often very large, particularly in semiarid regions in dry years.

The tables for purchasing power per acre may be continued for later years by using new figures given in the Monthly Crop Reporter for December. The figure for the year in question is divided by the five-year average before the war and the number thus obtained is divided by the index number of wholesale prices as given in Table II, to obtain the purchasing power.

TABLE XX.—*Farm price and purchasing power of corn in the United States at December 1 prices.*[1]

Year.	Price per bushel, in currency.	Purchasing power per bushel—1910-1914 = 100.	Value per acre harvested, in currency.	Purchasing power per acre harvested—1910-1914 = 100.	Year.	Price per bushel, in currency.	Purchasing power per bushel—1910-1914 = 100.	Value per acre harvested, in currency.	Purchasing power per acre harvested—1910-1914 = 100.
	Cents.					*Cents.*			
1867	76.8	86	$18.14	79	1894	45.7	109	$8.86	82
1868	63.3	75	16.44	76	1895	25.3	62	6.64	63
1869	72.7	91	17.11	84	1896	21.5	54	6.06	60
1870	54.7	73	15.49	81	1897	26.3	65	6.26	61
1871	47.4	64	13.79	73	1898	28.7	67	7.10	64
1872	39.6	53	12.18	64	1899	30.3	64	7.66	63
1873	48.6	67	11.56	62	1900	35.7	74	9.02	73
1874	65.2	92	13.50	75	1901	60.5	125	10.09	81
1875	41.8	63	12.31	72	1902	40.3	79	10.81	83
1876	36.7	59	9.59	61	1903	42.5	87	10.82	86
1877	35.8	63	9.54	65	1904	44.1	88	11.79	92
1878	31.7	60	8.55	63	1905	41.2	79	11.88	88
1879	37.5	68	10.94	78	1906	39.9	71	12.06	84
1880	39.6	69	10.91	74	1907	51.6	93	13.38	94
1881	63.6	110	11.82	80	1908	60.6	112	15.88	114
1882	48.5	84	11.94	81	1909	57.9	99	15.02	100
1883	42.4	77	9.63	68	1910	48.0	84	13.31	91
1884	35.7	69	9.19	69	1911	61.8	108	14.79	101
1885	32.8	65	8.69	68	1912	48.7	82	14.20	93
1886	36.6	74	8.06	63	1913	69.1	116	15.99	105
1887	44.4	89	8.92	69	1914	64.4	109	16.65	110
1888	34.1	67	8.95	69	1915	57.5	92	16.22	101
1889	28.3	56	7.63	59	1916	88.9	102	21.66	97
1890	50.6	102	10.48	82	1917	127.9	119	33.58	121
1891	40.6	84	10.98	88	1918	136.5	111	32.70	104
1892	39.4	85	9.09	76	1919	134.9	95	38.54	106
1893	36.5	81	8.21	71	1920	67.7	60	20.93	73

[1] Prices as reported by the Department of Agriculture are converted to currency basis during the Civil War period by using the premium on gold as reported by the Treasury Department. Purchasing power is calculated by dividing the price index by the index numbers of prices of all commodities for December (Table II.) Before 1900 the index numbers are not available for December. The average for the year and following year is then used.

TABLE XXI.—*Farm price and purchasing power of oats in the United States at December 1 prices.*[1]

Year.	Price per bushel, in currency.	Purchasing power per bushel—1910–1914 = 100.	Value per acre harvested, in currency.	Purchasing power per acre harvested—1910–1914 = 100.	Year.	Price per bushel, in currency.	Purchasing power per bushel—1910–1914 = 100.	Value per acre harvested, in currency.	Purchasing power per acre harvested—1910–1914 = 100.
	Cents.					*Cents.*			
1867	60.0	101	$16.57	93	1894	32.4	116	$7.95	95
1868	56.4	100	14.87	88	1895	19.9	73	5.87	72
1869	46.2	87	14.07	88	1896	18.7	71	4.81	61
1870	43.2	87	12.14	82	1897	21.2	79	5.75	72
1871	39.6	80	12.10	82	1898	25.5	89	7.23	84
1872	33.5	68	10.13	68	1899	24.9	79	7.52	80
1873	38.1	79	10.55	73	1900	25.8	80	7.63	79
1874	52.6	112	11.59	82	1901	39.9	124	10.29	107
1875	36.4	82	10.84	82	1902	30.7	91	10.60	105
1876	35.0	85	8.38	68	1903	34.1	105	9.68	99
1877	29.2	77	9.26	81	1904	31.3	94	10.05	101
1878	24.6	70	7.73	73	1905	29.1	83	9.88	94
1879	33.1	91	9.50	87	1906	31.7	85	9.89	89
1880	36.0	95	9.28	81	1907	44.3	120	10.51	95
1881	46.4	121	11.48	100	1908	47.2	131	11.78	109
1882	37.5	98	9.89	86	1909	40.2	104	11.52	99
1883	32.7	89	9.20	83	1910	34.4	90	10.88	96
1884	27.7	80	7.58	73	1911	45.0	118	10.98	96
1885	28.5	85	7.88	79	1912	31.9	81	11.93	101
1886	29.8	90	7.87	80	1913	39.2	99	11.45	97
1887	30.4	91	7.74	77	1914	43.8	112	12.99	111
1888	27.8	82	7.24	72	1915	36.1	87	13.65	110
1889	22.9	69	6.26	63	1916	52.4	91	15.80	91
1890	42.4	129	8.40	85	1917	66.6	93	24.37	113
1891	31.5	98	9.08	94	1918	70.9	87	24.59	101
1892	31.7	102	7.73	83	1919	71.7	76	21.12	75
1893	29.4	98	6.88	77	1920	47.2	63	16.61	74

[1] Prices as reported by the Department of Agriculture are corrected to currency basis during the Civil War period by using the premium on gold as reported by the Treasury Department. Purchasing power is calculated by dividing the price index by the index number of prices of all commodities for December (Table II). Before 1900 the index numbers are not available for December. The average for the year and following year is then used.

TABLE XXII.—*Farm price and purchasing power of wheat in the United States at December 1 prices.*[1]

Year.	Price per bushel, in currency.	Purchasing power per bushel—1910–1914=100.	Value per acre harvested, in currency.	Purchasing power per acre harvested—1910–1914=100.	Year.	Price per bushel, in currency.	Purchasing power per bushel—1910–1914=100.	Value per acre harvested, in currency.	Purchasing power per acre harvested—1910–1914=100.
	Cents.					*Cents.*			
1867.....	195.7	148	$22.69	116	1894.....	49.1	79	$6.48	71
1868.....	146.7	118	17.81	96	1895.....	50.9	85	6.99	78
1869.....	92.9	79	12.61	72	1896.....	72.6	124	8.97	103
1870.....	104.5	95	12.99	80	1897.....	80.8	136	10.86	123
1871.....	125.1	115	14.47	89	1898.....	58.2	92	8.92	95
1872.....	125.0	114	14.98	92	1899.....	58.4	84	7.17	69
1873.....	117.6	110	14.92	94	1900.....	61.9	87	7.61	72
1874.....	96.4	93	11.90	77	1901.....	62.4	88	9.37	89
1875.....	101.9	104	11.29	78	1902.....	63.0	84	9.14	82
1876.....	104.7	115	10.96	81	1903.....	69.5	96	8.96	84
1877.....	108.7	129	15.06	121	1904.....	92.4	125	11.58	106
1878.....	77.7	99	10.16	88	1905.....	74.8	97	10.83	94
1879.....	110.8	137	15.27	127	1906.....	66.7	81	10.37	85
1880.....	95.1	113	12.48	100	1907.....	87.4	107	12.26	101
1881.....	119.2	140	12.12	93	1908.....	92.8	116	12.97	109
1882.....	88.4	104	12.02	95	1909.....	98.6	115	15.11	119
1883.....	91.1	112	10.52	87	1910.....	88.3	105	12.28	98
1884.....	64.5	84	8.38	74	1911.....	87.4	104	10.96	88
1885.....	77.1	104	8.05	73	1912.....	76.0	87	12.12	93
1886.....	68.7	94	8.54	79	1913.....	79.9	91	12.16	93
1887.....	68.1	92	8.25	75	1914.....	98.6	114	16.41	127
1888.....	92.6	124	10.32	93	1915.....	91.9	100	15.58	114
1889.....	69.8	95	8.98	82	1916.....	160.3	125	19.50	103
1890.....	83.8	115	9.28	86	1917.....	200.8	126	28.35	120
1891.....	83.9	118	12.86	121	1918.....	204.2	113	31.80	119
1892.....	62.4	91	8.35	82	1919.....	215.1	103	27.63	89
1893.....	53.8	81	6.16	63	1920.....	144.3	....	19.86	....

[1] Prices as reported by the Department of Agriculture are converted to currency basis during the Civil War period by using the premium on gold as reported by the Treasury Department. Purchasing power is calculated by dividing the price index by the index numbers of prices of all commodities for December, Table II. Before 1900 the index numbers are not available for December. The average for the year and following year is then used.

TABLE XXIII.—*Farm price and purchasing power of potatoes in the United States at December 1 prices.*[1]

Year.	Price per bushel, in currency.	Purchasing power per bushel—1910–1914 =100.	Value per acre harvested, in currency.	Purchasing power per acre harvested—1910–1914 =100.	Year.	Price per bushel, in currency.	Purchasing power per bushel—1910–1914 =100.	Value per acre harvested, in currency.	Purchasing power per acre harvested—1910–1914 =100.
	Cents.					*Cents.*			
1867	88.8	95	$72.90	82	1894	53.6	123	$33.43	80
1868	80.2	91	75.14	89	1895	26.6	63	26.73	66
1869	52.1	63	57.15	72	1896	28.6	69	26.09	66
1870	72.0	93	62.35	84	1897	54.7	131	35.36	88
1871	58.9	76	58.10	79	1898	41.4	92	31.11	73
1872	60.0	77	51.16	69	1899	39.0	79	34.61	74
1873	71.7	95	58.74	81	1900	43.1	86	34.78	72
1874	68.7	94	55.62	79	1901	76.7	152	50.27	105
1875	39.2	57	43.27	66	1902	47.1	89	45.22	90
1876	66.8	104	47.90	78	1903	61.4	120	51.98	107
1877	44.9	75	42.61	75	1904	45.3	87	49.96	100
1878	58.8	106	41.08	78	1905	61.7	113	53.66	103
1879	43.6	76	43.09	79	1906	51.1	83	52.29	94
1880	48.3	81	43.98	77	1907	61.8	107	58.88	107
1881	91.0	151	48.62	85	1908	70.6	125	60.50	112
1882	55.7	93	43.88	77	1909	54.1	89	59.76	103
1883	42.2	73	38.38	70	1910	55.7	94	52.30	92
1884	39.6	73	34.00	66	1911	79.9	134	64.60	114
1885	44.7	86	34.49	69	1912	50.5	82	57.28	97
1886	45.7	90	34.30	70	1913	68.7	111	62.13	105
1887	68.2	131	38.82	78	1914	48.7	79	53.75	92
1888	40.2	76	32.14	64	1915	61.7	95	59.45	96
1889	35.4	68	27.42	55	1916	146.1	162	117.62	136
1890	75.8	147	42.36	86	1917	122.8	109	123.81	116
1891	35.8	71	33.52	70	1918	119.3	94	114.44	94
1892	66.1	136	40.65	88	1919	161.4	109	143.93	102
1893	59.4	127	41.71	94	1920	116.4	99	127.51	114

[1] Prices as reported by the Department of Agriculture are converted to currency basis during the Civil War period by using the premium on gold as reported by the Treasury Department. Purchasing power is calculated by dividing the price index by the index numbers of prices of all commodities for December. (Table II.) Before 1900 the index numbers are not available for December. The average for the year and following year is then used.

TABLE XXIV.—*Farm price and purchasing power of cotton in the United States at December 1 prices.*[1]

Year.	Price per pound in currency.	Purchasing power per pound—1910-14=100.	Value per acre harvested in currency.	Purchasing power per acre harvested—1910-14=100.	Year.	Price per pound in currency.	Purchasing power per pound—1910-14=100.	Value per acre harvested in currency.	Purchasing power per acre harvested—1910-14=100.
	Cents.					*Cents.*			
1876	9.7	85	$16.14	72	1900	9.2	103	$18.58	150
1878	8.2	83	15.62	81	1901	7.0	78	12.48	71
1879	10.3	102	18.60	93	1902	7.6	81	14.86	80
1880	9.8	93	18.12	87	1903	10.5	116	19.10	107
1882	9.1	85	16.93	80	1904	9.0	97	19.33	106
1883	9.1	89	14.96	74	1905	10.8	111	21.02	110
1884	9.2	95	14.14	75	1906	9.6	93	20.26	99
1885	8.4	91	13.76	75	1907	10.4	101	19.39	96
1886	8.1	88	13.65	76	1908	8.7	87	17.73	90
1887	8.5	92	15.61	85	1909	13.9	129	22.55	106
1888	8.5	91	15.33	83	1910	14.1	133	25.32	122
1889	8.5	92	13.64	75	1911	8.8	83	19.08	92
1890	8.6	94	16.06	89	1912	11.9	108	23.83	110
1891	7.2	81	12.99	74	1913	12.2	111	23.26	107
1892	8.3	96	17.42	102	1914	6.8	62	14.91	69
1893	7.0	84	10.50	64	1915	11.3	98	20.10	88
1894	4.6	59	8.96	59	1916	19.6	122	32.08	101
1895	7.6	101	11.82	79	1917	27.7	139	46.28	118
1896	6.7	92	12.30	85	1918	27.6	121	46.20	104
1897	6.7	90	12.20	83	1919	35.7	136	59.00	114
1898	5.7	71	12.63	80	1920	14.0	68	25.14	61
1899	7.0	80	13.41	78					

[1] Prices as reported by the Department of Agriculture are converted to currency basis during the Civil War period by using the premium on gold as reported by the Treasury Department. Purchasing power is calculated by dividing the price index by the index numbers of prices of all commodities for December. (Table II.) Before 1900 the index numbers are not available for December. The average for the year and following years is then used.

TABLE XXV.—*Farm prices and purchasing power of winter wheat in the United States at Dec. 1 prices.*[1]

Year.	Per bushel.			Per acre harvested.			Per acre sown.		
	Farm price per bushel (cents).	Index No. (1910–1914=100).	Purchasing power (1910–1914=100).	Farm value per acre harvested.	Index No. (1910–1914=100).	Purchasing power (1910–1914=100).	Farm value per acre sown.	Index No. (1910–1914=100).	Purchasing power (1910–1914=100).
1890	87.5	100	117	$9.50	66	78	$9.17	71	84
1891	88.0	100	121	12.95	90	109			
1892	65.1	74	93	8.93	62	78			
1893	56.3	64	83	6.78	47	61			
1894	49.8	57	79	6.97	49	68	7.61	59	82
1895	57.8	66	94	6.68	47	67	6.23	48	69
1896	77.0	88	129	9.05	63	93	8.82	68	100
1897	85.1	97	141	12.01	84	121	11.12	86	125
1898	62.2	71	96	9.23	64	87	8.60	67	90
1899	63.0	72	89	7.25	51	62	6.13	47	59
1900	63.3	72	87	8.45	59	71	7.18	56	67
1901	66.1	75	91	10.03	70	84	10.01	78	93
1902	64.8	74	85	9.33	65	75	8.22	64	73
1903	71.6	82	97	8.80	61	73	8.40	65	78
1904	97.8	112	130	12.12	85	98	10.29	80	93
1905	78.2	89	99	11.22	78	87	10.75	83	93
1906	68.3	78	81	11.37	79	83	10.74	83	87
1907	88.2	101	106	12.84	90	94	11.41	88	93
1908	93.7	107	115	13.52	94	102	12.97	100	108
1909	102.4	117	117	15.70	110	110	14.55	113	113
1910	88.1	100	103	13.99	98	100	12.08	94	96
1911	88.0	100	102	13.00	91	93	11.61	90	92
1912	80.9	92	90	12.18	85	83	9.74	75	74
1913	82.9	95	93	13.69	96	94	12.91	100	98
1914	98.6	112	111	18.76	131	130	18.20	141	140
1915	94.7	108	101	15.45	108	101	14.88	115	108
1916	162.7	186	124	22.53	157	106	19.95	155	104
1917	202.8	231	125	30.72	214	116	20.66	160	87
1918	206.3	235	112	31.40	219	104	27.56	214	102
1919	211.0	241	99	30.93	216	89	30.57	237	97
1920	149.3	170	88	22.83	159	83	20.65	160	83

[1] Values and acreages as reported by the Department of Agriculture. Purchasing power is calculated by dividing the price index by the index numbers of prices of all commodities for December, Table 2. Before 1900 the index numbers are not available for December. The average for the year and following year is then used. See also footnote 2, Table I.

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UNITED STATES DEPARTMENT OF AGRICULTURE
BULLETIN No. 1000
Contribution from the Office of Farm Management and Farm Economics.
G. W. FORSTER, Acting Chief.

Washington, D. C. December 30, 1921

LABOR AND MATERIAL REQUIREMENTS OF FIELD CROPS.

By L. A. MOORHOUSE, *Associate Farm Economist*, and O. A. JUVE, *Junior Farm Economist.*

CONTENTS.

INTRODUCTION.

There is a growing demand for information relating to the quantities of labor and materials required for agricultural production, especially with reference to the staple farm crops and the leading classes of live stock. In the cost of production studies which have been conducted by the Office of Farm Management and Farm Economics, United States Department of Agriculture, particular emphasis has been laid on the quantity requirements of labor and materials—hours of man labor, hours of horse labor, hours of tractor labor, pounds or bushels of seed, loads of manure, pounds of fertilizer, and quantities of other materials that are utilized in producing crops or live stock. When these items are known, it is easy to compute costs at any given time by applying the prevailing rate for each item.

This method makes it possible to determine approximate costs for any period, irrespective of changes in material and labor rates. As a rule, field practice does not change greatly from year to year, and the hours of man labor and the quantities of material necessary in the production of a given crop or a given class of live stock provide a

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more permanent basis for comparative determinations than mere money costs. For this reason the quantity requirements have come to be regarded as fundamental in any discussion of farm management problems.

In this bulletin all of the available crop requirement data assembled by the United States Department of Agriculture are summarized. In bringing these data together the Office of Farm Management and Farm Economics has based its findings upon two sources of information: First, enterprise survey records covering the more important farm crops which have been obtained during the past ten years; second, a large number of detailed farm accounting records which have been assembled in cooperation with several agricultural experiment stations. Labor and material requirements per acre are reported in this bulletin for the following crops:

Corn, corn silage, cotton, wheat, oats, barley, rye, grain sorghums, field beans, potatoes, sugar beets, tobacco, apples, and hay, and a few miscellaneous field crops.

In each instance the results have been compiled and averaged by districts. In obtaining the original records from which the accompanying tables have been prepared, representative areas or regions were selected for the studies. Thus the figures which are given for each of these regions are directly applicable to many other districts where agricultural conditions are similar.

The data given in the tables may be used in two ways. In the first place, by applying current prices for labor, seed, fertilizer, and other materials to the quantity requirements, the cost of producing a crop may be approximately calculated. The farmer who is conducting his work in a businesslike way will frequently desire to make estimates of this character. If a crop which he has used extensively in the past does not promise well, on account of an unfavorable market outlook, a few calculations will enable him to estimate probable results with the new combinations which appear to be practicable.

In the second place, quantity requirements may be applied in readjusting the enterprises of the farm as a whole. With this information available, the operator can obtain a clear idea of his labor requirements at different seasons, and peak loads may be avoided by developing the farm plan in such a manner as to distribute the man labor and horse labor uniformly. From a farm organization standpoint, therefore, these basic factors have proved to be exceedingly valuable.

Each type of farming develops practices which influence the quantity of man and horse labor that may be required in growing and marketing a given product. While field practice in any given district has a tendency to be quite uniform, and while the average requirements which have been determined for these individual areas can be applied safely in estimating costs and in working out readjustments in the organization of the farm when ordinary practices are followed, further study is needed to show requirements for special practices. For example, in typical wheat regions wheat may be grown by what is known as the summer fallow method, or it may be stubbled in after wheat, or it may be grown after some other crop, the land having been plowed and a suitable seed bed prepared. The requirements are not the same for all these cases. To provide the wheat farmer with specific directions, it would be necessary to get data on the labor and material requirements in growing and marketing the crop under the special conditions, or, better still, to gather detailed enterprise records in typical areas where these conditions prevail.

Cost-accounting records available for several of the crops included in this discussion make it possible to show the distribution of man labor and horse labor throughout the year. Such information is a distinct aid in combining crop enterprises so as to utilize the available farm labor economically. These facts often provide the key for increased efficiency in the management of labor, and a corresponding increase in the profits is the result. A knowledge of the quantity of labor and time required is necessary in adjusting crop production to market demands and in revising cropping systems. If labor is relatively high-priced, and a given crop requires a large quantity of labor in its production, the operator may be in a position to decide that this enterprise should be curtailed somewhat, in view of the price situation. On the other hand, the cost of labor and the market outlook may warrant the expansion of an enterprise, and the basic requirements should indicate the more important changes which will have to be made in the program of work.

Many farmers are keeping complete accounts of the farm business. After reviewing the returns for several years it may appear desirable to expand certain enterprises in order to increase farm profits. How will this expansion affect the organization of the farm? The answer to this question may be found, in part by analyzing the individual farm record, and in part by consulting the labor distribution charts for different crops in various parts of the country published herewith. Such a review will enable the farm operator to determine with a reasonable degree of accuracy whether he can meet the proposed adjustments with the supply of labor available. He will also be in a position to approximate his seed and other material requirements, and if the contemplated change is decided upon, can make due arrangements for procuring the necessary supplies in season.

Two terms used in this bulletin require a brief explanation, namely, "operating expense" and "total cost." Operating expense, as used in this discussion, includes all items of expense except the charge for the use of land; namely, the cost of man and horse labor, the cost of materials (such as seed, manure, fertilizer, containers, and chemicals used in the treatment of seed or for controlling insect pests), machinery and equipment costs, taxes, insurance, thrashing charges, and overhead. Total cost takes into account the items which have been enumerated and includes, in addition, interest, or rent charge for the use of land.

As an aid to estimating total expense of production, it is important to know what part the cost of labor and materials is of the total operating expense. In each of the following tables this percentage has been indicated. In a few cases it was not possible to determine the percentage for each district, but in these instances the relationship for the region has been worked out and these percentages can be applied in estimating the total operating expense. For several crops the labor and material requirements constitute rather uniformly from 65 to 85 per cent of the total operating expense.

In studying the various tables which follow it may be desirable to know how each item of cost compares with other items of cost, with the total operating expense, or with the total cost. A table therefore has been prepared for each crop, showing the percentage distribution of the total operating expense, and also of the total cost, among the various items of cost. In the production of a crop like wheat or barley the percentage distribution of the total operating expense may not vary greatly in two distinct regions, one of which has high land values, the other low land values. When total cost is considered, however, there will be a wide variation, because in the district having high priced land the interest charge will constitute a comparatively large part of the total cost.

In connection with each table certain significant differences in the quantity requirements shown for the respective districts are pointed out. If field practice influences requirements appreciably, especially if such practice happens to be somewhat unusual, the practice in question is discussed briefly, so that the reader may be able to interpret results accurately. It is not possible, however, to discuss in a bulletin of this character all the methods involved in the production of each individual crop.[1]

METHOD OF PRESENTATION.

The acre requirements for different crops are given in tabular form. The distribution of labor for each enterprise is also shown graphically in figures 1 to 14. The purpose of these graphs is to

[1] Several bulletins relating to the cost of producing special crops have been issued by the Office of Farm Management and Farm Economics. These publications describe the more important methods of production in some detail. (See reference lists which accompany tables.)

visualize the demand for labor in the production of the more important staple crops. Records for typical regions have been selected in each instance. The labor distribution is given by 10-day periods, except in the graph for sugar beets, which was prepared from enterprise cost records. In the latter case the distribution is shown by months.

In order to permit direct comparisons the graphs have all been drawn to the same scale, with the exception of those for tobacco, sugar beets, and apples. In these three cases it was found desirable to make the scales from two to two and one-half times the standard employed for other crops.

The length of the bars in each graph represents the total hours spent per acre during 10-day periods, and since with the exceptions noted the same scale is used throughout, the black bars not only show the distribution of labor for the various crops, but in comparison show also variations in the amount of labor required by different crops.

By referring to figure 12, which gives the labor distribution for hay, it will be observed that the major portion of the work on this particular crop occurs during the first 20 days in July. Apart from harvest labor, hay makes very little demand for labor. With spring wheat, on the other hand, the demand for labor is concentrated at two distinct points. One of these occurs during the seeding period in April and May. The other comes at the harvest season in August and September. The cotton graph shows that man labor on the cotton crop is distributed throughout a period of 11 months.

In using graphs of this type it is desirable to compare seasonable labor demands on a percentage basis. To permit comparisons of this character, monthly percentage figures are presented both for man labor and for horse labor.

CORN.

The figures which are shown in Table 1 are based upon 253 enterprise records representing the requirements (exclusive of marketing) of 14,510 acres of corn distributed as follows: Kansas and Nebraska, 2,385; Iowa, 3,748; Illinois, 4,336; Indiana and Ohio, 1,489; Virginia, Maryland, Pennsylvania, and Delaware, 2,552.[1]

The hours of labor required to produce an acre of corn naturally depend upon cultural practices and methods of harvesting. In the central part of the Corn Belt the usual method of harvesting is to husk the corn from the standing stalk and then pasture the fields. The average requirements for these areas were found to be about 19 man hours and 46 horse hours per acre. In eastern districts, where

[1] These data were obtained from an unpublished report which was prepared by M. R. Cooper and H. G. Strait, of the Office of Farm Management and Farm Economics.

the corn is cut and husked from the shock, the average labor requirements were about 53 man hours and 56 horse hours per acre.

In Kansas and Nebraska a large acreage of corn was listed. However, in the Kansas area the total hours per acre where the ground was plowed and planted in the regular way were practically the same as the total hours reported when listing was practiced. In Nebraska the man hours were slightly less with listing and the horse labor about 9 hours less than in cases where the land was plowed.

The usual practice in the two Iowa districts included stalk cutting, plowing with a two-bottom gang, disk (once), spike-harrow (twice), occasionally roll, plant with a two-row check planter, harrow twice while corn is small, and cultivate three times. Essentially the same treatment was given on the Illinois farms. Indiana operators plowed the land with walking and sulky plows, then disked, harrowed from one to three times, rolled occasionally, and planted with a two-row check planter. The spike-tooth harrow and roller were also used for the first cultivation and corn was cultivated about four times with a one-row implement. Practically the same treatment was given in Ohio.

TABLE 1.—*Corn: Labor and material requirements per acre, exclusive of marketing (253 records).*[a]

CORN-BELT AREAS (CORN HARVESTED FROM STANDING STALK).

Region.	Number of records.	Average yield per acre.	Man labor.			Horse labor.			Seed.	Manure.	Fertilizer.	Twine.
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest from standing stalk.	Total.				
		Bush.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Lbs.*	*Loads.*	*Lbs.*	*Lbs.*
Kansas	25	25	15.6	6.1	21.7	34.5	12.3	46.8	7.7	0.6	......	......
Nebraska	11	40	9.5	5.0	14.5	28.3	10.1	38.4	8.0	.7	......	......
Southwestern Iowa	18	48	10.0	6.3	16.3	30.2	12.7	42.9	8.3	.7	......	......
East central Iowa	55	48	12.0	6.4	18.4	32.0	12.8	44.8	8.0	1.4	......	......
Western Illinois	30	46	13.1	6.6	19.7	33.2	12.9	46.1	8.1	1.0	......	......
Eastern Illinois	16	42	11.0	5.7	16.7	33.5	11.5	45.0	7.7	.6	......	......
Indiana	14	49	17.3	8.3	25.6	42.8	16.5	59.3	7.9	1.0	22	......
EASTERN AREAS (CORN CUT AND HARVESTED FROM SHOCK).												
Ohio	13	45	20.4	28.5	48.9	38.5	14.5	53.0	8.2	2.2	27	2.0
Virginia	12	52	22.1	27.9	50.0	41.9	17.7	59.6	10.4	2.0	35	1.6
Maryland	12	60	23.5	36.0	59.5	45.2	18.5	63.7	8.7	3.8	......	2.2
Pennsylvania	22	62	19.1	31.2	50.3	40.6	13.4	54.0	7.6	4.0	54	2.8
Delaware	25	47	19.4	35.1	54.5	40.0	12.0	52.0	11.9	5.1	76	2.9

[a] The labor and material requirements as reported constitute 85 per cent of the operating expense in the corn belt and 88 per cent in eastern districts.

For the eastern districts field practice differed appreciably from practice in the central part of the corn belt. Three-horse walking plows were used quite generally. The disk was not employed to

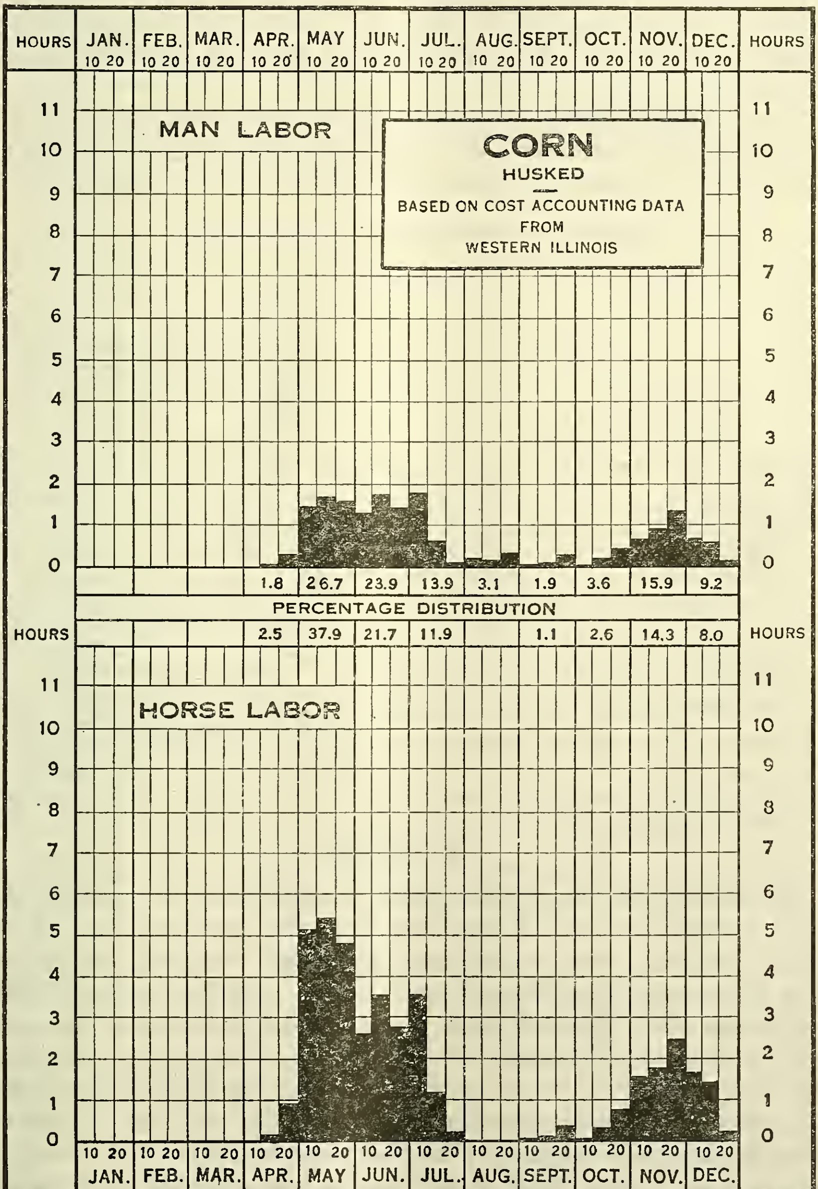

FIG. 1.—Distribution of man labor and horse labor for 9 farms producing a total of 426 acres of corn. Most of the corn on these farms was husked from standing stalks. Black bars indicate total hours spent per acre during 10-day periods.

any great extent in Virginia and Maryland, but was used in Pennsylvania and Delaware. Spring-tooth harrowing was quite common. The ground was rolled or dragged once in Virginia and Maryland and twice in Pennsylvania and Delaware. Very little harrowing was done after planting. From three to five cultivations were given in the eastern districts.

The average fertilizer application for the five eastern districts was 193 pounds per acre where used. Excepting in the Indiana district, no commercial fertilizer was applied by the farmers in western districts.

TABLE 2.—*Corn: Percentage distribution of costs.*

Item.	Corn-belt areas.		Eastern areas.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	31.1	20.5	40.7	33.0
Horse labor	44.8	29.5	25.9	21.0
Materials:				
Seed	2.3	1.5	1.0	.8
Twine			1.4	1.2
Manure	7.2	4.8	17.2	14.0
Fertilizer			1.5	1.2
Total materials	9.5	6.3	21.1	17.2
Other costs:				
Overhead	7.7	5.0	7.9	6.4
Machinery	6.9	4.5	4.4	3.6
Total other costs	14.6	9.5	12.3	10.0
Land charge [a]		34.2		18.8
Value of land per acre	$184		$163	

[a] Includes taxes and insurance.

CORN SILAGE.

In Table 3 (corn silage) the labor is divided into two groups, the first of which includes all the labor from manure hauling up to the last cultivation, the second the operations from the time cutting begins to packing the corn into the silo. For the regions studied the operations performed in growing and harvesting silage are very much the same. The variations in labor requirements are therefore due chiefly to differences in methods of doing the same kind of work. The use of large power units for seed-bed preparation and cultivation is an important factor in reducing the man-labor cost. For example, on the Iowa farms, which report the lowest man-labor requirement per acre, prior to harvest, the man and horse hour ratio is 1 to 2½, while in Ohio, which reports the highest labor requirement prior to harvest, it is 1 to 1.6. Other factors that may contribute to making these variations in man-labor requirements are difference in quantity of manure hauled per acre, greater adaptability of land to corn production, and better management and skill in growing corn.

The harvesting labor is not influenced so much by the size of the machinery used as by variations in yield and the distance that the corn is hauled from the field to the silo. The influence of distance does not appear in the average figures because the average distance is likely to be very much the same for the various States, but the influence of yield on harvest labor is clearly shown by the difference between the New York and the Minnesota figures.

TABLE 3.—*Corn silage: Labor and material requirements per acre (271 records).*

Region.	Number of records.	Average yield.	Man labor.			Horse labor.			Seed.	Manure.	Fertilizer.	Fuel.		Twine.	Per cent of operating expense [a] covered by foregoing.
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.				Gas.	Coal.		
		Tons.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Lbs.*	*Loads.*	*Lbs.*	*Gals.*	*Lbs.*	*Lbs.*	
Minnesota	30	7.1	13.4	10.2	23.6	36.6	15.7	52.3	14.0	3.6	.....	.....	22.0	3.3	76
Wisconsin	97	9.4	14.5	15.6	30.1	34.1	19.5	53.6	11.4	4.7	.....	2.5	20.5	3.6	84
Iowa	55	9.8	12.9	15.0	27.9	31.9	20.0	51.9	9.9	2.2	.....	2.8	14.0	3.6	80
New York	83	13.0	26.5	25.6	52.1	45.3	19.6	64.9	24.2	6.1	219.0	2.1	16.0	4.1	84
Ohio	6	8.3	27.2	24.1	51.3	38.7	22.5	61.2	7.8	6.2	.....	.....	.....	2.2	79

[a] Excluding interest on land.

The cost for seed is very small compared with the seed cost for many other farm crops. The range from 10 pounds per acre in Iowa to 24 pounds in New York is therefore not of much importance from the cost standpoint but is of interest in that it indicates different practices in the two States.

Much of the silage corn is cut and bound with the binder. Some of it is cut loose, but the percentage of the corn handled in this way is extremely small. The quantities of twine given in these records can therefore be considered as fair figures to use when determining the cost of corn harvested with the binder.

Corn responds very well to manuring and therefore receives most of the manure produced on the farms where it is grown. On the Wisconsin farms the records show that although corn does not occupy more than about one-fourth of the crop area it receives over half of the available manure.

Gasoline, coal, and wood were all used for fuel in filling silos, but the number of farmers using wood was so small that it disappears in an average. Because of the fact that the Ohio records give only the value of the fuel used and not the quantity it was impossible to determine the quantity of fuel for that State, but by comparing values it would seem that the fuel consumed would approximate that consumed in New York.

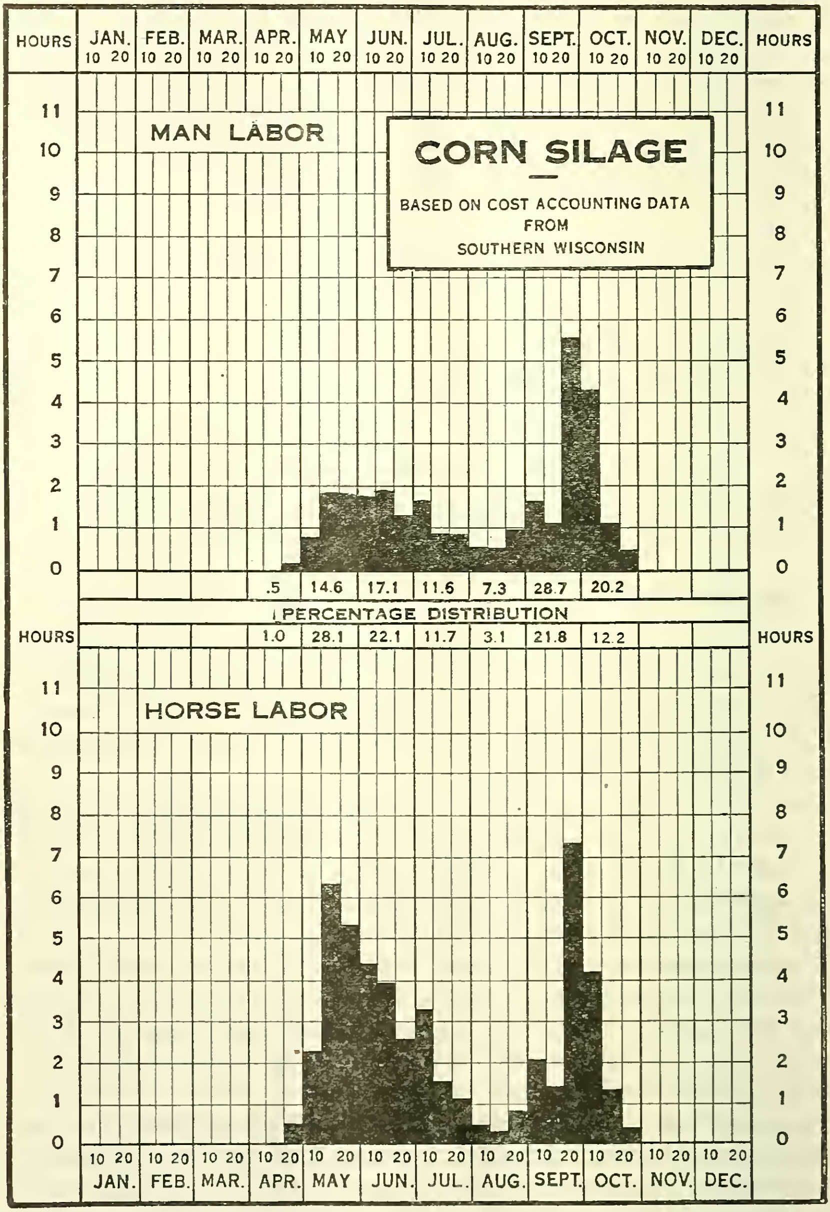

FIG. 2.—Distribution of man labor and horse labor for 13 farms having a total production of 325 acres of corn silage. Black bars indicate total hours spent per acre during 10-day periods.

TABLE 4.—*Silage: Percentage distribution of costs per acre.*

Item.	Iowa.		New York.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	24.8	16.8	24.6	21.0
Horse labor	29.8	19.3	21.5	18.3
Materials:				
Seed	2.2	1.5	2.3	2.0
Twine	1.8	1.2	1.1	1.0
Fuel	2.5	1.8	1.0	.8
Manure	16.5	11.4	32.0	28.0
Total materials	23.0	15.9	36.4	31.8
Other costs:				
Overhead	6.9	4.9	6.6	5.7
Machinery	15.5	10.5	10.9	9.2
Total other costs	22.4	15.4	17.5	14.9
Land charge	....	32.6	....	14.0
Value of land per acre	$190		$120	

COTTON.

During the year 1918 enterprise cost records were obtained in 10 southern counties. The acreage devoted to cotton on the farms visited in these counties was as follows: Anderson (S. C.), 2,866; Barnwell (S. C.), 3,936; Laurens (Ga.), 3,968; Greene (Ga.), 4,148; Sumter (Ga.), 4,188; Tallapoosa (Ala.), 1,169; Marshall (Ala.), 1,250; Dale (Ala.), 1,226; Ellis (Tex.), 8,148; Rusk (Tex.), 2,568—total for all districts, 33,467 acres.[1] The labor and material requirements as shown by this survey are summarized in Table 5.

TABLE 5.—*Cotton: Labor and material requirements per acre (842 records, 1918 crops).*

Region.	Number records.	Yield of lint per acre.	Man labor.			Mule labor.			Seed.	Fertilizer.	Per cent of operating expense[a] covered by foregoing.
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.			
		Lbs.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Lbs.*	*Lbs.*	
South Carolina:											
Anderson Co	89	248	75	56	131	45	12	57	35	404	86
Barnwell Co	91	268	73	63	136	45	17	62	31	555	86
Georgia:											
Laurens Co	85	277	61	64	125	44	16	60	25	288	85
Greene Co	78	260	74	57	131	47	13	60	35	257	85
Sumter Co	80	244	81	55	136	53	11	64	38	286	84
Alabama:											
Tallapoosa Co	89	172	85	39	124	50	9	59	35	187	87
Marshall Co	90	227	76	51	127	51	8	59	30	333	85
Dale	90	194	67	50	117	46	7	53	28	250	85
Texas:											
Ellis Co	75	176	31	25	56	33	4	37	22	......	79
Rusk Co	75	185	49	37	86	42	8	50	25	145	83

[a] Excluding interest on land.

[1] An analysis of labor practices for the farms represented in these counties is given in U. S. Dept. of Agriculture Bulletin 896, entitled "The Cost of Producing Cotton."

The more extensive cultural methods followed in Texas, as compared with those followed in the southeastern portions of the Cotton Belt, explain in some measure the differences in man-labor requirements. The lower yields reported for the three Alabama areas in 1918 will account for the low labor requirement of those areas as compared with that of the five districts in Georgia and South Carolina. There was marked uniformity in the average requirements for man labor in the latter districts.

Farm manure is not used extensively in cotton production, largely because live-stock farming does not figure as an important part of the farm business. Only 27 per cent of the operators who were interviewed applied manure to a part of the cotton land. Commercial fertilizer was applied in all districts except Ellis County, Tex. In Rusk County, Tex., the average application was 145 pounds per acre, while in Barnwell County, S. C., the average application was 555 pounds per acre.

The seed cotton picked per day varied under average conditions from 142 pounds per day in Barnwell County, S. C., to 236 pounds per day in Ellis County, Tex. The average amount picked per day in several of these districts was not far from 150 pounds of seed cotton. It is undoubtedly true that the rate of picking exceeds these average amounts during the early part of the season, more especially for the first and second times over, but late in the season the average rate would be greatly reduced on account of the smaller number of bolls opening at that time.

Since picking constitutes an important part of the man labor in producing cotton, any noticeable reduction in yield would influence the total man labor requirement. In the Georgia districts it required 45 to 57 man hours per acre (district averages) for this harvest work; in South Carolina the range was from 47 to 49 hours per acre, while in Texas the picking amounted to 24 and 32 hours, respectively, for the two districts.

In 1919 farm survey and cost records were obtained in 12 southern counties, and the acreage of cotton represented in each of these areas was as follows: Anderson (S. C.), 2,018; Barnwell (S. C.), 2,301; Laurens (Ga.), 3,111; Greene (Ga.), 3,000; Mitchell (Ga.), 2,310; Lauderdale (Ala.), 1,470; Marshall (Ala.), 1,196; Ellis (Tex.), 7,408; Rusk (Tex.), 2,233; Washington (Miss.), 2,524; Monroe (Miss.), 1,644; Lee (Ark.), 3,347; making a total of 32,562 acres.

TABLE 6.—*Cotton: Labor and material requirements per acre (821 records, 1919 crop).*

Region.	Number of records.	Yield.		Man labor.			Mule labor.			Seed.	Fertilizer.	Ginning charge.
		Lint.	Seed.	Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.			
South Carolina:		*Lbs.*	*Lbs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Lbs.*	*Lbs.*	*P. cwt.*
Anderson Co.[a]	74	286	495	80	60	140	45	14	59	35	449	$1.00
Barnwell Co..	76	248	408	65	52	117	41	12	53	28	699	1.04
Georgia:												
Laurens Co....	77	93	168	55	23	78	39	3	42	26	254	1.24
Greene Co.....	74	225	413	63	45	108	40	8	48	37	295	1.11
Mitchell Co....	50	159	300	61	39	100	43	5	48	30	277	1.07
Alabama:												
Marshall Co...	79	272	473	70	58	128	46	11	57	31	369	1.02
Lauderdale Co.	84	192	345	69	51	120	47	7	54	29	168	1.10
Mississippi:												
Washington Co..........	29	171	391	87	54	141	47	5	52	35	....	1.69
Monroe Co....	49	132	238	54	34	88	35	6	41	34	([b])	1.39
Arkansas:												
Lee Co........	83	174	363	109	55	164	47	8	55	34	([b])	1.35
Texas:												
Ellis..........	71	[c]50 / [d]29 / [e]24	134	31	15	46	29	2	31	22	....	1.80
Rusk........	75	61	106	48	16	64	37	3	40	22	105	1.87

[a] On 31 owned farms producing wage cotton, man labor, mule labor, seed, fertilizer, and manure constituted 85 per cent of the total operating expense. By adding ginning to the foregoing list the operating expense amounted to 89 per cent of total cost, excluding interest on land.
[b] In Monroe County, Miss., fertilizer was applied on only 13 farms; in Lee County, Ark., on only one.
[c] Picked cotton.
[d] Bollie cotton.
[e] Unginned seed cotton.

The total man labor requirements were exceptionally low in Ellis and Rusk Counties, Tex., and relatively low in Laurens County, Ga. (See Table 6.) It will be observed that comparatively small yields were reported for the farms surveyed in these counties, and this is reflected in the quantity of labor utilized in harvesting the crop. This factor also influenced the mule hours to a certain extent.

Exceptionally high man labor requirements are given for Lee County, Ark., and Washington County, Miss. In both of these areas there was a considerable growth of grass and weeds during the early part of the summer and this necessitated much extra hoeing. This condition was somewhat unusual.

The lowest average application of commercial fertilizer was reported for Monroe County, Miss.; the highest, in Barnwell County, S. C. Commercial fertilizers were used very generally in the latter State, while in Monroe County, Miss., fertilizer was used on very few of the farms. In Lee County, Ark., only one farm reported use of fertilizer, while farmers in Washington County, Miss., and Ellis County, Tex., did not use any.[1]

[1] Reference on cotton:
Dept. Bulletin 492. An Economic Study of Farming in Sumter Co., Ga.
Dept. Bulletin 511. Farm Practice in the Cultivation of Cotton.
Dept. Bulletin 648. A Farm Management Survey in Brooks Co., Ga.
Dept. Bulletin 651. A Farm Management Study in Anderson Co., S. C.
Dept. Bulletin 659. A Farm Management Study of Cotton Farms in Ellis Co., Tex.

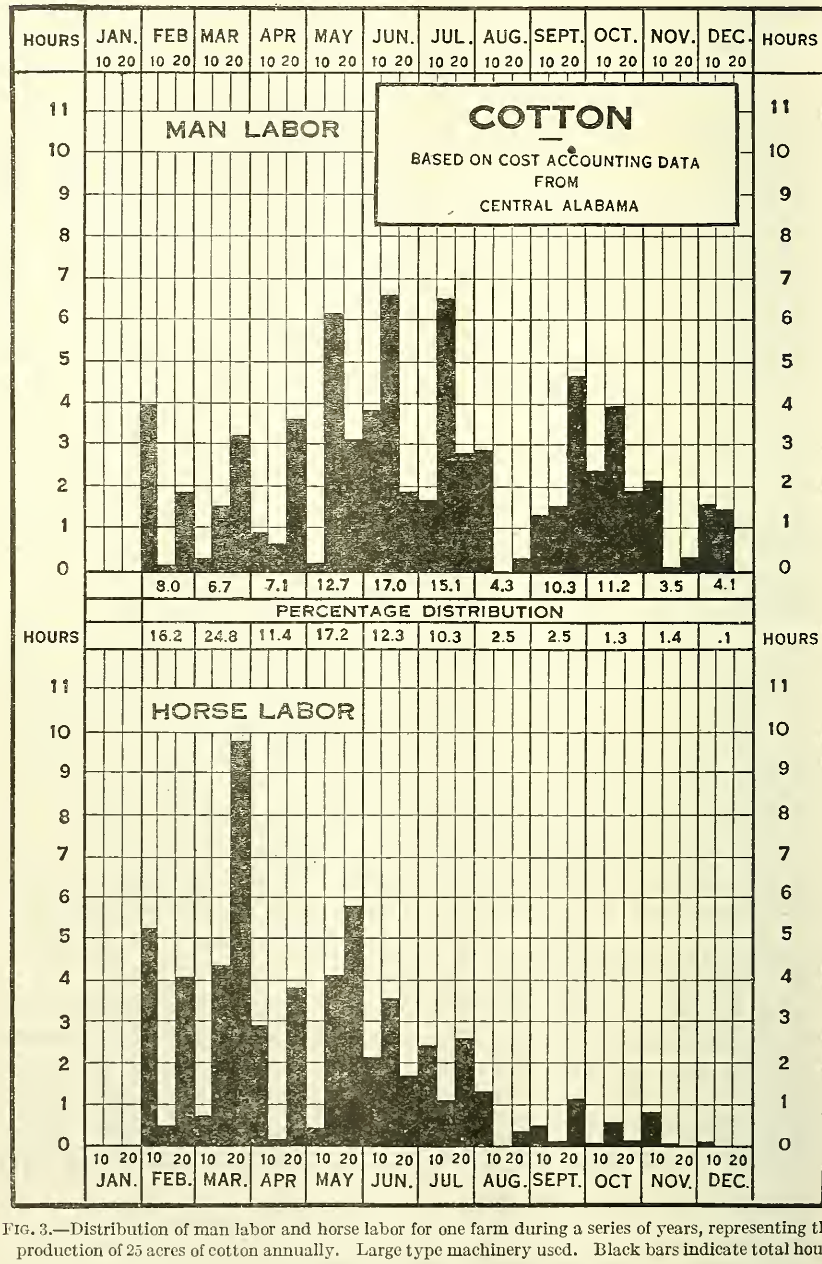

FIG. 3.—Distribution of man labor and horse labor for one farm during a series of years, representing the production of 25 acres of cotton annually. Large type machinery used. Black bars indicate total hours spent per acre during 10-day periods.

TABLE 7.—*Cotton: Percentage distribution of costs per acre (1918 crop).*

Item.	Anderson Co., S. C.		Ellis Co., Tex.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	63.8	54.3	60.0	38.1
Mule labor	10.0	8.5	15.1	9.6
Materials:				
Seed	2.5	2.1	3.9	2.5
Manure	.6	.6	(a)	(a)
Fertilizer	8.7	7.4		
Sacks and sheets	.2	.2	.2	.1
Total materials	12.0	10.3	4.1	2.6
Other costs:				
Ginning	2.9	2.5	6.2	4.0
Machinery	2.3	2.0	5.1	3.2
Overhead	9.0	7.6	9.5	5.9
Total other costs	14.2	12.1	20.8	13.1
Land charge		14.8		36.6
Value of land per acre	$110		$190	

a Less than one-tenth of 1 per cent.

POTATOES.

In this study 26 potato-growing districts were visited and 918 farmers were interviewed (Table 8). The acreage of potatoes represented was as follows: Early potatoes (southern districts), 11,487; midsummer potatoes (central coastal plain), 5,598; late crop potatoes in Maine, New York, Michigan, and Wisconsin, 6,373; in Iowa and Minnesota, 4,763; in Colorado, 2,210; in Washington, 782—total, 31,213 acres.[1]

There was a wide range in normal man-labor and horse-labor requirements. It would be natural to look for some uniformity in the man-labor and horse-labor requirements within a given region, more particularly if the conditions under which the crop was grown happened to be fairly uniform and the yields were approximately the same. In the region producing the midsummer crop of potatoes the amount of man labor utilized in marketing was much the same for all districts. However, the central New Jersey district, reporting the highest yield per acre, had the minimum labor requirement.

Farm manure applications varied from 7 to 12 loads per acre in the late potato districts and three of the midsummer districts. Commercial fertilizers were used in larger quantities in the early and midsummer districts than in the late producing areas. The Maine districts may be taken as exceptions from this general statement. Comparatively light applications were made in the three

[1] The enterprise records which were used in compiling the information on potatoes were obtained during the years 1912–1913 by H. H. Clark and L. L. Corbett. A report prepared by E. H. Thomson in connection with this cost survey was available for reference in compiling Table VIII.

New York districts. The rest of the late-producing areas applied no fertilizer whatever.

In the majority of these districts man labor and horse labor, manure, seed, and fertilizer constituted 72 per cent or more of the total cost of producing potatoes exclusive of land rent. These results have been computed on the basis of normal yield.

TABLE 8.—*Potatoes: Labor and material requirements per acre (918 records), 1912–13.*

Region.	Number of records.	Normal yield per acre.	Man labor.			Horse labor.			Seed.	Manure.	Fertilizer.	Per cent of operating expense [a] covered by foregoing.
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.				
		Bush.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Bush.*	*Loads.*	*Lbs.*	*Per ct.*
Early:												
Florida	42	122	44	60	104	62	18	80	13.2	....	1,920	77
Texas	43	87	23	24	47	41	12	53	11.4	....	......	80
South Carolina	35	146	68	48	116	54	12	66	14.3	....	1,980	80
Midsummer:												
Virginia—												
Norfolk	37	142	54	35	89	47	14	61	11.7	....	1,840	78
Eastern shore	22	139	50	32	82	60	11	71	10.0	....	1,300	72
New Jersey—												
Southern	31	173	38	32	70	43	25	68	10.8	4.7	1,680	89
Central	36	245	36	31	67	54	27	81	13.1	3.4	1,500	89
Long Island	82	167	43	32	75	48	20	68	12.0	2.1	1,840	89
Late:												
Maine—												
Aroostook County	81	254	44	51	95	70	34	104	13.8	2.2	1,840	87
Southern	23	259	48	57	105	71	44	115	14.2	4.7	1,800	90
New York—												
Northern	19	211	56	63	119	69	39	108	12.6	5.5	260	92
Western	68	151	41	42	83	59	33	92	11.8	5.3	120	87
Southern	56	135	42	50	92	50	31	81	9.4	4.2	160	90
Michigan—												
Southeastern	20	138	40	42	82	48	25	73	7.4	4.7	......	91
Traverse Bay	20	148	46	56	102	40	27	67	9.9	3.6	......	89
Southwestern	20	145	32	46	78	38	28	66	8.0	4.2	......	89
Wisconsin—												
Central	47	127	26	34	60	31	30	61	7.0	2.6	......	85
Southern	15	185	37	45	82	44	41	85	15.1	3.3	......	87
Iowa—												
Eastern	22	174	36	33	69	52	33	85	14.7	4.5	......	88
Grundy County	19	151	25	28	53	49	28	77	16.6	1.8	......	87
Minnesota—												
Eastern	46	116	32	34	66	38	33	71	7.4	3.1	......	87
Clay County	25	122	18	40	58	41	28	69	12.2	1.8	......	77
Colorado—												
Greeley	44	217	31	42	73	67	28	95	11.3	2.2	......	72
Montrose County	19	258	46	47	93	71	36	107	16.2	4.5	......	73
Washington—												
Eastern	25	145	23	31	54	36	24	60	7.3	1.3	......	74
Yakima	21	311	44	84	128	49	40	89	14.4	3.4	......	73

[a] Excluding interest on land.

An enterprise survey was made in nine Northern potato-growing districts during the year 1920. Four hundred and sixty-one growers were interviewed and records were obtained for the following potato acreages: Minnesota, 3,428; Wisconsin, 995; Michigan, 1,005; New York, 1,100; and Maine, 1,633—total, 8,161 acres.[1]

[1] The requirements which are given in Table 9 were prepared by W. C. Funk, of the Office of Farm Management and Farm Economics, U. S. Department of Agriculture.

TABLE 9.—*Potatoes: Labor and material requirements per acre.* (461 *records,* 1919).

Region.	Number of records.	Yield per acre	Man labor.			Horse labor.			Seed.	Manure.	Fertilizer.	Percent of operating expense[a] covered by foregoing.
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.				
Minnesota:		*Bush.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Bush.*	*Tons.*	*Lbs.*	
Clay County...	51	103	18.3	[b] 10.9	[b] 29.2	46.1	19.6	65.7	12.3	2.3	......	74.5
Anoka County.	54	104	34.9	28.8	63.7	60.3	26.6	86.9	9.5	6.0	......	77.2
Wisconsin:												
Barron County.	47	152	47.6	45.1	92.7	61.5	38.8	100.3	11.6	7.1	([c])	80.6
Waupaca County............	50	123	41.7	35.7	77.4	46.3	30.9	77.2	10.6	5.5	......	82.3
Michigan:												
Montcalm County.......	49	109	40.1	33.8	73.9	54.8	30.7	85.5	7.7	6.0	([c])	80.7
Grand Traverse County.......	52	124	49.9	40.3	90.2	54.4	23.6	78.0	11.3	5.0	......	80.4
New York:												
Steuben County............	50	141	40.8	46.3	87.1	58.4	40.0	98.4	11.2	4.5	([c])	81.2
Monroe County	50	110	47.9	37.7	85.6	76.5	39.5	116.0	13.2	7.1	([c])	81.2
Maine:												
Aroostook County.......	58	254	50.4	[b] 27.2	[b] 77.6	71.1	38.9	110.0	14.0	2.0	1,965	83.5

[a] Excluding interest on land.
[b] Picking not included in time for harvesting and total hours.
[c] Commercial fertilizers not generally used.

Since picking was not included in the time for harvesting in all areas, the harvest labor as well as the total man labor appears comparatively low for Clay County, Minn., and Aroostook County, Me. In both of these districts the potatoes were picked largely by contract.

Considerable variation was found in the labor requirements for the same operation in different areas. For example, in Clay County, Minn., two-row cultivators are not uncommon and man-labor-saving machinery can be used to good advantage, while in some of the districts potatoes are planted and dug by hand.

Commercial fertilizer was not used extensively outside of the Maine area. The lowest application noted in this area was 1,333 pounds per acre and the highest was 2,800. The use of manure was common to all areas. With the exception of two districts, namely, Clay County, Minn., and Aroostook County, Me., over 75 per cent of the potato acreage was manured.

There was quite a wide range in the quantity of seed potatoes used in these districts. The five farms using the least seed in Montcalm County, Mich., used an average of 5.7 bushels of seed per acre, while in Barron County, Wis., the five farms using the most seed averaged 16.2 bushels per acre. When seed is high in price, this item is exceedingly important from a cost standpoint.

The per cent of total operating expense represented by the factors which are included in Table 9 varied on the average from 74.5 in Anoka County, Minn., to 83.5 in Aroostook County, Me.

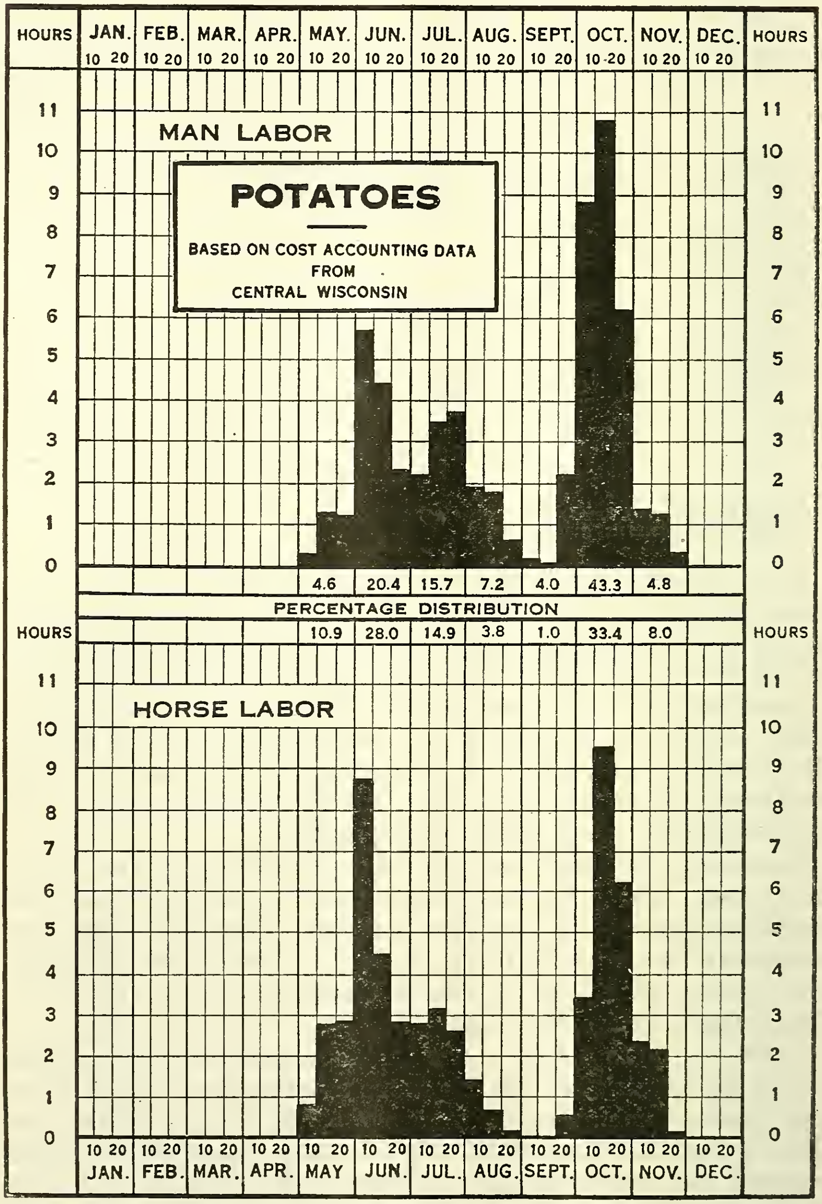

Fig. 4.—Distribution of man labor and horse labor per acre for 14 farms, representing 161 acres of potatoes. Only marketing done directly from the field included. Black bars indicate total hours spent per acre during 10-day periods.

TABLE 10.—*Potatoes: Percentage distribution of costs per acre.*

Item.	Steuben County, N. Y.		Grand Traverse County, Mich.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	28.8	27.3	32.8	30.3
Horse labor	26.0	24.7	18.9	17.4
Materials:				
Manure	12.1	11.5	14.3	13.2
Seed	12.3	11.7	14.4	13.3
Fertilizer	2.0	1.9		
Spray material	1.4	1.4	2.1	1.9
Total materials	27.8	26.5	30.8	28.4
Other costs:				
Overhead	6.6	6.3	5.0	4.6
Machinery	8.7	8.2	7.6	7.0
Miscellaneous	2.1	2.0	4.3	3.9
Loss on abandoned acreage			.6	.5
Total other costs	17.4	16.5	17.5	16.0
Land charge		5.0		7.9
Value of land per acre	$80		$117	

SUGAR BEETS.

During the years 1915, 1916, and 1917 enterprise records were obtained in three districts within each of the regions where the sugar beet is grown as one of the important crops. The acreage represented was as follows: California, 14,139; Utah-Idaho, 3,029; Colorado, 9,913; Montana, 8,849; Michigan and Ohio, 4,280—total, 40,210 acres. The basic requirements for this crop have been worked out on a basis slightly different from that used in the case of other staples, like corn and wheat. (See Table 11.) In view of the fact that a rather large amount of the hand labor was performed on a contract basis, it was not thought advisable to separate the work prior to harvest from the work performed in harvesting the beet crop.

Considerable variation was found in the practices which obtained with reference to the hand work on sugar beets. In the three California districts and in the Billings area the hand work was all done on a contract basis. In several of the other districts, like Greeley and Rocky Ford, the farm operator with the aid of his family did a small part of this work and the remainder was done on a contract basis. More than half of the hand labor in the Garland and Fort Morgan districts was done by the operator, while in the Provo area a relatively small amount of the hand labor was let on contract. The cash paid out for contract labor has been converted to hours by using a rate of 25 cents per hour, which appears to be reasonable for the period under study.

Certain important factors are to be considered in comparing the man labor requirements by districts. First, California operators used somewhat larger equipment than operators in other districts, and this is reflected in the man labor utilized per acre. Second, in Utah, Idaho, Colorado, and Montana, sugar beets are grown under irrigation, which increases the number of man hours per acre. Third, the extent of the enterprise, together with the type of soil, will influence the requirement for man labor. Fourth, the sugar beet is a heavy crop to handle, and, since districts differ in yield, the lifting and hauling to market may show considerable range in the total time utilized.

The quantity of seed used in the respective districts showed considerable uniformity. At the time this survey was made approximately 15 pounds per acre was the customary amount for practically all districts. The seed requirements as given represent one planting, and also a small amount of replanting.

Farm manure was applied in all of the districts visited. However, this factor was much less important in the California districts than elsewhere. A review of the detailed reports which have been issued in connection with this study will indicate some of the variations that occured relative to the application of farm manure.[1] Commercial fertilizer was applied only in the Michigan and Ohio districts.

TABLE 11.—*Sugar beets: Labor and material requirements per acre, (1,320 records, 1914–1916).*

Region.	Number of records.	Yield per acre.	Farmers' labor.		Contract labor.		Total hours per acre.		Seed.	Manure.	Fertilizer.	Per cent of operating expenses[a] covered by foregoing.
			Machine.	Hand.	Cash per acre.	Equivalent hours.	Man.	Horse.				
California:		*Tons.*	*Hrs*	*Hrs.*					*Lbs.*	*Tons.*	*Lbs.*	
Los Angeles...	81	14.5	27.7	....	$15.01	60.0	87.7	109.3	20.7	([b])	......	84
Oxnard.......	45	9.5	20.2	....	14.82	59.3	79.5	111.5	16.6	([b])	......	85
Salinas........	39	15.6	25.7	....	18.87	75.5	101.2	124.3	14.6	([b])	......	85
Utah-Idaho:												
Garland.......	79	14.8	36.7	21.2	18.87	75.4	133.3	98.5	14.7	5.1	......	87
Provo.........	58	15.0	58.8	48.4	5.90	23.6	130.8	117.1	14.9	7.0	......	86
Idaho Falls...	36	13.6	34.2	16.0	17.29	69.2	119.4	79.3	14.7	6.3	......	83
Colorado:												
Greeley.......	195	15.6	48.5	6.3	17.26	69.1	123.9	104.5	18.0	8.3	......	91
Fort Morgan..	66	13.6	45.3	18.7	13.52	54.1	118.1	103.0	21.1	4.4	......	88
Rocky Ford...	106	13.0	56.0	4.9	14.11	56.4	117.3	132.7	21.7	3.6	......	90
Montana:												
Billings.......	305	10.8	41.8	....	18 64	93.2	135.0	94.2	17.2	4.5	......	93
Michigan-Ohio:												
Caro..........	134	9.7	39.4	5.1	15.26	61.0	105.5	80 0	15 6	2.0	92	90
Alma..........	53	11.4	50.3	10.3	13.55	54.2	114.8	95.3	15 3	2.7	62	90
Grand Rapids.	36	10.2	45.3	15.4	12.66	50.6	111.3	93.8	14.2	2.8	94	90
Northwestern Ohio........	97	13.2	38.6	5.8	17.24	69.0	113.4	79.1	15.2	([b])	61	89

[a] Excluding interest on land.

[b] Manure applied on negligible number of farms.

[1] References:

U. S. Dept. of Agr. Bulletin 693. Farm Practice in Growing Sugar Beets in Utah and Idaho.

U. S. Dept. of Agr. Bulletin 726. Farm Practice in Growing Sugar Beets in Colorado.

U. S. Dept. of Agr. Bulletin 735. Farm Practice in Growing Sugar Beets in the Billings Region, Montana.

U. S. Dept. of Agr. Bulletin 748. Farm Practice in Growing Sugar Beets in Michigan and Ohio.

U. S. Dept. of Agr. Bulletin 760. Farm Practice in Growing Sugar Beets in California.

U. S. Dept. of Agr. Bulletin 963. Cost of Producing Sugar Beets in Utah and Idaho, 1918–1919.

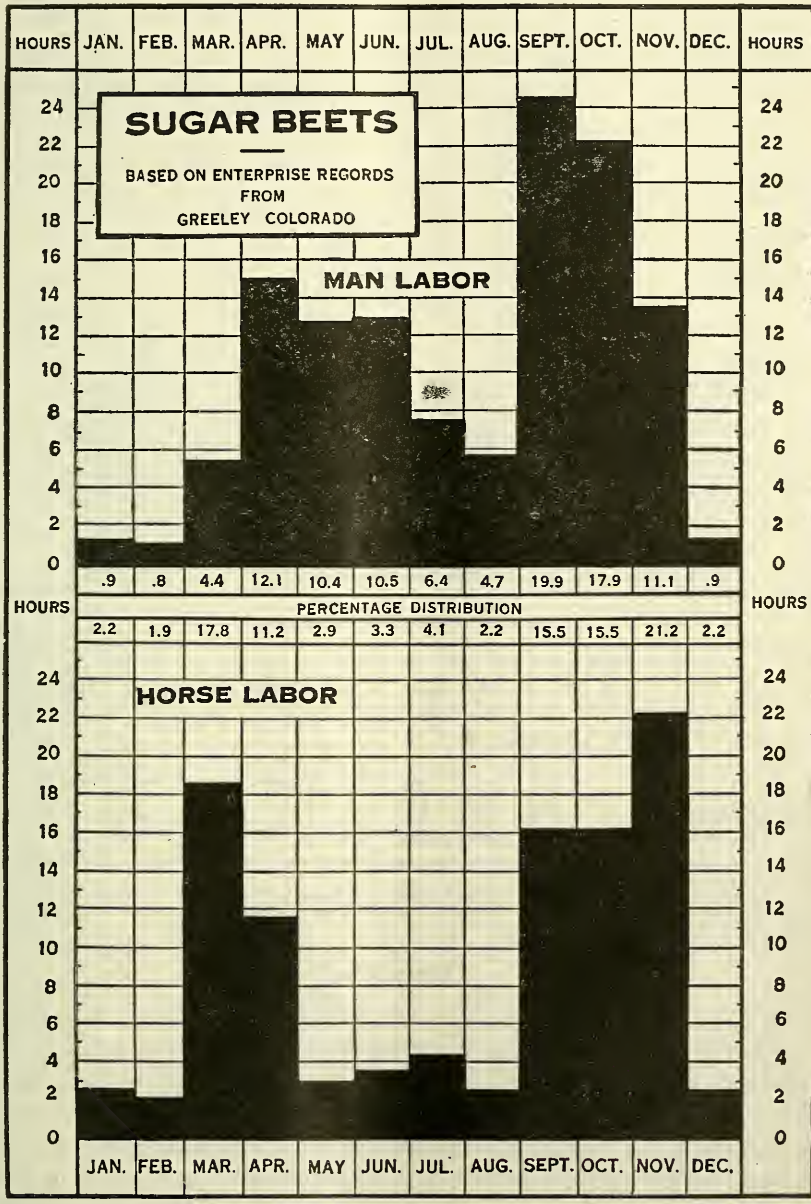

FIG. 5.—Distribution of man labor and horse labor by months, as shown by 195 enterprise survey records covering 2 years and involving the production of 5,028 acres of sugar beets. The total man labor includes operator's labor and contract labor, which has been converted to equivalent hours. Black bars indicate total hours spent per acre during periods of one month.

TABLE 12.—*Sugar beets: Percentage distribution of costs per acre.*

Item.	Weld County, Colo.		Tuscola County, Mich.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	53.9	38.3	57.1	49.1
Horse labor	22.4	16.0	19.5	16.8
Materials:				
Seed	3.5	2.4	5.7	4.9
Manure	10.8	7.6	4.6	4.0
Fertilizer			2.9	2.5
Water	1.0	.7		
Total materials	15.3	10.7	13.2	11.4
Other costs:				
Machinery	4.0	2.8	5.0	4.3
Overhead	4.4	3.2	5.2	4.4
Total other costs	8.4	6.0	10.2	8.7
Land charge		29.0		14.0
Value of land per acre	$187		$102	

TABLE 13.—*Tobacco: Labor and material requirements per acre.*

Region.	Number of records.	Yield.	Man labor.			Horse labor.			Manure.	Per cent of operating expense[a] covered by foregoing.
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.		
		Lbs.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Tons.*	
Wisconsin	19	1,300	90.8	104.3	195.1	65.5	25.2	90.7	8	77.8
Kentucky (Burley)[b]	81	1,141	170.6	204.4	375.0	68.5	29.5	98.0		75
Kentucky (dark)	70	825	146.3	115.7	262.0	60.7	28.3	89.0		75

[a] Excluding interest on land.
[b] See Kentucky Bulletin 229, "The Cost of Producing Tobacco in Kentucky," by W. D. Nicholls, College of Agriculture, Kentucky, and F. W. Peck, Office of Farm Management and Farm Economics, U. S. Department of Agriculture.

TOBACCO.

Because of the large quantity of skilled labor required in the production of tobacco and the long period over which the labor is distributed, this crop competes with practically every other farm enterprise. Wherever it is grown, therefore, it is usually the chief source of income and all other enterprises are more or less neglected in the interest of the tobacco crop. Labor, machinery, and building costs are the three chief factors in the operating cost of tobacco production.

The materials used are seed, paper, twine, fuel, and in some sections small quantities of poison, used for killing worms. The amounts of all these supplies are, however, very small and of very little importance compared with the other cost factors, seed usually

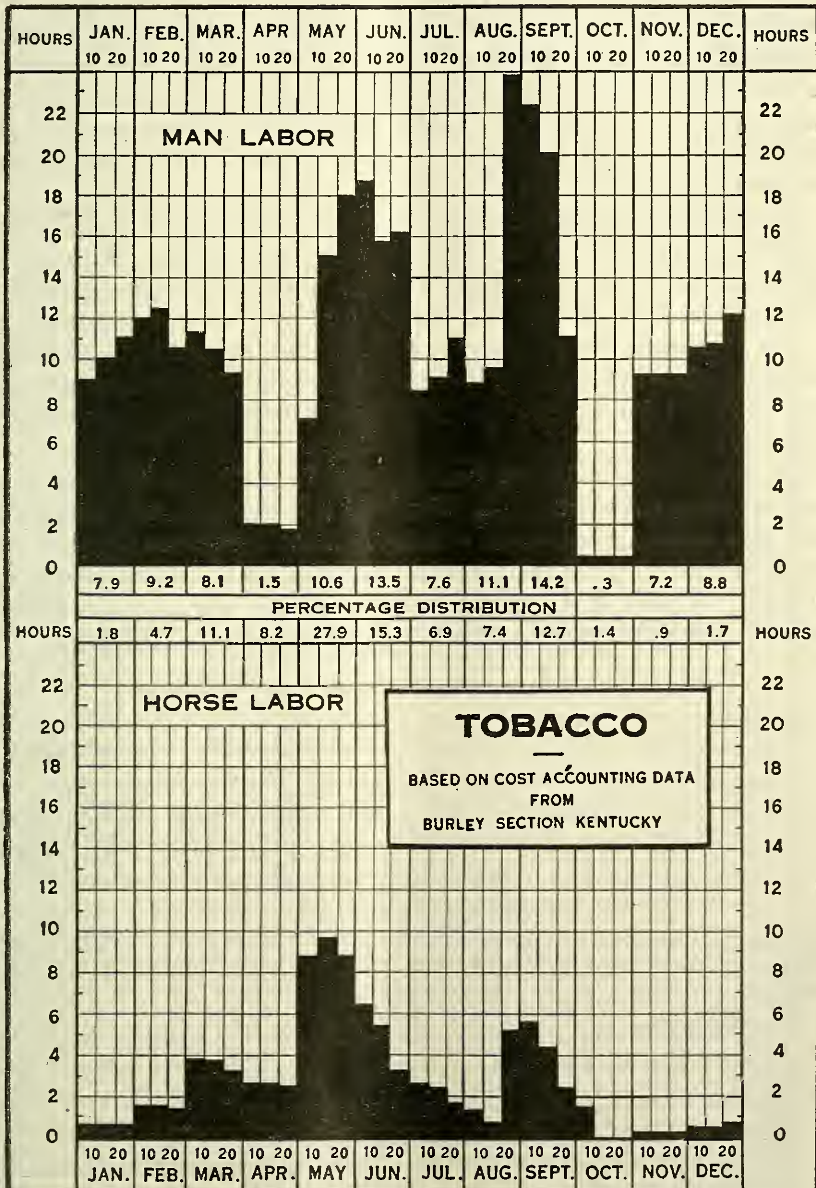

FIG. 6.—Distribution of man labor and horse labor as shown by reports from 12 farms. Labor for marketing included. Black bars indicate total hours spent per acre during 10-day periods.

amounting to about one ounce per acre, while the paper and twine used are very often paid for by the purchaser of the crop.

On the Kentucky farms visited the crop was grown mostly on new land, with only small quantities of fertilizer and manure, which is quite different from the practice on the Wisconsin farms, where it is customary to apply practically all of the farm manure to the tobacco land. The labor of hauling manure is included in all of the above records, and for Wisconsin this amounted to about 9 man hours and 16 horse hours per acre.

After the tobacco is harvested it is cured in sheds or barns which are built especially for the tobacco crop, and because of the large space required, the investment in these buildings becomes a considerable item, even though they may be of very simple construction.

For Wisconsin the yearly cost for buildings ranged from $6 to $10 per acre, while in Kentucky it went up as high as $42, with an average cost of $27.71 for the Burley district and $10.01 for the dark tobacco district.

In many sections of the country crop insurance is also becoming an important cost factor. In Wisconsin this item was not common at the time these records were obtained; hence insurance was left out of the account. In Kentucky, on the other hand, insurance was included. In the Burley section the average cost per acre was $11.57, while in the dark tobacco area it was $6.25 per acre (1919).

TABLE 14.—*Tobacco: Percentage distribution of costs per acre.*

Items.	Kentucky.		Wisconsin.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	64.0	42.0	49.0	45.3
Horse labor	10.3	6.7	16.8	15.4
Materials:				
Seed, canvas, etc	2.5	1.7	1.2	1.2
Manure and fertilizer	.7	.5	10.8	10.0
Total materials	3.2	2.2	12.0	11.2
Other costs:				
Machinery	1.8	1.2	4.3	3.9
Barns	14.6	9.6	12.8	11.8
Insurance	6.1	4.0		
Overhead			5.1	4.5
Total other costs	22.5	14.8	22.2	20.2
Land charge		[a] 34.3		7.9
Value of land per acre	([b])		$100	

[a] Includes taxes, interest, and overhead.

[b] From $200 to $600.

BEANS.

The acreage of beans represented in Table 15 is as follows: New York, 540; Michigan, 462; Wisconsin, 349; California (irrigated), 805; California (dry), 1,433; Colorado (irrigated), 853; Colorado (dry), 860; New Mexico (dry), 1,850; Idaho (dry), 864—total, 8,016 acres. These records pertain to the crop year 1917.[1]

In all sections except Ventura County, Calif., the farmer, with the assistance of his hired help, performed all the labor involved in growing field beans. In the latter area, however, thrashing was done at a contract rate per hundred pounds. Since the farm labor had no part in doing the thrashing on these farms, it was impossible to report the time required for this work in terms of man hours and horse hours.

In the eastern areas, New York, Michigan, and Wisconsin, the operations entering into the production of field beans were very similar. The one outstanding difference was in the method of harvesting in Wisconsin. In that State beans are thrashed from the stack in the field, while in New York and Michigan they are thrashed in the barn. Of the three States visited the labor required for seed-bed preparation was lowest in Wisconsin, where the light soil type was the factor mainly influencing the labor required in seed-bed preparation. In New York and Michigan the land was spring-tooth-harrowed 3.7 times and 2.9 times, respectively.

The labor requirements in irrigated bean areas such as Stanislaus County, Calif., and Weld County, Colo., differ somewhat from those in dry-land areas. Naturally more labor is required on farms where water is applied artificially than on farms which depend upon the annual rainfall. Of all the regions visited, the labor requirements in the lima bean areas of Ventura County, Calif., were the greatest. Here considerable work was done in an attempt to eradicate morning glory, which is a serious weed pest in this region.

No manure was applied to the bean crop in the dry land areas of New Mexico and Colorado or to the bean areas of Ventura County, Calif., or to the dry-land beans of Idaho. Twenty-six per cent of the total bean land of New York, 22 per cent of the bean acreage represented in Wisconsin, 12 per cent of the irrigated bean land of Colorado, and 4 per cent of the irrigated bean land in California received applications of farmyard manure. New York, Michigan, and Wisconsin were the only regions which used commercial fertilizer.

The seed requirements varied considerably in different districts. The principal factors which governed the quantity of seed used are the number of seed per pound, the width of row, and the moisture available.

[1] The data for Table 15 are taken from an unpublished report prepared by R. S. Washburn, on file in the Office of Farm Management and Farm Economics.

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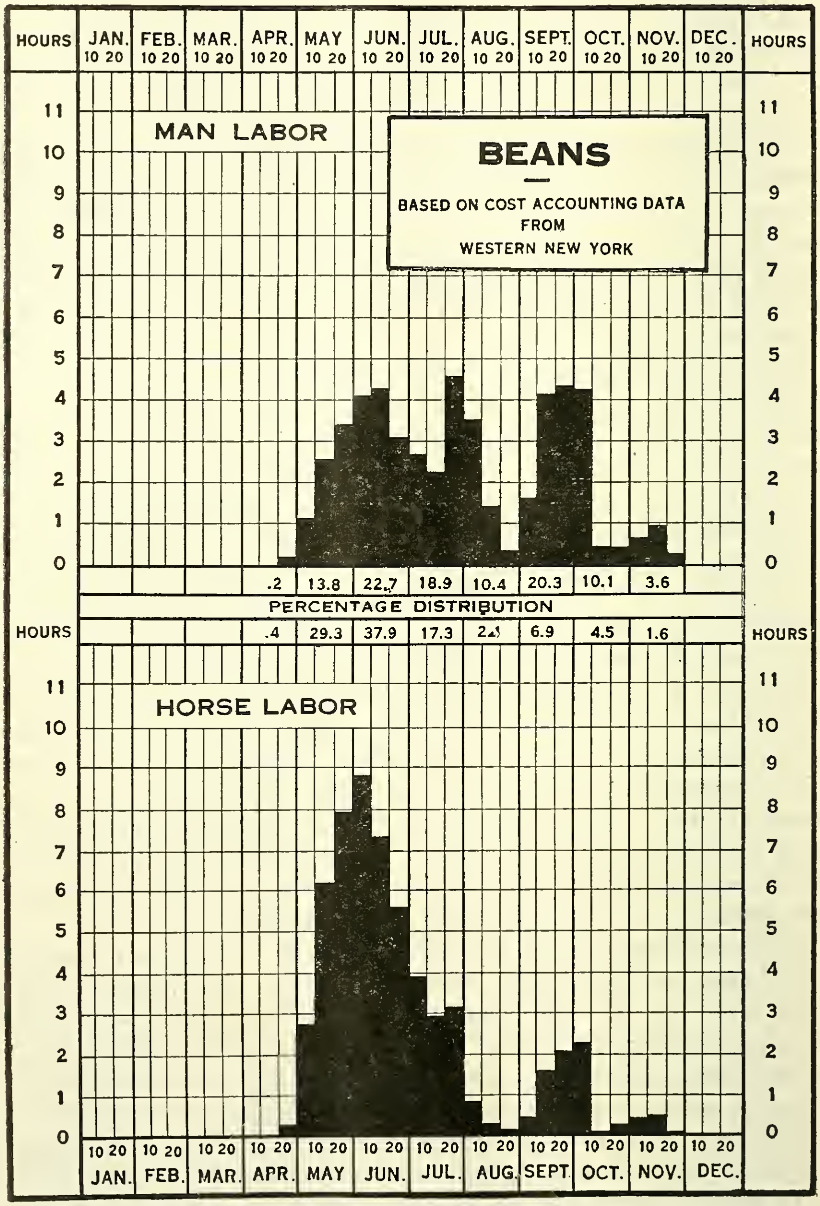

Fig. 7.—Distribution of man labor and horse labor per acre for 12 farms, involving the production of 164 acres of beans. Black bars indicate total hours spent per acre during 10-day periods.

TABLE 15.—*Field beans: Labor and material requirements per acre (166 records, 1917).*

Region.	Number of records.	Yield per acre.	Man labor.			Horse labor.			Seed.	Manure.	Fertilizer.	Coal.	Per cent of operating expense covered by foregoing.[a]
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.					
		Bush.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Lbs.*	*Tons.*	*Lbs.*	*Lbs.*	
New York	26	10.9	27.6	14.3	41.9	53.3	8.2	61.5	50	3.6	95	62	67
Michigan	23	10.5	27.0	12.4	39.4	42.9	7.1	50.0	46	1.3	30	86	67
Wisconsin	16	7.3	20.2	12.1	32.3	36.2	8.7	44.9	66	3.4	7	64	74
Average			25.6	13.1	38.7	45.5	7.9	53.4					
California (irr.)	15	20.7	20.0	17.5	37.5	37.9	11.3	49.2	9–26	3.0	[b] 13.8		62
Colorado (irr.)	16	25.0	27.9	18.4	46.3	55.5	12.0	67.5	30	.4		124	68
Average			24.1	17.9	42.0	46.9	11.7	58.6					
Colorado (dry)	17	6.8	15.3	10.5	25.8	31.4	8.1	39.5	15			56	72
New Mexico (dry)	23	4.1	17.3	10.8	28.1	33.6	6.3	39.9	17		[b]2.5		82
Average			16.4	10.7	27.1	32.6	7.1	39.7					
California (dry)	15	26.5	25.0	9.0	34.0	71.3	6.7	78.0	81		[b]15.9		60
Idaho (dry)	15	9.7	21.3	8.9	30.2	42.0	7.0	49.0	20–27		[b]3.7		79
Average			23.2	9.0	32.2	56.7	6.8	63.5					

[a] Excluding interest on land. [b] Sacks.

TABLE 16.—*Field beans: Percentage distribution of costs per acre.*

Items.	Columbia County, Wis.		Weld County, Colo.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	20.5	17.8	28.4	21.0
Horse labor	17.1	14.8	27.6	20.4
Handling charge	7.4	6.4	3.1	2.3
Materials:				
Manure	10.1	8.7	3.6	2.6
Fertilizer	.2	.2		
Seed	25.2	21.8	8.0	5.9
Coal	.7	.6	.7	.6
Total materials	36.2	31.3	12.3	9.1
Water rent			3.0	2.2
Other costs:				
Thrashing	2.4	2.1	7.7	5.7
Equipment	7.4	6.4	7.3	5.4
Overhead[a]	9.0	7.7	9.8	7.2
Hail insurance			.8	.6
Total other costs	18.8	16.2	25.6	18.9
Land charge		13.5		26.1
Value of land per acre	$114		$247	

[a] Includes taxes and insurance.

GRAIN SORGHUMS.

The records available on the cost of producing kafir and milo (1917) covered acreage as follows: Texas, 2,408; Oklahoma, 1,276; Kansas, 642; total, 4,726 acres. (See Table 17).[1]

Kafir and milo are not handled in the same manner in all districts. About 50 per cent of the Texas growers plowed, and 50 per cent plank-listed before planting. Thirty-five per cent used the disk and 65 per cent used the spike-tooth harrow. In Oklahoma about 13 per cent plowed, 43 per cent listed, and approximately the same percentage disked. Occasionally it was necessary to harrow. Fifty per cent of the Kansas operators disked, 25 per cent listed, and 25 per cent plowed.

Three types of planters were used in putting in the kafir, namely, the lister planter, the corn planter with furrow openers attached, and what is known as the "knife planter." The latter type is used invariably on sod land.

There are two general methods of harvesting: (1) The heads are harvested from standing stalks and hauled to bins or stacked in the barnyard; (2) the corn is cut with a corn binder, shocked, and headed from the shock with a knife attached to the end gate or side of the wagon. The heads are then hauled to bins and fed, or they may be stacked and thrashed out later from the stack.

In general, 1917 yields were below the average. In some sections the crop made no grain and it had to be utilized as fodder or it was pastured or put into the silo. The latter method was unusual, although the number of silos in this territory has apparently increased within recent years.

TABLE 17.—*Kafir and milo: Labor and material requirements per acre (96 records, 1917).*

Region.	Number of records.	Yield per acre.	Man labor.			Horse labor.			Seed.	Manure.	Twine.	Per cent of operating expense covered by foregoing.[a]
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.				
		Bush.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Lbs.*	*Tons.*	*Lbs.*	
Texas	40	20.8	9.7	6.7	16 4	29.5	8.8	38.3	3.8	......	.5	67
Oklahoma	37	22.6	8.8	10.0	18 8	25.6	12.8	38.4	3.0	2 0	1.3	77
Kansas	19	23.2	11.4	12.9	24.3	26.4	15.4	41.8	5.1	5.3	3.6	78

[a] Excluding interest on land.

[1] From an unpublished report prepared by T. H. Summers, formerly employed by the Office of Farm Management and Farm Economics, U. S. Department of Agriculture.

TABLE 18.—*Kafir and milo: Percentage distribution of costs per acre.*

Item	Kansas.		Texas.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	21.2	18.7	27.0	20.8
Horse labor	22.7	20.0	37.8	29.2
Materials:				
Seed	.6	.5	1.2	.9
Manure	30.8	27.2		
Twine	2.4	2.1	.8	.6
Total materials	33.8	29.8	2.0	1.5
Other costs:				
Thrashing	3.4	3.0		
Machinery	10.0	8.8	24.1	18.6
Overhead [a]	8.9	7.9	9.1	7.0
Total other costs	22.3	19.7	33.2	25.6
Land charge		11.8		22.9

[a] Includes insurance and taxes.

WHEAT—SPRING AND WINTER.

The study from which our wheat records were obtained covered 42,847 acres of spring wheat, with a total production of 362,047 bushels, and 42,174 acres of winter wheat, with a total production of 635,124 bushels. The acreage was distributed by States as follows: North Dakota, 17,271; South Dakota, 9,500; Minnesota, 17,447; Kansas, 24,436; Nebraska, 10,986; and Missouri, 8,518. In all there were 481 records. (See Table 18.) [1]

The figures on man labor and horse labor are averages for the farms operated by horse labor exclusively, farms on which tractors or motor trucks were used not being included.

In the spring-wheat area 86 per cent of the total wheat acreage was plowed, and of this 20 per cent was handled with tractor power. The remainder of the wheat acreage was corn stubble and potato land, which was usually disk harrowed and planted directly to wheat without plowing. There was a wide variation in the winter wheat districts with respect to plowing. Twenty-one and 23 per cent, respectively, of the wheat land in Pawnee and Ford Counties, Kans., was plowed, while in some other districts as much as 60 to 98 per cent was plowed. In several of the western areas the lister was used as a substitute for the plow.

Contract thrashing was the rule in a few districts, and, since the farmer furnished no labor in these areas, the amount of harvest labor was influenced thereby. This was true particularly in Grand Forks

[1] See U. S. Dept. of Agr. Bulletin 843, "The Cost of Producing Wheat."

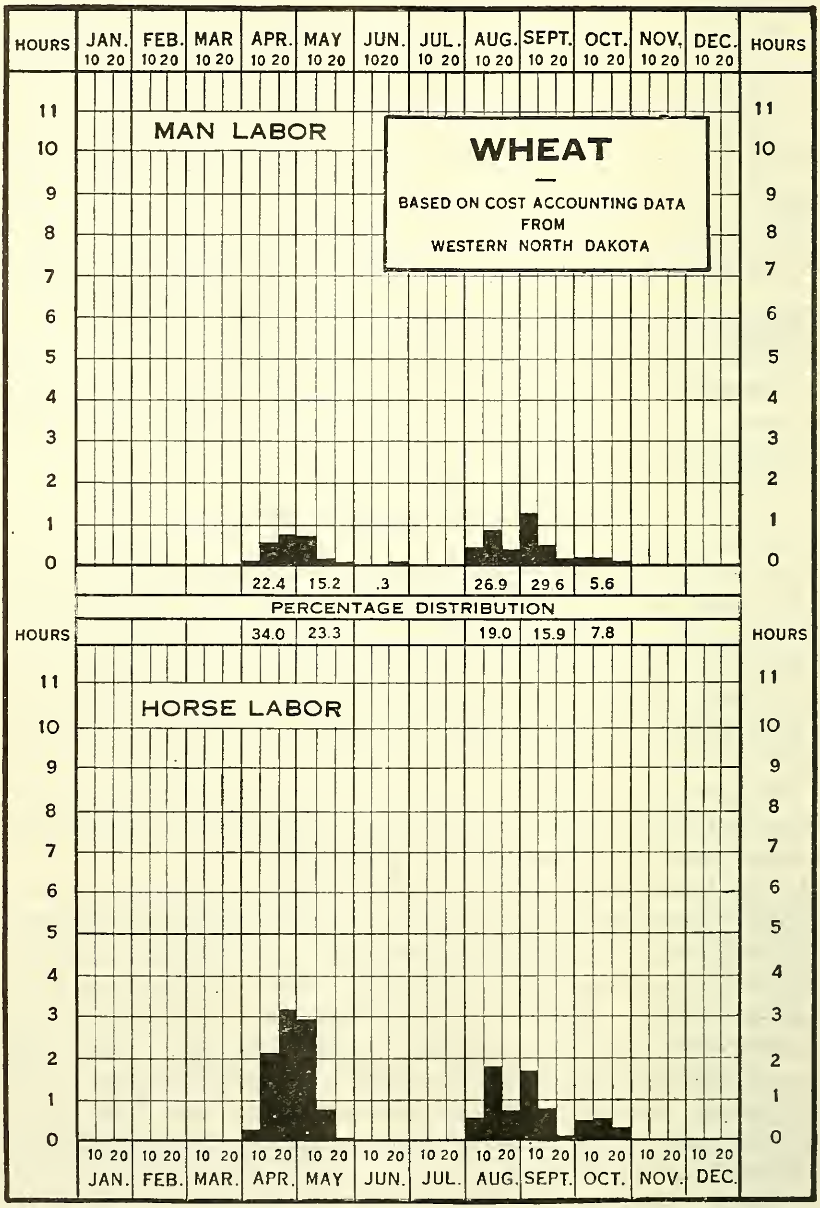

FIG. 8.—Distribution of man labor and horse labor per acre for 16 farms, representing the production of 960 acres of wheat. On eleven of these farms the thrasher furnished a part or all of the crew for thrashing. Black bars indicate total hours spent per acre during 10-day periods.

County, N. Dak., Spink County, S. Dak., and Pawnee and Ford Counties, Kans.

A light crop of straw in the spring-wheat region accounts in part for the low twine requirements in these districts. The header was used on 90 per cent of the wheat acreage in Morton County, N. Dak. The header was also used extensively in several of the winter-wheat districts.

Eighty per cent of the farmers in Saline County, Nebr., reported the use of manure. In Ford County, Kans., and Keith County, Nebr., only 1 per cent of the wheat acreage was manured. Here manure appears to have its greatest value as a top dressing, to prevent blowing. Eight per cent of the total wheat acreage received an application of manure and straw in the spring-wheat districts, and in the winter-wheat belt only 5 per cent of the total area was covered. Manuring may therefore be considered a minor operation in the production of wheat.

Commercial fertilizer was not used in any of the areas visited except Missouri, and in this State not to an appreciable extent except in Jasper County.

TABLE 19.—*Wheat: Labor and material requirements per acre (481 records, 1919).*

Region.	Number of records.	Yield per acre.	Man labor.			Horse labor.			Seed.	Twine.	Per cent of operating expense[a] covered by foregoing.
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Ttoal			
Spring wheat region:		*Bush.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Bush.*	*Lbs.*	
Grand Forks, N. D.	39	9.8	3.6	2.2	5.8	14.6	4.6	19.2	1.4	1.9	59
Morton, N. D.	39	4.4	5.4	3.8	9.2	19.6	6.1	25.7	1.2	.1	68
Spink, S. D.	39	9.9	3.1	3.0	6.1	14.8	5.3	20.1	1.2	1.5	62
Clay, Minn.	38	8.1	4.2	4.0	8.2	15.1	7.3	22.4	1.4	2.2	67
Traverse, Minn.	42	8.4	4.1	4.7	8.8	17.3	8.4	25.7	1.4	2.0	72
Winter wheat region:											
Ford, Kans.	32	13.3	2.8	4.8	7.6	12.0	8.8	20.8	.8	1.2	63
Pawnee, Kans.	32	13.9	2.6	4.7	7.3	11.7	8.0	19.7	1.0	.5	56
McPherson, Kans.	35	12.7	4.5	4.8	9.3	18.8	8.1	26.9	1.1	2.7	63
Saline, Mo.	29	16.3	5.1	8.1	13.2	18.5	11.1	29.6	1.3	2.8	63
Jasper, Mo.	30	19.2	8.1	9.4	17.5	26.8	12.7	39.5	1.2	2.3	75
St. Charles, Mo.	38	19.6	8.2	8.9	17.1	25.1	11.5	36.6	1.1	2.3	68
Phelps, Nebr.	30	10.8	3.7	5.5	9.2	13.0	8.6	21.6	1.0	2.7	69
Saline, Nebr.	35	18.1	6.7	8.1	14.8	24.7	12.4	37.1	1.4	3.7	71
Keith, Nebr.	23	18.1	2.7	6.9	9.6	9.3	10.1	19.4	.9	1.8	59

[a] Excluding interest on land.

TABLE 20.—*Wheat: Percentage distribution of costs per acre (1919).*

Item.	McPherson County, Kans.		Clay County, Minn.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	24.6	17.9	20.5	15.2
Horse labor	23.1	16.8	21.5	15.9
Materials:				
Seed and seed treatment	10.5	7.6	19.9	14.7
Manure and straw	1.8	1.3	2.3	1.7
Twine	2.8	2.0	2.9	2.1
Total materials	15.1	10.9	25.1	18.5
Other costs:				
Thrashing	12.6	9.2	6.8	5.0
Crop insurance	1.2	.9	3.1	2.3
Machinery	8.8	6.4	7.5	5.5
Tractor	1.5	1.1	3.9	2.8
Loss on abandoned acreage	3.1	2.2	....	....
Overhead [a]	10.0	7.3	11.6	8.6
Total other costs	37.2	27.1	32.9	24.2
Land charge	....	27.3	....	26.2
Value of land per acre	$134		$137	

[a] Includes taxes and insurance.

This investigation included a survey of 453 farms in the winter wheat belt. The following acreages were planted to wheat by these operators: Missouri, 5,397; Nebraska, 13,053; Kansas, 28,870; and Oklahoma, 14,423, making a total for all farms of 61,743 acres.

TABLE 21.[a]—*Labor and material requirements, winter wheat, 1920 (representing predominating practice in each region).*

[453 Records.]

Regions.	Man hours.			Horse hours.			Seed.	Twine.	Land value.
	Preparation and seeding.	Harvest.	Total.	Preparation and seeding.	Harvest.	Total.			
							Bushels.	*Pounds.*	
Missouri:									
Pike County	7.4	7.1	14.5	24.6	9.6	34.2	1.30	1.5	$122
Carroll County	7.3	9.3	16.6	26.1	13.0	39.1	1.23	2.2	219
Nebraska:									
Gage County	5.4	8.0	13.4	21.8	11.9	33.7	1.28	2.4	208
Clay County	4.3	5.5	9.8	18.3	9.5	27.8	1.21	2.4	171
Cheyenne County	3.4	5.2	8.6	14.0	9.8	23.8	.77	2.2	108
Kansas:									
Thomas County—									
Seeded	1.9	4.6	6.5	8.1	8.3	16.4	.74	....	61
Vol	.7	4.6	5.3	3.2	8.3	11.5			
McPherson County—									
Shock thrashed	4.5	4.0	8.5	18.5	7.5	26.0	1.06	2.0	140
Stack thrashed	4.5	5.0	9.5	18.5	8.1	26.6			
Pawnee County	2.2	4.4	6.6	10.6	7.2	17.8	.94	....	89
Oklahoma:									
Garfield County	4.9	4.3	9.2	20.1	6.9	27.0	1.07	2.5	120
Woodward County	3.8	4.2	8.0	14.4	8.3	22.7	.87	....	44

[a] From preliminary report on the cost of producing wheat, by R. S. Washburn and L. A. Moorhouse.

In Table 21 are summarized the average labor and material requirements for all districts. The methods of handling the crop showed considerable variation even within the same region. The labor requirements represent the prevailing practices on the farms that were operated exclusively with horsepower.

In Thomas and Pawnee Counties, Kans., and Woodward County, Okla., the requirements are for headed grain, while in all other districts they are for grain cut with a binder. The labor requirements for the two Missouri districts, and Gage and Clay Counties, Nebr., are for conditions where all bundle haulers and field pitchers were furnished by the farmer. In Cheyenne County, Nebr., and for the shock thrashing in McPherson County, Kans., the farmer furnished no labor except the bundle haulers. In Pawnee County, and for the stack thrashing in McPherson County and the two Oklahoma districts, the requirements include no time for thrashing, which was all done by contract.

A division of the labor as to land preparation and seeding, and harvesting and marketing, indicates that the man-hours for the latter were slightly greater than for the former, while the horse-hours for seed-bed preparation and seeding exceeded those required for harvesting and marketing in all cases except for volunteer wheat in Thomas County, Kans. The man-labor and horse-labor requirements were highest in the two Missouri districts, where a relatively large percentage of the acreage was covered with tillage implements which were smaller than those used in other districts. Furthermore, in Missouri the farmers furnished a greater percentage of the thrashing crew.

The seed requirements per acre were governed mainly by the amount of annual rainfall. The rate of seeding ranged from an average of 0.74 of a bushel in Thomas County, Kans., a region of limited rainfall, to 1.30 bushels in Pike County, Mo., a region of abundant rainfall. The acre use of binder twine ranged from an average of 1.5 pounds in Pike County, Mo., to 2.5 pounds in Garfield County, Okla.

OATS.

Oats do not require so loose a seed bed as many of the other farm crops, and for this reason they are often sown on corn land without plowing. On the farms for which figures are available the following percentages of land were plowed: North Dakota, 92; Wisconsin, 80; Ohio, 80; Minnesota, 75; New York, 50; Illinois, 11. (See Table 22.)

Table 22.—*Oats: Labor and material requirements per acre (301 records).*

Region.	Number of records.	Yield per acre.	Man labor.			Horse labor.			Seed per acre.	Fertilizer	Fuel (coal).	Twine per acre.	Per cent of operating expense [a] covered by foregoing.
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.					
		Bush.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Bush.*	*Lbs.*	*Lbs.*	*Lbs.*	
Minnesota	79	35.4	4.2	5.9	10.1	15.7	7.8	23.5	2.6	......	....	2.3	71
Wisconsin	92	35.7	6.0	9.0	15.0	16.3	7.7	24.0	2.2	......	48.9	2.5	71
New York	9	50.4	8.3	10.5	18.8	18.0	7.6	25.6	2.4	192.1	69.5	2.6	70
Ohio	30	34.3	9.0	11.5	20.5	19.4	8.4	27.8	2.3	......	49.5	2.2	71
Illinois	38	35.3	2.7	6.1	8.8	9.2	8.4	17.6	2.4	......	43.8	2.1	61
North Dakota	53	33.0	2.9	2.7	5.6	13.0	4.4	17.4	2.0	......	....	1.9	59

[a] Excluding interest on land.

The low labor requirement for Illinois is largely explained by the fact that only 11 per cent of the ground was plowed. In North Dakota, which has the second lowest requirement for preparation and sowing, the highest percentage of plowed land is found, but the farmers of that State save time by using larger machinery and perhaps working faster because of their skill in handling small grain with machinery. The same reasons explain the low labor requirement for harvesting in that State.

The fuel used per acre for thrashing will vary with the size of the machine, the amount of straw per acre, etc. It will be noticed, however, that the variation in cost due to fuel is negligible. In Minnesota and North Dakota straw-burning engines were used, hence there is no charge for fuel.

For Illinois and North Dakota, because of the low labor and high machine charges, the percentage of total operating expense repre-ented by labor and material is very much lower than for the other States.

Table 23.—*Oats: Percentage distribution of costs per acre.*

Item.	Illinois.		North Dakota.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
Man labor	17.9	8.7	23.4	16.4
Horse labor	24.9	12.2	19.9	14.0
Materials:				
Seed	14.4	7.0	11.7	8.2
Twine	2.7	1.3	3.6	2.5
Fuel	1.0	.5	....	....
Total materials	18.1	8.8	15.3	10.7
Other costs:				
Overhead	15.6	7.6	8.8	6.1
Machinery	10.7	5.2	8.4	5.9
Thrashing	12.8	6.2	24.2	17.0
Total other costs	39.1	19.0	41.4	29.0
Land charge	....	51.3	....	29.9
Value of land per acre	$100		$42	

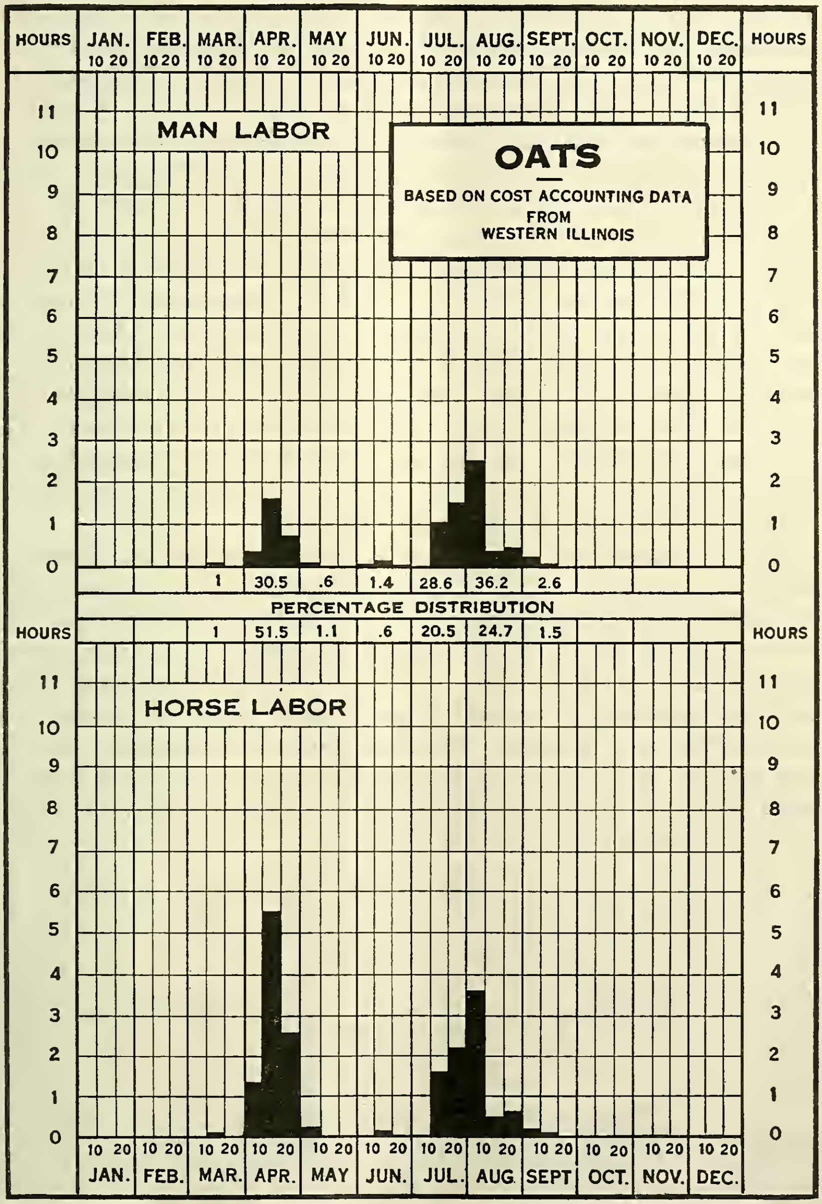

FIG. 9.—Distribution of man labor and horse labor for 22 farms, which produced a total of 891 acres of oats. Black bars indicate total hours spent per acre during 10-day periods.

BARLEY.

For best results barley must be sown in a well-prepared seed bed, and consequently the land is generally plowed for this crop. The percentages of the land plowed for barley on the farms from which records for this crop are available are as follows: Minnesota, 87; North Dakota, 97; Wisconsin, 86; New York, 50. Variations in labor requirements are due chiefly to the different sizes of machines and power units used in different sections. It will be noted (Table 24) that in North Dakota there are over three horse hours per man hour, while in New York the ratio is about 1:1½.

Barley stands up well and is for this reason very popular as a nurse crop for grass seeding. When so used it is customary to sow less seed than usual per acre. In Wisconsin, for instance, where 43 per cent of the total barley acreage covered in this investigation was seeded to grass, the records show that about one-fourth bushel less seed than usual was sown per acre when used as a nurse crop. The fact that barley is often handled in a special way for the good of the grass seeding should be borne in mind when comparing its profitableness with that of other farm crops.

The differences in labor requirements for harvesting and thrashing barley are largely due to the variations in size of machinery used. The harvest labor requirement of barley is slightly lower than that of oats, for the reason that the barley produces less straw, stands better, and thrashes faster. In North Dakota 81 per cent of the crop was thrashed by contract; that is, all or a part of the crew was furnished by the thrasher. On these farms the harvest labor per acre was 1.8 man-hours and 3.4 horse-hours, as compared with 4.1 man-hours and 6.5 horse-hours per acre on farms where the entire crew was furnished by the farm operator.

TABLE 24.—*Barley: Labor and material requirements per acre (154 records).*

Region.	Number of records.	Yield per acre.	Man labor.			Horse labor.			Seed.	Fertilizer.	Fuel (coal).	Twine.	Per cent of operating expense covered by foregoing.[a]
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	To al.					
		Bush.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Bush.*	*Lbs.*	*Lbs.*	*Lbs.*	
Minnesota	61	23.8	4.7	6.0	10.7	17.3	7.8	25.1	2.0	......	....	2.3	73
Wisconsin	37	27.3	6.4	10.5	16.9	18.6	8.7	27.3	1.7	......	49.7	2.2	75
New York	9	32.4	6.9	9.6	16.5	14.6	7.8	22.4	2.1	195.0	77.6	2.7	75
North Dakota	47	20.7	2.8	2.2	5.0	13.1	4.0	17.1	1.8	......	....	1.8	59

[a] Excluding interest on land.

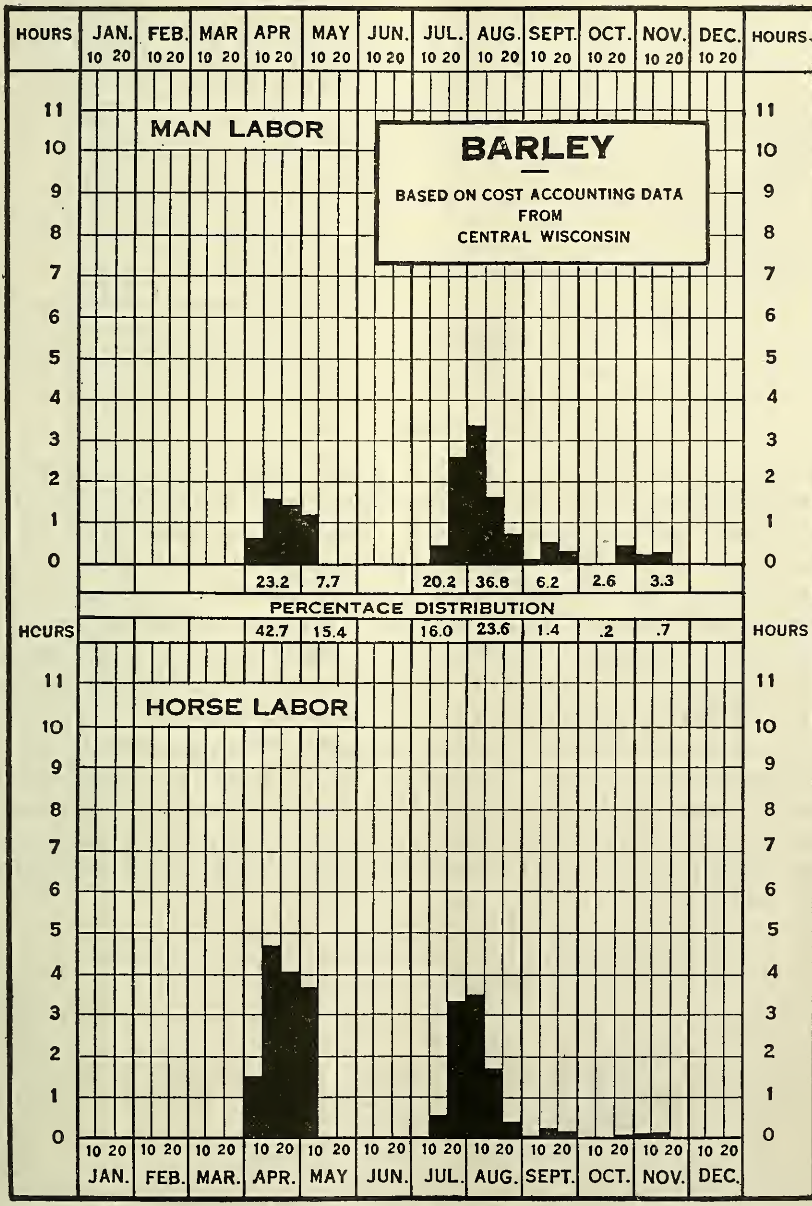

FIG. 10.—Distribution of man labor and horse labor for 16 farms, representing the production of 175 acres of barley. Marketing labor not included. Black bars indicate total hours spent per acre during 10-day periods.

TABLE 25.—*Barley: Percentage distribution of costs per acre.*

Items.	North Dakota.		Wisconsin.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	20.6	14.7	28.0	19.5
Horse labor	21.2	15.1	30.0	20.8
Materials:				
Seed	13.4	9.6	14.8	10.3
Twine	4.0	2.8	2.1	1.6
Fuel	....	....	1.0	.8
Total materials	17.4	12.4	17.9	12.7
Other costs:				
Overhead	9.7	7.0	8.3	6.2
Machiuery	7.6	5.4	8.0	5.5
Thrashing	23.5	16.7	7.8	4.8
Total other costs	40.8	29.1	24.1	16.5
Land charge	....	28.7	....	30.5
Value of land per acre	$36		$72	

RYE.

Rye does best on good land, but because of its ability to produce a comparatively good yield on poor ground it is usually grown on the lighter soils. Because of its hardiness, rye also very often receives less care and attention than the other small grains. On some farms, for instance, it is regularly sown in standing corn, making the value of the seed and the labor cost for sowing the only charges for seeding. In other regions, like the sections studied in New York and New Jersey, rye is always sown on land that is plowed and prepared in the ordinary way. Such variations in methods, of course, are bound to result in considerable variations in the cost of producing the crop. In Wisconsin 75 per cent of the rye fields were plowed, while for Minnesota and Ohio the figures are 50 and 10 per cent, respectively. The causes underlying variations in the other cost factors for rye are the same as those already discussed under oats and barley.

TABLE 26.—*Rye: Labor and material requirements per acre.*

Region.	Number of records.	Yield per acre.	Man labor.			Horse labor.			Seed.	Fertilizer.	Fuel (coal).	Twine.	Per cent of operating expense covered by foregoing. (a)
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.					
		Bush.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Bush.*	*Lbs.*	*Lbs.*	*Lbs.*	
Minnesota	6	22.3	2.8	7.4	10.2	9.0	7.9	16.9	2.0	......	......	3.1	76
Wisconsin	12	16.2	4.5	9.9	14.4	12.3	8.5	20.8	1.1	......	49.0	1.9	73
Ohio	10	14.6	6.0	10.4	16.4	11.9	7.5	19.4	1.9	......	48.0	2.0	67
											Gal.		
New York	(b)	17.0	9.9	13.4	23.3	21.2	7.1	28.3	1.9	183.0	0.8	4.0	76
New Jersey	(b)	17.6	10.0	11.4	21.4	22.7	5.4	28.1	1.8	337.0	......	2.8	74

a Excluding interest on land.
b Figures taken from the results of a special investigation.

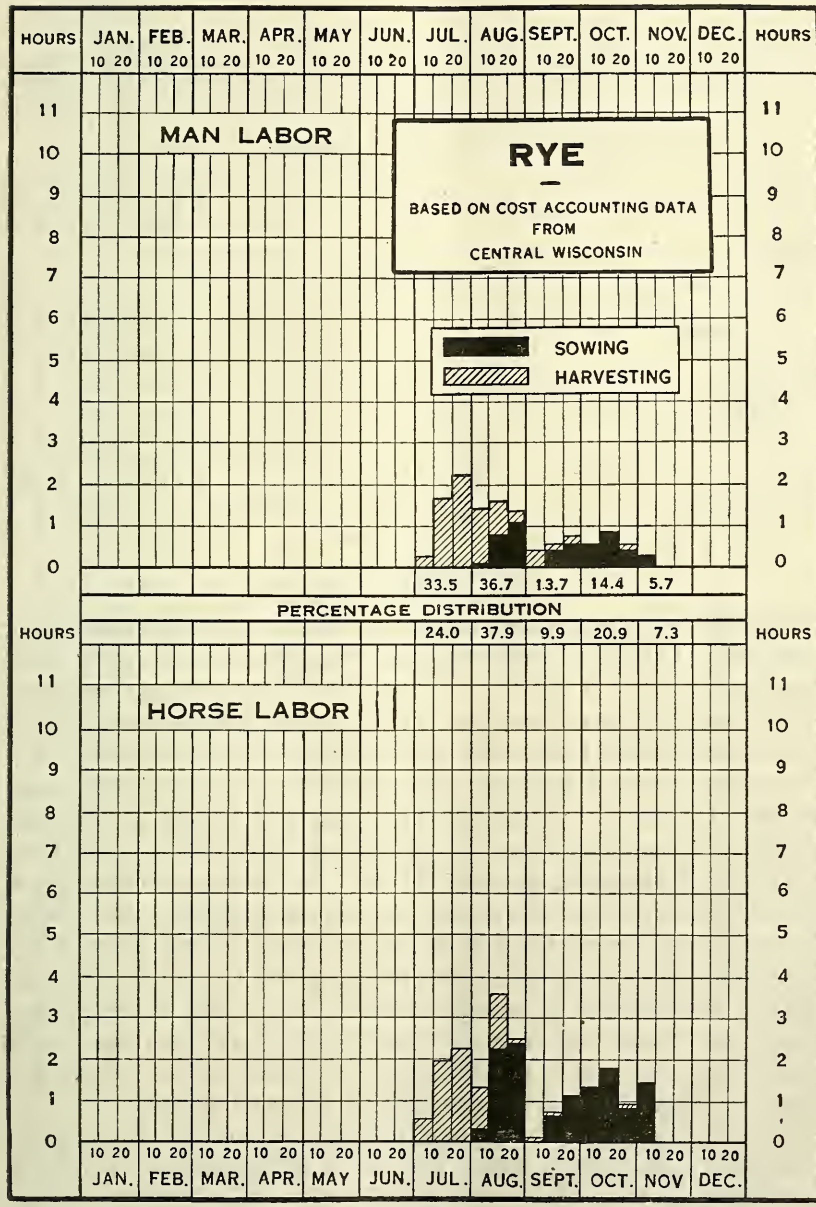

FIG. 11.—Distribution of man labor and horse labor for 12 farms, with a production of 133 acres of rye. Black bars indicate total hours spent per acre during 10-day periods.

TABLE 27.—*Rye: Percentage distribution of costs per acre.*

Item.	Minnesota.		Ohio.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	21.7	16.0	29.3	21.6
Horse labor	42.6	29.6	17.6	13.0
Materials:				
Seed	9.8	7.0	17.4	12.8
Twine	2.1	1.5	1.4	1.0
Fuel	....	....	.3	.2
Manure	....	....	15.5	11.5
Total materials	11.9	8.5	34.6	25.5
Other costs:				
Overhead	5.0	3.6	1.2	.9
Machinery	9.8	7.4	11.5	8.5
Thrashing	9.0	6.5	5.8	4.3
Total other costs	23.8	17.5	18.5	13.7
Land charge	....	28.4	....	26.2
Value of land per acre	$70		$73	

HAY.

Most of the tame grasses used for hay are either biennials or perennials. This is a very important fact to consider when comparing crop costs. In view of the fact that these crops are not sown annually on the same fields, the cost of the seed is always prorated over several years, thus reducing the seed charge for each. Not only is the seed cost reduced, but the labor of preparing the seed bed, and also, in most instances, the sowing of the seed, are charged against the nurse crop, thus leaving only the value of the seed sown as the cost of obtaining a stand of hay. In the tables following on the cost of hay, labor refers only to harvesting operations. In all of the sections studied there appeared on some records a few hours for sowing and other miscellaneous work on the hay fields, but only in New York, where it is common to roll the hay land in the spring, is this labor of any importance. On the latter farms the time spent in taking care of the hay ground in the spring amounted to six-tenths of a man hour and seven-tenths of a horse hour per acre.

Seed is always one of the costs of producing tame hay and is given for all the States except Ohio, for which the records showed only the money cost of seeding. (See Table 28.) Seed and labor make up about three-fourths of the expenses of producing hay, and machinery and overhead make up the other one-fourth. A few farmers applied fertilizer to the hay land and a few reports showed that salt was used in the hay mow, but neither of these items is of

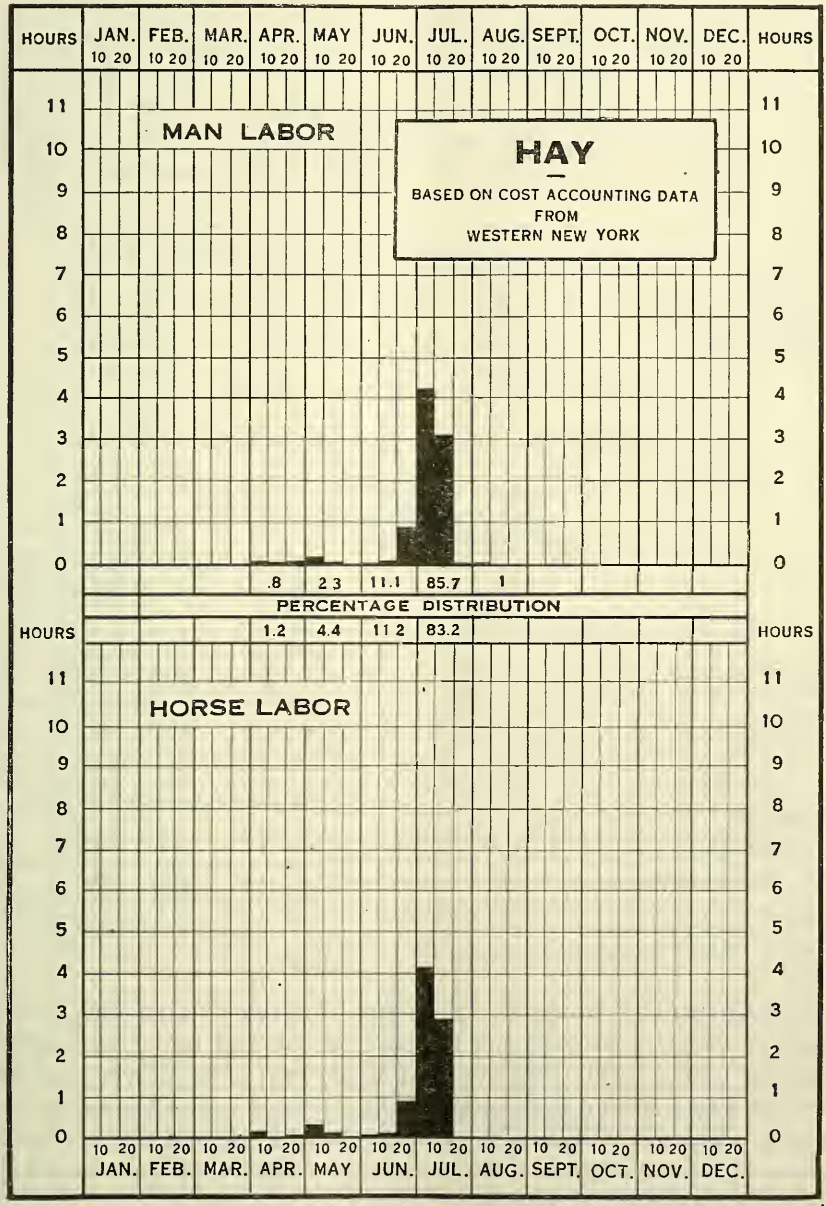

FIG. 12.—Distribution of man labor and horse labor for 13 farms, including the production of 301 acres of hay. Black bars indicate total hours spent per acre during 10-day periods.

sufficient importance to be considered. Some farmers reported baling costs, but as baling was rather the exception than the rule, no baling costs have been counted.[1]

TABLE 28.—*Mixed tame hay: Labor and material requirements per acre (197 records).*

Region.	Number of records.	Yield per acre.	Man labor: Mowing, raking, and hauling.	Horse labor: Mowing, raking, and hauling.	Seed.		Per cent of operating expense covered by foregoing.[a]
					Timothy.	Clover.	
		Tons.	*Hours.*	*Hours.*	*Pounds.*	*Pounds.*	
Minnesota	11	1.5	7.8	10.1	4.6	4.0	74
Wisconsin	65	1.4	9.1	10.2	4.6	3.8	70
New York	23	1.4	7.9	7.7	9.2	4.9	82
Pennsylvania	37	1.5	7.5	7.8	9.1	10.5	80
Ohio	52	1.4	7.9	8.5	....	....	71
New England	9	1.6	10.7	9.5	10.0	[b] 12.0	77

[a] Excluding interest on land. [b] Timothy and red top.

TABLE 29.—*Mixed tame hay: Percentage distribution of costs per acre.*

Item.	New York.		Ohio.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	22.4	15.9	33.9	17.7
Horse labor	17.6	12.5	21.3	11.2
Materials:				
Seed	25.3	17.9	15.3	8.0
Manure	16.3	11.5	....	....
Total materials	41.6	29.4	15.3	8.0
Other costs:				
Overhead	10.0	7.0	.6	.3
Machinery	8.4	6.0	28.9	15.1
Total other costs	18.4	13.0	29.5	15.4
Land charge	....	29.2	....	47.7
Value of land per acre	$83		$51	

Clover usually produces two crops, but very often the second crop is either pastured, cut for seed, or plowed under as a green manure crop. Table 30 shows that 50 per cent of the clover land was cut for hay a second time in Minnesota, though only 33 per cent was cut in Ohio and Wisconsin. On the New York and Illinois farms covered by these records the second crop was in all instances used either for seed or for pasture.

[1] References:
Dept. Bul. 578. A Study of Haymaking Crews and Labor Costs.
Dept. Bul. 641. Farm Practice in the Production of Hay in Steuben County, N. Y., and Washington County, Pa.

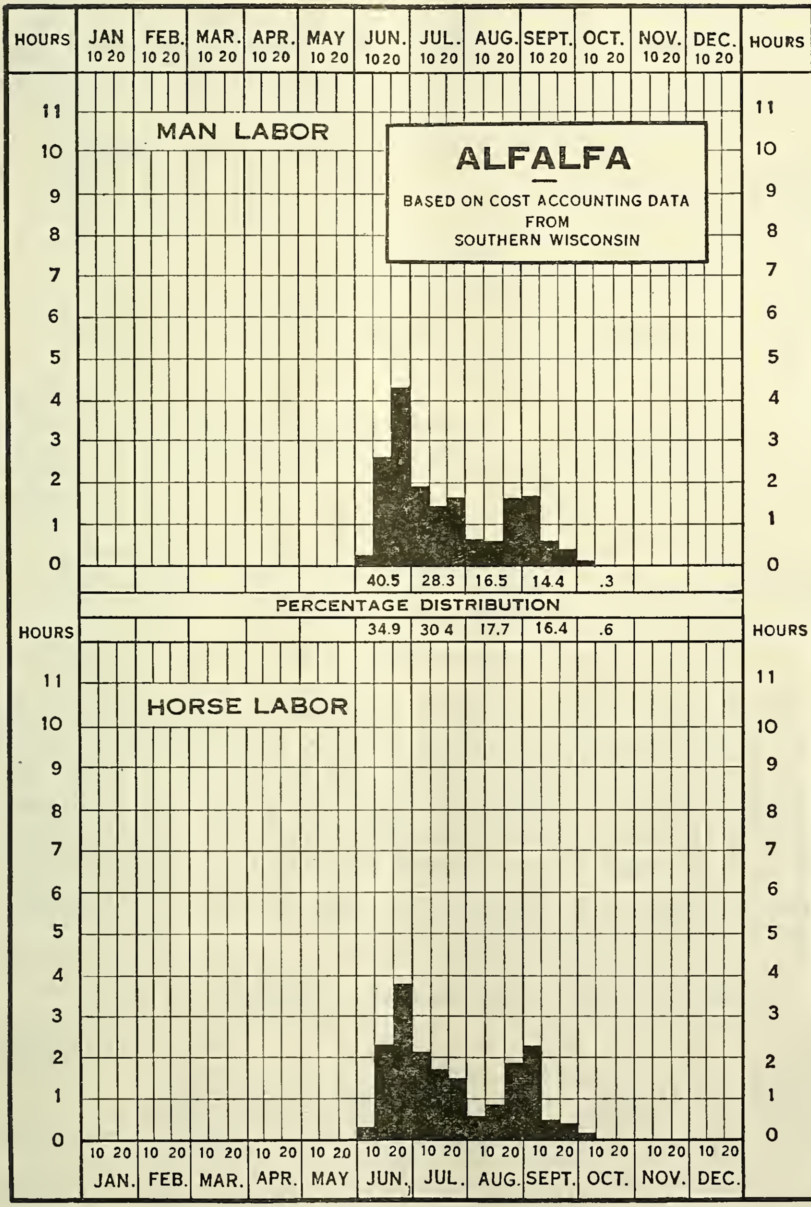

FIG. 13.—Distribution of man labor and horse labor for 20 farms, representing the production of 128 acres of alfalfa. The reports show that the first and second crops may overlap during the period July 10 to 20. Black bars indicate total hours spent per acre during 10-day periods.

TABLE 30.—*Clover hay: Labor and material requirements per acre (99 records).*

Region.	Number of records.	Yield per acre.	Man labor: Mowing, raking, and hauling.	Horse labor: Mowing, raking, and hauling.	Seed.	Per cent of operating expense covered by foregoing.[a]
		Tons.	*Hours.*	*Hours.*	*Pounds.*	
Minnesota	31	1.5	8.6	12.4	10.7	79
Wisconsin	37	2.2	14.2	15.5	7.2	79
New York	7	2.0	8.9	9.9	10.1	80
Ohio	20	1.6	11.6	10.5	....	76
Illinois	4	1.3	8.7	10.0	7.2	....

[a] Excluding interest on land.

TABLE 31.—*Timothy hay: Labor and material requirements per acre (49 records).*

Region.	Number of records.	Yield per acre.	Man labor: Mowing, raking, and hauling.	Horse labor: Mowing, raking, and hauling.	Seed.	Per cent of operating expense covered by foregoing.[a]
		Tons.	*Hours.*	*Hours.*	*Pounds.*	
Minnesota	13	1.3	8.0	11.4	5.4	80
Wisconsin	21	1.4	9.1	11.0	5.5	82
Ohio	8	1.2	7.9	9.2	....	75
Iowa	7	1.8	7.5	8.8	4.0	70

[a] Excluding interest on land.

Alfalfa grows rapidly, and under favorable conditions, will produce several cuttings each season. To know the number of cuttings is rather important when studying cost figures for this crop and, therefore, figures on number of cuttings are given in the accompanying table (Table 32). Costs for alfalfa other than harvesting are about the same as those given for mixed hay, but the equipment cost is somewhat larger for alfalfa, which tends to reduce the proportion represented by seed and labor.

TABLE 32.—*Alfalfa: Labor and material requirements per acre (105 records).*

Region.	Number of records.	Yield per acre.	Man labor: Mowing, raking, and hauling.	Horse labor: Mowing, raking, and hauling.	Seed.	Per cent of operating expense[a] covered by foregoing.	Part of acreage cut more than once.	
							Two times.	Three times.
		Tons.	*Hrs.*	*Hrs.*	*Lbs.*		*Per cent.*	*Per cent.*
Minnesota	37	2.5	20.2	24.1	11.7	73	80	60
Wisconsin	39	2.4	21.8	21.2	18.0	72	93	59
Iowa	7	2.0	14.0	22.4	15.0	69	100	72
Illinois	3	1.9	19.2	23.7	13.7	63	....	....
Ohio	7	1.8	17.4	13.8	....	67	86	58
New York	12	2.2	14.4	16.0	15.3	69	91	64

[a] Excluding interest on land.

Besides clover, timothy, and alfalfa, several other crops may be used for hay. Many farmers depend largely upon peas and oats and other grains for their hay, but on most farms these crops are harvested for hay only in case of emergency. The seed used for the grain hay is very often a mixture of peas and oats, although the records indicate that the other grains are also used. The amounts of seed given per acre in the following table consist of about two-thirds oats and the remainder peas, rye, wheat, etc.:

TABLE 33.—*Wild and grain hays: Labor and material requirements per acre (83 records).*

Region.	Kind of hay.	Number of records.	Yield per acre.	Man labor.			Horse labor.			Seed.	Per cent of operating expense[a] covered by foregoing.
				Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.		
			Tons.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Lbs.*	
Minnesota	Wild	52	1.3	......	7.6	7.6	......	10.9	10.9	......	46
Do	Millet	8	1.7	6.9	11.3	18.2	23.2	12.7	35.9	35.9	69
North Dakota	...do	5	1.9	3.2	5.1	8.3	14.3	8.1	22.4	21.0	83
Wisconsin	Grain	8	1.2	8.1	8.5	16.6	16.4	8.1	24.5	75.0	80
Illinois	...do	2	.5	3.1	3.4	6.5	8.1	5.5	13.6	42.0	......
Minnesota	...do	8	1.3	2.9	8.3	11.2	8.9	9.8	18.7	70.4	......

[a] Excluding interest on land.

GRASS-SEED CROPS.

On many farms it is customary to use the second cutting of clover for the production of seed. When so used it has been the practice to divide the annual charges against the field between the two cuttings. When only two cuttings are made the hay and clover seed crops are made to carry equal proportions of such items as the seeding cost, land rent, taxes, etc., or two-thirds of the expense may be charged to the hay, if two crops of hay and one crop of seed are obtained during the same season.

With timothy, which usually produces only one crop a year, this question does not arise. (See Tables 34, 35, and 36.)

TABLE 34.—*Timothy seed: Labor and material requirements per acre.*

Region.	Number of records.	Yield per acre.	Man labor.		Horse labor.		Seed.	Twine.	Per cent of operating expense covered by foregoing.[a]
			Harvest.	Total.	Harvest.	Total.			
		Bush.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	*Lbs.*	*Lbs.*	
Minnesota	12	4.0	6.3	6.3	7.6	7.6	5.6	1.9	45
Wisconsin	4	1.7	3.9	3.9	4.4	4.4	4.6	.8	62
Iowa	10	5.8	6.9	6.9	7.6	7.6	4.0	3.1	49
Ohio	3	1.7	6.0	6.0	5.0	5.0	....	....	64
New York	......	6.3	10.0	10.0	8.9	8.9	....	....	....

[a] Excluding interest on land.

TABLE 35.—*Timothy seed: Percentage distribution of costs per acre.*

Item.	Iowa.		Minnesota.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	20.6	9.5	22.0	9.5
Horse labor	16.3	7.5	14.0	6.0
Materials:				
Seed	7.7	3.3	4.8	2.0
Twine	4.8	2.2	4.4	1.6
Total materials	12.5	5.5	9.2	3.6
Other costs:				
Overhead	21.9	10.2	16.0	6.1
Machinery	11.4	5.3	21.6	9.4
Thrashing	17.3	8.0	17.2	7.4
Total other costs	50.6	23.5	54.8	22.9
Land charge	....	54.0	....	58.0
Value of land per acre	$180		$70	

TABLE 36.—*Clover seed: Labor and material requirements per acre.*

Region.	Number of records.	Yield per acre.	Man labor.		Horse labor.		Seed.	Per cent of operating expense covered by foregoing.[a]
			Harvest.	Total.	Harvest.	Total.		
		Bush.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Lbs.*	
Minnesota	8	.9	5.3	5.3	7.2	7.2	10.7	56
Wisconsin	17	1.6	8.9	8.9	7.0	7.0	10.3	40
Ohio	19	1.0	6.0	6.0	5.3	5.3	....	53
Illinois	2	.7	8.5	8.5	11.9	11.9	6.6	55

[a] Excluding interest on land.

APPLES.

The apple acreage for which records are available is as follows: Wenatchee (Wash.), 566, Yakima (Wash.), 766; Hood River (Oreg.), 672; Payette (Idaho), 430; western Colorado, 1,351; western New York, 3,052—total, 6,837 acres. The records were obtained during the years 1914, 1915, and 1916.

The labor necessary for the production of apples varies considerably from year to year. The differences are due chiefly to size of crop and methods of soil management. Orchards may be handled by the clean-cultural method or by the sod or mulch crop method. In this study the more common method of soil management in each locality was considered. The man labor and horse labor requirements are based upon practice throughout a period of five or six years. The maintenance labor has been separated from harvest labor in order to indicate the relative demand for labor during these

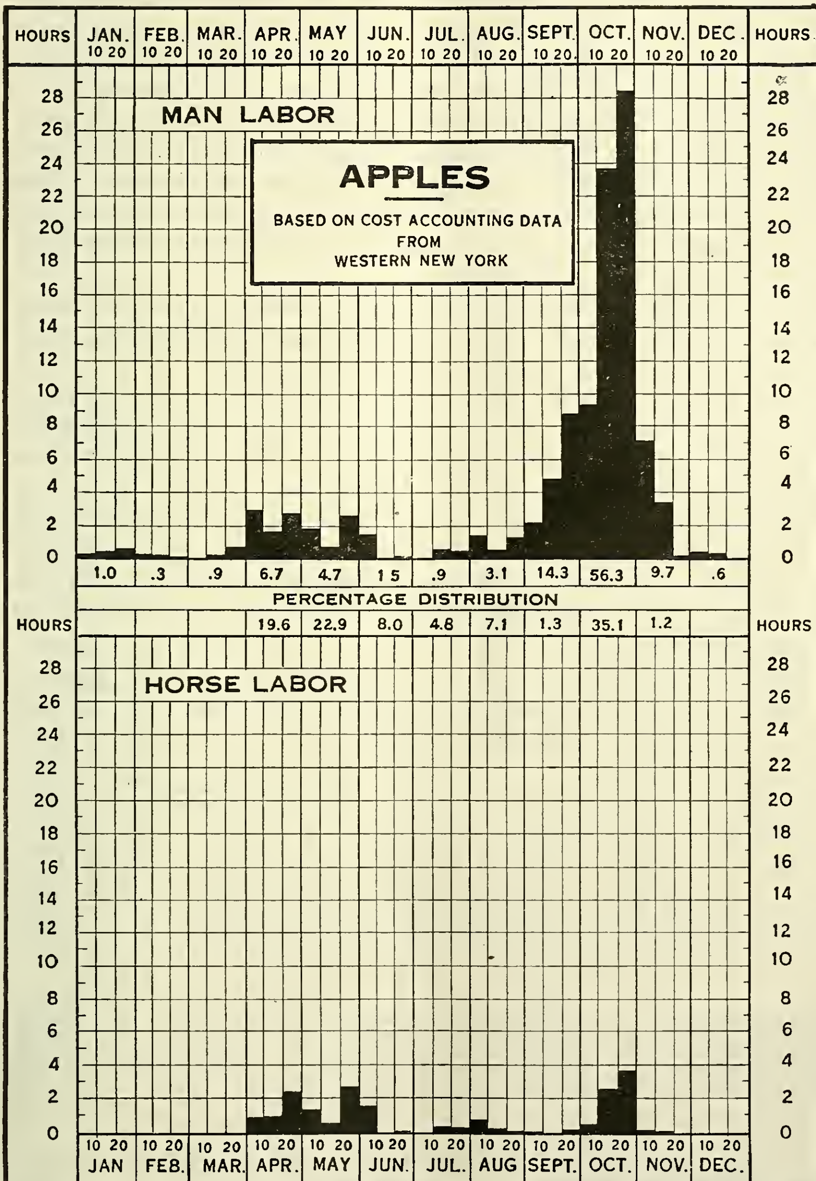

FIG. 14.—Distribution o fman labor and horse labor on 7 farms, with a total of 87 acres in bearing apples. Market labor and time spent on crops grown in these orchards have been excluded. Black bars indicate total hours spent per acre during 10-day periods.

two periods. The harvest labor is influenced largely by crop yields. It will be seen (Table 37) that the maintenance labor varied from 77 man hours per acre in western New York to 230 man hours per acre in Wenatchee Valley, Washington. Approximately the same range will be noted for the harvest labor. For most of these districts the harvest labor exceeded the maintenance labor quite appreciably.

Northwestern apple growers do not make a practice of using commercial fertilizers on their orchards, but in western New York about 50 per cent of the growers apply some commercial fertilizer. The average application of fertilizer was approximately 500 pounds per acre. The amount of farm manure applied annually to apple orchards as a whole was comparatively low.

For practically all of these districts the costs which are included under basic requirements constitute approximately 90 per cent of the total cost of producing apples, exclusive of land rent.

It will be seen that the gallons of solution used for the dormant spray are given in Table 37. Owing to variations in the solutions which were applied in subsequent sprays it did not appear to be feasible to separate the gallons of solution for each application, but the average number of sprays is given for each district, together with the average number of gallons of solution used with the later sprays. This method of reporting is not a satisfactory one, but the figures indicate in some measure the practices with respect to the use of spray materials.[1]

TABLE 37.—*Apples: Labor and material requirements per acre (642 records).*

Region.	Number of records.	Year.	Man labor.			Horse labor.			Manure.	Fertilizer.	Spraying.			Part of operating expense covered by foregoing.[a]	Yield per acre.[b]	Average land value per acre.
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.			Dormant spray solution.	Other sprays.				
												Number.	Solution.			
			Hrs.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Tons.*	*Lbs.*	*Gals.*		*Gals.*	*Per cent.*	*Boxes.*	
Wenatchee Valley, Wash.	87	1914	230	364	594	96	62	158	2.2	....	467	2.4	1,185	89	593	$1,925
Yakima Valley, Wash ..	120	1915	214	300	514	91	59	150	4.7	....	430	4.0	1,619	89	432	1,080
Hood River, Oreg.	54	1915	142	164	306	82	33	115	1.5	....	222	4.8	1,040	82	222	991
Payette Valley, Idaho...	38	1915	177	235	412	72	41	113	4.0	...	389	3.1	1,155	93	337	613
Western Colorado.......	125	1914–15	161	191	352	76	47	123	3.5	....	353	4.0	2,020	89	284	653
															Bbls.	
Western New York......	218	1915	77	93	170	63	27	90	4.8	177	264	2.3	620	91	[c] 84	514

[a] Per cent that man and horse labor, manure, fertilizer, spray materials and containers are of operating expense, exclusive of land rent.

[b] The average yield represents the yield over a five or six year period.

[c] To reduce to boxes, multiply by 3.

[1] See:

U. S. Dept. of Agr. Bul. 446. Cost of Producing Apples, Wenatchee Valley, Washington.

U. S. Dept. of Agr. Bul. 500. Cost of Producing Apples in Western Colorado.

U. S. Dept. of Agr. Bul. 518. Cost of Producing Apples in Hood River Valley, Oregon.

U. S. Dept. of Agr. Bul. 614. Cost of producing Apples in Yakima Valley, Washington.

U. S. Dept. of Agr. Bul. 636. Cost of Producing Apples in Payette Valley, Idaho.

U. S. Dept. of Agr. Bul. 851. Cost of Producing Apples in Western New York.

TABLE 38.—*Apples: Percentage distribution of costs per acre.*

Item.	Western New York.		Yakima Valley, Wash.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	34.8	28.1	50.2	37.9
Horse labor	12.6	10.2	8.5	6.4
Materials:				
Fertilizer and cover-crop seed	2.5	2.0	(a)	(a)
Manure	7.8	6.3	2.7	2.0
Gas and oil	.5	.4	.3	.2
Spray	8.0	6.5	4.6	3.5
Boxes and barrels	26.5	21.4	23.5	17.8
Total materials	45.3	36.6	31.1	23.5
Other costs:				
Apple building	1.9	1.5	1.6	1.2
Machinery	2.9	2.4	3.4	2.6
Taxes and insurance	2.5	2.0	4.4	3.4
Water rent	....	....	.8	.6
Total other costs	7.3	5.9	10.2	7.8
Land charge	....	19.2	....	24.4
Value of land per acre	$514		$1,080	

a Less than one-tenth of 1 per cent.

MISCELLANEOUS CROPS.

Besides the staple farm crops there are a great many minor crops. Although most of these may be the chief crops in certain sections, they are of secondary importance considering the country as a whole, and, therefore, have not been made the subject of special cost investigations. The only available data as to the cost of growing these crops have been obtained on farms where complete cost accounting records have been kept for the entire farm business. It will be observed in studying the following tables that in a number of instances the number of records is not sufficiently large to warrant drawing definite conclusions, but it is hoped that they may give a general idea as to the probable labor and material requirements for the crops in question.

Table 39 gives the cost for the miscellaneous crops that may be grown as regular field crops, while Table 40 gives the data for truck crops and the like. Each of the crops covered in Table 40 received about the same amount of care, namely, about 150 man hours per acre. The pansy and aster seed, though grown by experts and not of very much interest to the average farmer, are of general interest as examples of extremely intensive crops. An acre of pansy seed required as much man labor as is necessary to produce 200 acres of wheat in North Dakota. The crops listed in Table 40 are therefore types of crops that may be produced to advantage in sections where land is scarce and labor plentiful.

TABLE 39.—*Miscellaneous field crops: Labor and material requirements per acre.*

Region and crop.	Number of records.	Yield per acre.	Man labor.			Horse labor.			Seed.	Twine.	Manure.	Fertilizer.	Per cent of operating expense *a* covered by foregoing.
			Prior to harvest.	Harvest.	Total.	Prior to harvest.	Harvest.	Total.					
New York:		*Bush.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Bush.*	*Lbs.*	*Tons.*	*Lbs.*	
Buckwheat	......	19.3	11.0	6.7	17.7	27.6	5.6	33.2	1.0	......	......	......	73
Peas (canning)	5	*Lbs.* 1,112.6	19.6	20.8	40.4	37.9	17.0	54.9	4.0	......	......	251.8	89
Pennsylvania:													
Buckwheat	......	*Bush.* 19.5	13.8	4.8	18.6	28.5	6.2	34.7	1.0	......	......	......	74
Minnesota:													
Flax	8	7.5	6.1	4.0	10.1	21.7	7.5	29.2	.5	4.0	......	......	72
North Dakota:													
Flax	25	7.5	3.3	2.3	5.6	15.2	4.3	19.5	.5	1.8	......	......	60
Wisconsin:													
Buckwheat	3	16.8	6.0	10.6	16.6	17.0	8.0	25.0	.8	2.0	......	......	80
Cabbage	5	*Tons.* 10.7	37.6	64.0	101.6	30.8	54.8	85.6	*b* 5,500	......	3.0	......	90
Peas (dry)	8	*Bush.* 12.4	7.8	10.8	18.6	19.2	8.8	28.0	2.1	......	......	......	75
Onions	4	329.0	323.6	126.4	450.0	32.5	24.0	56.5	*Lbs.* 5.2	......	10.0	......	88

a Excluding interest on land. *b* Plants.

TABLE 40.—*Miscellaneous crops (truck, etc.): Labor and material requirements per acre.*

Region and crop.	Number of records.	Yield per acre.	Man labor.			Horse labor.			Seed.	Fertilizer.
			Prior to harvest	Harvest.	Total.	Prior to harvest	Harvest.	Total.		
Wisconsin:		*Bushs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Bushs.*	*Lbs.*
Onions (seed)	3	260.0	106.8	55.2	162.0	58.0	0.3	58.3	28	....
Beets	4	69.0	68.0	73.0	141.0	53.0	28.0	81.0	*Lbs.* 8.2	....
Mangels	1	385.0	101.8	38.1	139.9	36.7	21.5	58.2	5.8	....
Turnips	1	333.0	91.6	41.7	133.3	40.8	43.3	84.1	3.0	....
Radish seed	1	*Lbs.* 35.0	67.8	55.4	123.2	61.6	8.9	70.5	3.1	....
Cucumber	1	215.0	66.0	64.8	130.8	83.8	5.7	89.5	3.6	....
Pansy seed	1	9.4	566.8	321.1	887.9	24.7	....	24.7	.7	....
Aster seed	2	39.0	230.0	95.0	325.0	193.5	1.5	195.0	.6	....
Pennsylvania:										
Tomatoes	1	....	....	....	170.4	....	....	48.7	....	....
New Jersey:										
Tomatoes	......	....	....	....	125.9	....	....	85.0	*Oz.* 24	84.4

TABLE 41.—*Flax: Percentage distribution of costs per acre.*

Items.	North Dakota.		Minnesota.	
	Distribution of operating expense.	Distribution of total costs.	Distribution of operating expense.	Distribution of total costs.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Man labor	22.4	16.9	19.0	13.9
Horse labor	24.1	18.1	32.4	23.8
Materials:				
Seed	10.1	7.6	14.3	10.5
Twine	3.3	2.5	7.2	5.3
Total materials	13.4	10.1	21.5	15.8
Other costs:				
Overhead	7.6	5.7	10.3	7.6
Machinery	8.9	6.7	7.9	5.8
Thrashing	23.6	17.8	8.9	6.6
Total other costs	40.1	30.2	27.1	20.0
Land charge	....	24.7	....	26.5
Value of land per acre	$33		$70	

METHOD OF USING FOREGOING DATA IN ESTIMATING COSTS.

The figures presented in the foregoing tables represent the average crop requirements for the regions investigated, and may be of value to those interested in determining general costs, and to individual farmers as a basis for determining approximate costs on their own farms. In either case the method of procedure is the same, the only difference being that average rates should be used for finding regional costs, while the individual farmer should use, if available, the actual hours of labor and rates for labor and materials applicable to his own farm.

It will be understood that the requirements and proportions presented for each crop may be used in approximating costs in those areas only in which the farm practice in general is similar to that of the regions for which the data are given.

The method of estimating the cost of a given crop may be outlined as follows:

1. **Determine the total cost of labor and material per acre** *by applying current rates to the quantities of labor and materials obtained from the individual's own records, or, if these are not available, use the averages given in the table.*
2. **Determine the total operating expense per acre** *by dividing the cost of labor and material by the percentage figure (per cent of total operating expense) for the given crop in the given region.*
3. **Determine the total acre cost of production** *by adding the interest charge or the cash rent paid for the use of land.*
4. **To determine the cost per bushel or ton** *divide the total acre cost by the yield per acre.*

The following examples will illustrate the way in which these rules are applied.

EXAMPLE 1.—*Showing how to use the figures presented for estimating the cost of silage on a farm in Iowa.*

[See Table 3.]

Item.	Amount.	Estimated rate.	Cost.
Man labor...hours..	27.9	$0.35	$9.76
Horse labor...hours..	51.8	.25	12.95
Seed...lbs..	9.9	.08	.79
Manure...tons..	2.2	2.00	4.40
Gasoline...gals..	2.8	.25	.70
Coal...lbs..	14.0	.005	.07
Twine...lbs..	3.6	.25	.90
Total labor and material (80 per cent of operating expense)...			$29.57
Total operating expense (100 per cent) [a]...			36.96
Interest on acre of land ($200 at 5 per cent)...			10.00
Total cost...			46.96
Average yield per acre, tons...			9.8
Average cost per ton...			$4.80

[a] $\$29.57 \div 80 \times 100 = \$36.96$, or total operating expense.

NOTE.—The following figures show how to make the necessary adjustments for a farm where, for example, $5 worth of fertilizer was applied to the corn land, but on which no twine was used: $46.96+$5.00=$51.96, less twine ($0.90)=$51.06.

EXAMPLE 2.—*Cost of producing clover hay in New York, 1921.*

[See Table 30.]

Item.	Amount.	Estimated rate.	Cost.
Man labor...hours..	8.9	$0.30	$2.67
Horse labor...hours..	9.9	.20	1.98
Seed...pounds..	10.1	[a].53	2.67
Total cost of labor and material (80 per cent of operating expense)...			$7.32
Total operating expense (100 per cent) [b]...			9.15
Interest on land ($84 at 5 per cent) [c]...			4.20
Total cost of producing 1 acre...			13.35
Average yield per acre...tons..			1.96
Average cost per ton...			$6.80

[a] If seed is estimated at $32 per bushel the total cost of seed per acre is $5.35, which must be prorated over the number of years that the land is expected to remain in hay. In this illustration it was assumed that the field would be left two years ($5.35÷2=$2.67). It was also assumed that the seed was sown with a nurse crop, so there was no labor nor machine charge for sowing. On farms where the sowing of the grass seed is a separate operation, the cost of such labor must be added to the cost of the seed. Thus, 1 man hour and 2 horse hours for sowing would make a cost of 65 cents per acre, to which may be added 15 cents for the seeder, thus giving a grand total of 80 cents for sowing. This, added to the cost of seed, would increase the seed charge from $5.35 to $6.15 per acre ($6.15÷2=$3.07 per year).

[b] $7.32÷80×100=$9.15, or total operating expense.

[c] See Table 42 on present land values.

EXAMPLE 3.—*Cost of producing potatoes, Barron County, Wis., 1920.*

[See Table 8.]

Item.	Amount per acre.	Estimated rate.	Cost per acre.
Man labor...hours..	92.7	$0.40	$37.08
Horse labor...hours..	100.3	.20	20.06
Manure...tons..	7.1	2.00	14.20
Seed...bushels..	11.6	3.75	43.50
80.6 per cent of operating expense...			$114.84
Total operating expense...			142.48
Interest on land (6 per cent on $179)...			10.74
Total cost per acre...			153.22
Total cost per bushel (90 bushels)...			1.70

NOTE.—In this example 1920 rates and values were applied to the basic quantity requirements found in the 1919 study for the Barron County area. The man labor rate increased approximately 20 per cent and cost of seed potatoes 300 per cent over 1919. The high price of seed accounts for the high cost per bushel of yield. Figuring labor, fertilizer, and seed together at prevailing rates for any year, the result will be approximately 80 per cent of the total operating expense per acre (not including land rent). This percentage will fluctuate slightly from year to year, as the rates for one or more of these factors increase or decrease more rapidly than the others. It may, however, be taken as a fair approximation. A few farmers in Barron County applied commercial fertilizer to the potato crop. When this charge was prorated to all farms, it amounted to a cost of 14 cents per acre. This amount has not been added in preparing the potato example. On farms where fertilizer is applied this item should be included in computing the operating expense per acre.

EXAMPLE 4.—*Cost of producing wheat, McPherson County, Kansas, 1920.*

[See Table 19.]

Item.	Amount per acre.	Estimated rates.	Cost per acre.
Man labor (prior to harvest)........hours..	4.5	$0.30	$1.35
Man labor (harvest)........do....	4.8	.60	2.88
Horse labor........do....	26.9	.20	5.38
Seed........bushels..	1.1	2.50	2.75
Manure [a]........tons..	.5	2.00	1.00
Twine........pounds..	2.7	.25	.68
63 per cent of operating expense........			$14.04
Total operating expense........			22.29
Interest on land (6 per cent on $134)........			8.04
Total cost per acre........			30.33
Total cost per bushel (15.4 bushels)........			1.97

[a] Comparatively few farmers applied manure to the wheat land in McPherson County. When the manure was prorated to all the farms in this group, the application amounted to one-half a ton per acre and the charge made a total of $1 per acre. The cost of manure on this basis was approximately 5 per cent of the operating expense.

EXAMPLE 5.—*Showing application of 1920 rates to basic factors in estimating the operating expenses per acre and per pound for cotton (without land rent), Mitchell County, Georgia.*

Item.	Amount.	Approximate rates.	Per acre.	Per cent operating costs.
Man labor........hours..	100	$0.30	$30.00	53.8
Mule labor........do....	48	.20	9.60	17.2
Seed........bushels..	1	[b] 81.00	1.21	2.2
Fertilizer........pounds..	277	[b] 45.00	6.23	11.2
Subtotal........	....	....	47.04	84.4
If $47.04=84.4 per cent of total cost, then the total [a] cost (100 per cent) equals........	....	....	55.73	....
Seed credit........pounds..	300	[b] 26.00	3.90	....
Total net cost per acre........	....	....	51.83	....
Interest on land (6 per cent on $67)........			$4.02	
Total net cost per acre........			55.85	
Total net cost per pound of lint ($55.85÷159)........			.35	

[a] Including in addition manure, equipment, taxes, insurance, ginning, and overhead.
[b] Per ton.

VALUE OF PLOW LANDS.

In view of the fact that it has been customary in some methods of accounting to include interest on land as a cost, a table showing the value of plow lands in the United States has been added for convenience. To compute the approximate land charge for a particular district, ascertain the usual interest rate for this region, then multiply this rate by a valuation which appears to be fair for the kind of land devoted to the crop under consideration. It is assumed that Table 41 will afford some suggestions concerning the values for different grades of land.

TABLE 42.—*Value of plow lands.*[a]

State.	Average of poor plow lands.			Average of good plow lands.			Average of all plow lands.			
	1921	1920	1919	1921	1920	1919	1921	1920	1919	1918
Maine	$25.00	$30.00	$24.00	$50.00	$56.00	$50.00	$36.00	$42.00	$37.00	$35.00
New Hampshire	24.00	24.00	23.00	63.00	64.00	54.00	41.00	42.00	39.00	39.00
Vermont	29.00	30.00	30.00	67.00	69.00	64.00	47.00	48.00	44.00	44.00
Massachusetts	40.00	40.00	41.00	98.00	103.00	92.00	69.00	72.00	68.00	68.00
Rhode Island	50.00	50.00	47.00	105.00	105.00	92.00	85.00	85.00	73.00	70.00
Connecticut	34.00	35.00	37.00	90.00	100.00	80.00	58.00	60.00	55.00	52.00
New York	40.00	39.00	38.00	84.00	84.00	80.00	65.00	64.00	60.00	58.00
New Jersey	55.00	50.00	50.00	125.00	104.00	103.00	92.00	80.00	76.00	78.00
Pennsylvania	39.00	40.00	38.00	81.00	86.00	79.00	62.00	66.00	60.00	58.00
Delaware	38.00	44.00	36.00	72.00	86.00	70.00	55.00	66.00	55.00	59.00
Maryland	31.00	46.00	39.00	70.00	82.00	66.00	51.00	60.00	53.00	47.00
Virginia	32.00	34.00	31.00	70.00	73.00	62.00	50.00	53.00	47.00	43.00
West Virginia	31.00	32.00	29.00	70.00	75.00	64.00	48.00	51.00	44.00	43.00
North Carolina	36.00	42.00	31.00	76.00	87.00	67.00	55.00	63.00	50.00	42.00
South Carolina	32.00	41.00	27.00	68.00	82.00	56.00	50.00	61.00	45.00	36.00
Georgia	23.00	30.00	24.50	50.00	63.00	49.30	36.00	46.00	37.50	28.00
Florida	25.00	23.00	21.00	55.00	53.00	48.00	40.00	36.00	33.00	32.00
Ohio	60.00	69.00	63.00	110.00	132.00	113.00	88.00	105.00	91.00	86.00
Indiana	71.00	80.00	68.00	137.00	150.00	126.00	109.00	119.00	100.00	96.50
Illinois	105.00	115.00	100.00	195.00	213.00	170.00	157.00	170.00	144.00	132.06
Michigan	41.00	41.00	40.00	83.00	80.00	76.00	65.00	64.00	61.00	60.00
Wisconsin	65.00	66.00	60.00	122.00	125.00	110.00	98.00	100.00	89.00	82.00
Minnesota	74.00	73.00	59.00	121.00	120.00	88.00	101.00	100.00	78.00	75.00
Iowa	145.00	157.00	129.00	238.00	257.00	196.00	200.00	219.00	169.00	154.00
Missouri	58.00	60.00	51.00	106.00	110.00	91.00	83.00	87.00	72.00	66.00
North Dakota	30.00	31.00	27.50	49.00	49.00	43.00	42.00	43.00	37.00	35.00
South Dakota	66.00	67.00	50.00	102.00	108.00	77.00	85.00	90.00	67.00	56.00
Nebraska	80.00	85.00	67.00	140.00	150.00	115.00	115.00	125.00	95.00	80.00
Kansas	50.00	50.00	44.00	90.00	90.00	77.00	70.00	70.00	61.00	58.00
Kentucky	33.00	42.00	37.00	75.00	95.00	80.00	53.00	70.00	61.00	50.00
Tennessee	35.00	40.00	31.00	81.00	90.00	75.00	55.00	60.00	53.00	48.00
Alabama	17.00	20.00	17.00	38.00	43.00	33.00	26.00	30.00	24.00	21.00
Mississippi	16.00	23.00	16.00	36.00	49.00	33.50	26.00	35.00	25.50	23.00
Louisiana	24.00	34.00	25.00	50.00	65.00	44.00	38.00	50.00	33.00	33.00
Texas	33.00	36.00	27.00	70.00	72.00	58.00	52.00	56.00	46.00	45.00
Oklahoma	29.00	30.00	24.00	63.00	63.00	51.00	46.00	47.00	38.00	35.00
Arkansas	24.00	26.00	22.00	54.00	65.00	50.00	38.00	45.00	38.00	31.00
Montana	19.00	21.00	21.00	41.00	48.00	45.00	30.00	36.00	34.00	35.00
Wyoming	25.00	34.00	26.00	60.00	70.00	53.00	44.00	53.00	43.00	41.00
Colorado	35.00	40.00	36.00	86.00	88.00	80.00	67.00	66.00	60.00	55.00
New Mexico	30.00	30.00	30.00	60.00	60.00	60.00	45.00	45.00	45.00	42.00
Arizona	75.00	90.00	60.00	140.00	180.00	125.00	120.00	130.00	100.00	98.00
Utah	50.00	60.00	55.00	140.00	135.00	125.00	100.00	103.00	95.00	86.00
Nevada	45.00	46.00	50.00	90.00	110.00	110.00	75.00	80.00	85.00	80.00
Idaho	58.00	60.00	50.00	128.00	135.00	98.00	99.00	105.00	76.00	70.00
Washington	63.00	68.00	60.00	140.00	150.00	121.00	105.00	115.00	95.00	94.00
Oregon	60.00	60.00	53.00	135.00	130.00	108.00	103.00	100.00	81.00	84.00
California	75.00	70.00	69.00	200.00	175.00	165.00	135.00	130.00	121.00	120.00
United States	56.66	60.76	51.26	106.33	113.34	91.83	83.78	90.01	74.31	68.38

[a] From Monthly Crop Reporter, March, 1921.

LABOR DISTRIBUTION AMONG FARM ENTERPRISES.

Figures 15 and 16, showing the distribution of man labor on two representative farms, illustrate the manner in which the various enterprises of the farm compete for labor at different periods throughout the year. It should be noted, that the length of each bar represents the average hours per day of the ten-day period and not the total hours, as in the case of the foregoing single enterprise charts.

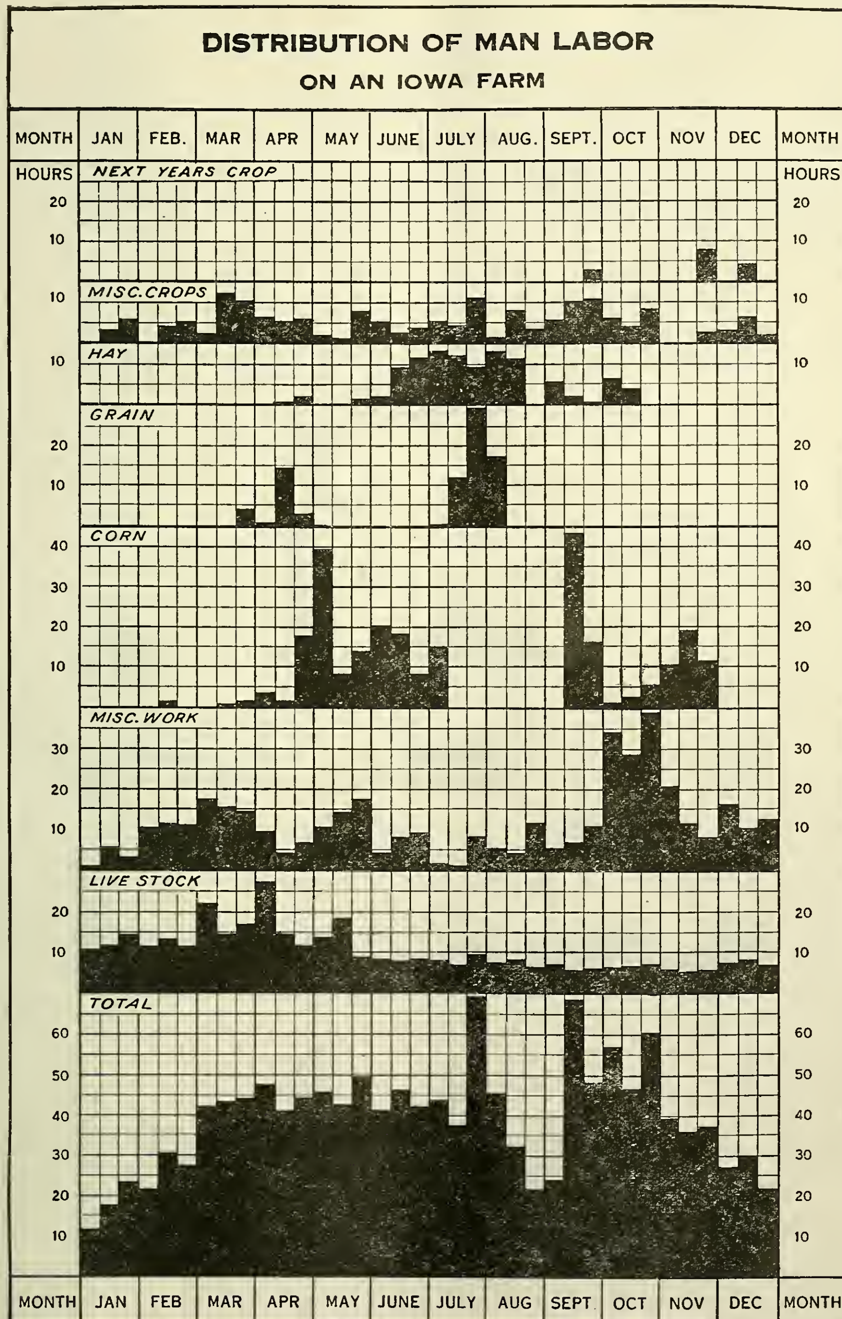

FIG. 15.—Distribution o man labor on an Iowa farm. This farm had the following crop and live stock organization: Silage corn, 26.4 acres; ear corn, 69 acres; corn hogged down, 5.75 acres; oats, 26.1 acres; barley, 15.88 acres; spring wheat, 4.7 acres; winter wheat, 17 acres; clover, 13.2 acres; timothy hay, 19.3 acres; timothy seed, 17.5 acres; alfalfa, 9.3 acres; potatoes, 3.5 acres. Total crop acreage, 227.63. The following live stock was kept on the arm: Horses, 14.1; cows, 6; steers, 24.2; beef cattle (breeding herd), 28.1; hogs, 16.1; making a total of 88.5 animal units. Black bars indicate average hours per day for each 10-day period.

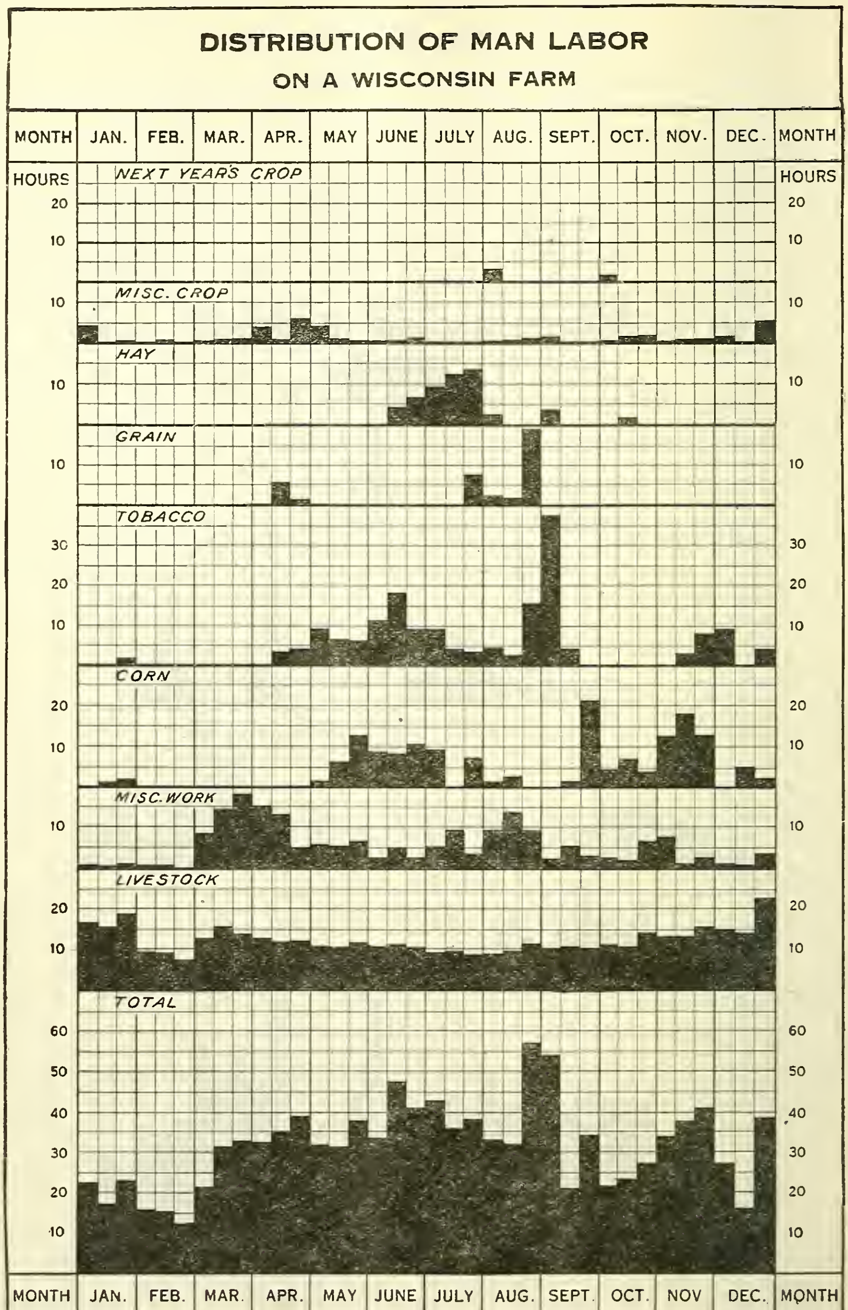

Fig. 16.—Distribution of man labor on a Wisconsin farm. On this farm the following crops were grown: Silage corn, 10 acres; husked corn, 39.8 acres; tobacco, 10.6 acres; barley, 12.5 acres; oats, 39.6 acres; clover hay, 26.8 acres; alfalfa, 3.4 acres; potatoes, 1 acre. Total crop acres, 143.7. The live stock organization was as follows: Horses, 5; dairy cows, 19; hogs, 0.8. Total, 25 animal units. Black bars indicate average hours per day for each 10-day period.

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WM. A. TAYLOR, Chief

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CULTURAL EXPERIMENTS WITH GRAIN SORGHUMS IN THE TEXAS PANHANDLE

By

BENTON E. ROTHGEB, formerly Assistant Agronomist in Charge of Grain-Sorghum and Broom-Corn Investigations, Office of Cereal Investigations

CONTENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

UNITED STATES DEPARTMENT OF AGRICULTURE
BULLETIN No. 979

Contribution from the Bureau of Markets and Crop Estimates
H. C. TAYLOR, Chief

Washington, D. C. October 22, 1921

MARKETING HAY THROUGH TERMINAL MARKETS

By

G. A. COLLIER, Investigator in Hay Marketing, and
H. B. McCLURE, Specialist in Hay Marketing

CONTENTS

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1921

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GEORGE LIVINGSTON, Chief

Washington, D. C. ▼ June, 1921

MARKET STATISTICS

Prepared Under the Direction of

CARL J. WEST, Specialist in Market Statistics, assisted by
LEWIS B. FLOHR, Investigator in Marketing

CONTENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1921

[illegible]
[illegible]
[illegible]
[illegible]

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BULLETIN No. 983

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WILLIAM B. GREELEY, Forester

FOREST PRODUCTS LABORATORY, MADISON, WISCONSIN
IN COOPERATION WITH THE UNIVERSITY OF WISCONSIN

Washington, D. C. PROFESSIONAL PAPER. April 6, 1922

THE MANUFACTURE OF ETHYL ALCOHOL FROM WOOD WASTE

By

F. W. KRESSMANN
Formerly Chemist in Forest Products

CONTENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

PREFATORY NOTE.

This report is based primarily on experiments conducted by the author, Mr. F. W. Kressmann, at the Forest Products Laboratory, prior to December, 1916. The information thus obtained has been supplemented by the results obtained in succeeding years by Mr. Kressmann while in private employment as manager successively of the Standard Lessee Corporation and the International Alcohol Corporation and as director of the development department of the latter corporation. Acknowledgments are due these companies for their consent to the utilization of information obtained by Mr. Kressmann in connection with his work for them and to Mr. Kressmann himself for his assistance in the completion of the investigation and report.

William B. Greeley,
Forester.

FOREST SERVICE.

WILLIAM B. GREELEY, Forester.
EDWARD A. SHERMAN, Associate Forester.

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Carlile P. Winslow, *Director.*
Ovid M. Butler, *Assistant Director.*

SECTION OF DERIVED PRODUCTS.

L. F. Hawley, *in charge.*
F. W. Kressmann, *formerly chemist in Forest Products.*

UNITED STATES DEPARTMENT OF AGRICULTURE

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Contribution from the Office of Farm Management and Farm Economics
H. C. TAYLOR, Chief

Washington, D. C. December 1, 1921

THE NATIONAL INFLUENCE OF A SINGLE FARM COMMUNITY

A STORY OF THE FLOW INTO NATIONAL LIFE OF MIGRATION FROM THE FARMS

By

EMILY F. HOAG, Assistant Economist

(Section of Farm Life Studies, C. J. GALPIN, Economist in Charge)

CONTENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1921

UNITED STATES DEPARTMENT OF AGRICULTURE

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Contribution from the Bureau of Markets and Crop Estimates
H. C. TAYLOR, Chief

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HANDBOOK OF FOREIGN AGRICULTURAL STATISTICS

Compiled under the Direction of

FRANK ANDREWS, Chief, Division of Crop Records

CONTENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1921

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 994

Contribution from the Office of Farm Management and Farm Economics
H. C. TAYLOR, Chief

Washington, D. C. ▼ November 15, 1921

METHODS OF CONDUCTING COST OF PRODUCTION AND FARM ORGANIZATION STUDIES

By

F. W. PECK

Farm Economist

CONTENTS

WASHINGTON
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1921

UNITED STATES DEPARTMENT OF AGRICULTURE

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Contribution from the Bureau of Plant Industry
WM. A. TAYLOR, Chief

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THE BEET-SUGAR INDUSTRY IN THE UNITED STATES IN 1920

By

C. O. TOWNSEND, Pathologist in Charge
Office of Sugar-Plant Investigations

CONTENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1921

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 997

Joint contribution from the Office of Farm Management and Farm Economics, H. C. TAYLOR, Chief; Bureau of Public Roads, THOS. H. MacDONALD, Chief; and Bureau of Animal Industry, JOHN R. MOHLER, Chief

Washington, D. C. December 21, 1921

THE COST AND UTILIZATION OF POWER ON FARMS WHERE TRACTORS ARE OWNED

286 FARMS—OHIO, INDIANA, ILLINOIS—1920

By

H. R. TOLLEY, Agricultural Engineer, and
L. A. REYNOLDSON, Junior Farm Economist

CONTENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
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THIS bulletin presents the results of the first of a series of investigations which have been planned by the Committee on Farm Power, appointed by the Secretary of Agriculture to represent the Bureau of Public Roads, the Office of Farm Management and Farm Economics, and the Bureau of Animal Industry in a cooperative study of all phases of the farm power problem. This committee has been charged with carrying out, for the Department of Agriculture, the plan of research in this field outlined by the Farm Power Conference, at Chicago, on October 6 and 7, 1919.

The committee recognizes the great importance of this field of work and the inadequacy of the present investigation. It is hoped that through more adequate appropriations and more general cooperation with the State agricultural experiment stations, the work may be broadened to make possible a comprehensive study of the problems now calling for solution in the development of farm power, in order that farmers, horse breeders, and manufacturers may have at hand such facts as will guide them toward the greatest ultimate success.

H. C. TAYLOR,
Chief, Office of Farm Management
and Farm Economics,
G. M. ROMMEL,
Chief, Animal Husbandry Division,
Bureau of Animal Industry,
S. H. McCRORY,
Chief, Agricultural Engineering,
Bureau of Public Roads,
Department Committee on Farm Power.

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 999

Contribution from the Bureau of Markets and Crop Estimates
H. C. TAYLOR, Chief

Washington, D. C. ▼ August 26, 1921

PRICES OF FARM PRODUCTS IN THE UNITED STATES

By

G. F. WARREN

CONTENTS

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1921

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 1000

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G. W. FORSTER, Acting Chief

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LABOR AND MATERIAL REQUIREMENTS OF FIELD CROPS

By

L. A. MOORHOUSE, Associate Farm Economist
O. A. JUVE, Junior Farm Economist

CONTENTS

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1921

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