NINTH ANNUAL REPORT

OF THE

BOARD OF CONTROL

OF THE

NEW YORK

Agricultural Experiment Station,

(GENEVA, ONTARIO CO.)

FOR THE YEAR 1890,

WITH REPORTS OF DIRECTOR AND OTHER OFFICERS.

New York State Agricultural Experiment Station.

TRANSMITTED TO THE LEGISLATURE JANUARY, 1891.

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No. 25.

IN ASSEMBLY,

January, 1891.

REPORT

OF THE

Board of Control of the New York Agricultural Experiment Station.

Hon. William F. Sheehan,

Speaker of the Assembly:

Sir.— I herewith transmit to the Legislature the Ninth Annual Report of the New York Agricultural Experiment Station.

Very respectfully,

Your obedient servant.

N. M. CURTIS,

President of Board of Control.

1890.

ORGANIZATION OF THE STATION.

BOARD OF CONTROL.

DAVID B. HILL, *Governor*	Albany.
N. M. CURTIS, *President*	Ogdensburgh, St. Lawrence Co.
JAMES McCANN	Elmira, Chemung County.
CHARLES JONES	Geneseo, Livingston County.
DANIEL BATCHELOR	Utica, Oneida County.
G. S. MILLER	Peterboro, Madison County.
GEORGE F. MILLS	Fonda, Montgomery County.
W. C. BARRY	Rochester, Monroe County.
PHILIP N. NICHOLAS	Geneva, Ontario County.
ADRIAN TUTTLE	Watkins, Schuyler County.

STATION OFFICERS.

Director	Dr. PETER COLLIER.
First Assistant	WM. P. WHEELER.
Chemist	L. L. VAN SLYKE, Ph. D.
Assistant Chemist	W. I. TIBBALLS, Ph. C.*
Assistant Chemist	P. H. SEYMOUR.*
Assistant Chemist	W. H. WHALEN, Ph. B.
Assistant Chemist	R. B. ARMSTRONG, Ph. C.
Assistant Chemist	R. D. YOUNG, Ph. C.
Acting Horticulturist	C. E. HUNN.
Acting Pomologist	GEORGE W. CHURCHILL.
Clerk and Stenographer	FRANK E. NEWTON.

Post-office address: Geneva, Ontario county, N. Y.

* Connected with Fertilizer Control.

TABLE OF CONTENTS.

Ninth Annual Report

OF THE

Board of Control of the New York State Agricultural Experiment Station.

REPORT OF THE EXECUTIVE COMMITTEE.

Since our last report your committee have, together or separately, been present several times at the Station, and have to report the following work as having been accomplished:

The lawn extending from the gate to the cattle pens has been graded and seeded down, and graveled driveways have been extended along the cattle pens.

The yards for the pigs east and north of the barns have been completed, and also others upon the west.

The pump and tank have been connected with the windmill, for the removal of the liquid manure from the reservoirs underneath the manure platform.

A small addition has been built on the dairy to provide for an engine room, which gives greater facilities for work in the dairy, the second story of which has been fitted up with arrangements for the manufacture of cheese in connection with the investigations of cattle.

A summer shed for swine and another for a temporary brooder in connection with the poultry experiments have been erected.

The orchards have been thoroughly trimmed, and many new fruit trees of different varieties planted.

The pile of debris which accumulated during the building and repairs has been removed, and the driveway leading through the orchards laid out and graveled.

A tile drain has been laid from the dairy, connecting with a main drain below the barns, and a line of tile laid to remove the surface water from the southeastern part of the farm into Castle brook.

Feed bins have been constructed in the new barn and in the pig pens to facilitate the storage of feed and the feeding of the stock.

In the investigations with the different breeds of cattle there has been provided an additional building at a cost of $350.

The executive committee decided to lower the floor of the horse barn about five inches, to place a series of stalls upon the west side and box stalls and harness room upon the east side, with two windows upon the west side, three upon the east and one upon the north side of the stable, and means provided for connecting the stalls with the system of tile drains connected with the manure platform, all of which was accomplished at a cost of $450.

The report of Mr. Batchelor, a member of the committee appointed by the board to visit some of the Experiment Stations in New England and elsewhere, was presented, and, after consideration of the same, Mr. Jones moved that the executive committee adopt the report, namely, that a laboratory similar to the one at Amherst, Mass., should be erected at this Station, with such alterations and modifications as were suggested by Mr. Batchelor and Dr. Goessmann; and that the board be urged to meet soon to take action in reference to the matter. This resolution was unanimously adopted.

The director was authorized to secure definite estimates as to the cost of construction of a laboratory conforming to the above resolution.

The director was also authorized to correspond with the architect of the Amherst and Kingston laboratories, and ascertain the cost for furnishing plans and specifications of these laboratories as modified in Mr. Batchelor's report.

The director was also authorized to secure a building and temporarily equip the same for the purpose of carrying out the provisions of the fertilizer law so far as it was possible with such limited facilities; and in accordance with this rooms were secured in the village of Geneva, and fitted up, enabling the law to be carried into practical execution.

Plans and specifications were secured from the architect, and, after advertising, submitted to contractors in several cities of the State, from whom a large number of proposals were received. Upon examining these proposals it was found that the amount required exceeded the appropriation made for the purpose, and the architect was thereupon requested to modify the plans and specifications in order to reduce, if possible, the amount necessary for building to a sum within the appropriation. It was found, however, that, with these modifications, the proposals offered were in excess of the appropriation, after allowing a sufficient sum to carry on the work of analyses for the current year. It is thought best by the committee to recommend that a sufficient sum be provided by the Legislature to enable the original plans to be carried out which were entered upon after careful deliberation. The committee are of the impression that it would be unwise to enter upon the construction of a laboratory inadequate for the conduct of the work and the investigations which are necessary in carrying on the work of the station, especially after the costly experience of several of the other stations in the country, and the committee, therefore, recommend an appropriation of $10,000 for the completion and equipment of a suitable laboratory, and $6,000 additional for the collection of samples of fertilizers and their analysis, and the publication of the results during the next year.

The committee recommend, for the purpose of carrying forward the investigations of the Station, that there be provided four assistant chemists, and that the staff be increased by securing a horticulturist and botanist, as also an entomologist and microscopist, it being practicable to place these four departments under the supervision of two competent men. The committee also recommend that somewhat increased salaries be paid to certain of those at present engaged in the work at the Station, and that an accountant be secured for the purpose of preparing the accumulation of data for bulletins and reports. For these purposes and the greatly increased work of the Station which is involved in a thorough investigation of representatives of six breeds of cattle, the committee earnestly recommend that the regular appropriation for carrying on the work of the Station be increased to $30,000 annually.

JAMES McCANN,
CHAS. JONES,
GERRIT S. MILLER,
Executive Committee.

GENEVA, N. Y., *January* 1, 1891.

Treasurer's Report.

To the Board of Control of the New York Agricultural Experiment Station:

As treasurer of the board of control, I do respectfully report:

That I have received from the Treasurer of the State of New York, for the twelve months ending September 30, 1890	$20,000 00
That the balance on hand October, 1, 1889, was	20 33
Total	$20,020 33

And I do further report that I have expended during the twelve months ending September 30, 1890, $19,983.34, vouchers for which, duly audited by the special auditing committee of the board of control, have been furnished the Comptroller of the State of New York.

Properly classified, the expenditure has been as follows:

Farm	$582 70
Farm implements and tools	306 10
Freight, cartage and express	410 32
Labor	6,010 71
Laboratory department	304 53
Library	25 15
Live stock	327 00
Manure and fertilizer	21 77
Permanent improvement	176 96
Postage expenses	121 32
Printing	45 50
Repairs	368 54
Salaries	8,269 92
Stationery	10 50
Sundries	447 32
Supplies	1,361 16
Tenement-houses	200 00
Carried forward	$19,983 34

Brought forward	$19,983 34
Travel	403 25
Board of control	568 09
Insurance	22 50
Total	$19,983 34
Balance on hand	36 99
Total	$20,020 33

And I do further report that I have expended $5,179.54, the balance, September 30, 1890, of the special appropriation of $10,860, vouchers for which, duly audited by the special auditing committee of the board of control, have been furnished the Comptroller of the State of New York.

Properly classified the expenditures have been as follows:

Bulletins	$736 88
Farming and scientific implements	443 98
Farm improvement	2,560 52
Poultry house and piggery	45 56
Clerical division	19 60
Library	189 00
Labor	1,184 00
Total	$5,179 54

And I do further report that I have received from the Treasurer of the State of New York, on account of special appropriation, $10,000 for improving the breed of cattle and testing the quality and quantity of the milk of the dairy, and for improving the breed and productiveness of poultry, and for keeping and publishing complete records of the work; that I have expended on this account $7,689, vouchers for which, duly audited by the special auditing committee of the board of control, have been furnished the Comptroller of the State of New York.

And I do further report that I have received from the Treasurer of the State of New York, on account of fertilizer control, $5,000; that I have expended on this account for

Salaries	$278 71
Fixtures and apparatus	1,500 89
Carried forward	$1,779 60

Brought forward	$1,779 60
Securing samples	288 62
Bulletins	79 50
Rent of building	60 00
Total	$2,207 72
Balance on hand	2,792 28
Total	$5,000 00

Vouchers for which, duly audited by the special auditing committee of the board of control, have been furnished the Comptroller of the State of New York.

And I do further report that I have received from sales the sum of $584.75, which sum has been duly paid to the Treasurer of the State of New York.

WILLIAM O'HANLON,
Treasurer.

Director's Report.*

To the Board of Control of the New York Agricultural Experiment Station:

Gentlemen.— I herewith submit the ninth annual report of the Experiment Station for the calendar year 1890.

The report of the executive committee of the board of control presents a statement of what, under their direction, has been done in completing repairs of buildings and grounds, in the erection of certain buildings necessary in carrying forward the work of the Station, and the increase in force imperatively demanded in order that this work may be most productive in results of value to our farming population.

To instance but a single line of the work upon which the Station has entered, the thorough investigation of the several breeds of dairy cattle, and in preparation for which the State has already made ample provision during its progress thus far, in the erection of a suitable barn for the accommodation of these cattle, and in furnishing the means for their careful and constant supervision, all of which has resulted in placing at the disposal of the Station, for this investigation, a herd consisting of the choicest representatives of seven of our leading dairy breeds. Most of these heifers are now in milk, and the two years of preparation for this work are now at an end. The work of investigation has already begun, and already the results are such as to fully justify the wisdom of entering upon it. The value, scientific and practical, of these results will be in direct ratio to the amount of investigation and work which can be expended in this direction.

As will be seen further on, the careful study of the food and products of a single cow will demand the undivided attention of one chemist; and here we have twenty cows, nearly all in milk, sure to repay in practical results the most thorough investigation to which they may be subjected by which their relative values for the purposes of the dairy may be determined.

* Peter Collier, A. M., M. D., Ph. D.

It is hoped that ample provision to carry on this important work may be made.

That the practical value of this investigation commends itself to our dairymen is manifest from the increasing correspondence concerning the work and requests for frequent bulletins reporting its progress, as also by the fact that within a month several of the prominent breeders of Devon cattle have donated to the station five choice representatives of that famous breed, in order that the investigations may be made as complete as possible.

FEEDING EXPERIMENTS WITH MILCH COWS.

Feeding experiments were undertaken with the Jersey cows, Flora and Ann, for the purpose of determining the effects of various foods upon the butter product, and, if possible, to throw some light upon the source of the fat in milk. Flora dropped her calf December 23, 1889, and Ann her calf December 24, 1889. Flora received hay, wheat, bran and corn meal throughout the experiment, more or less of the corn meal being replaced by cotton-seed meal or palm-nut meal at different periods of the experiment. A record of the milk yield was kept and frequent analyses of the milk were made during the experiment, as also occasional analyses of the butter.

The following table shows the kind and amount of food fed during the several periods:

The following table gives the proximate analyses of the foods fed during these experiments with Flora and Ann:

	Water.	Ash.	Album.	Fiber.	Carbohyd.	Fats.
Timothy hay, mixed..	15.61	4.34	7.42	31.27	38.12	3.24
Clover, mixed.......	16.94	5.23	11.72	25.10	37.20	3.81
Wheat straw........	17.86	4.16	2 98	42.74	31.04	1.22
Wheat bran	13.80	5.80	17.83	8.83	50.32	3.32
Corn meal	17.62	1.27	10.21	2.24	64.81	3.85
Cotton-seed meal....	8.78	7.03	44.81	5.33	24.65	9.40
Palm-nut meal......	8.23	3.53	16.29	21.35	37.78	12.82
Gluten meal	11.23	.67	77.23	.87	9.61	.39

Number of period.	DATE.	Food.	Pounds.
1...	January 13th to 18th, inclusive..	Hay.............	117.13
		Corn meal	36
		Wheat bran	12
2...	February 3d to 8th, inclusive....	Hay.............	118.13
		Corn meal........	18
		Wheat bran	12
		Cotton-seed meal..	18
3...	February 9th to 15th, inclusive; hay changed, February 17th..	Hay.............	140.56
		Corn meal........	21
		Wheat bran	14
		Cotton-seed meal..	21
4...	March 3d to 8th, inclusive; back to timothy, March 14th.......	Hay.............	123.19
		Corn meal........	18
		Wheat bran	12
		Palm-nut meal....	18
5...	March 17th to 22d, inclusive....	Hay.............	123.38
		Corn meal........	18
		Wheat bran	12
		Palm-nut meal....	18
6...	March 24th to 29th, inclusive ...	Hay.............	124
		Corn meal........	18
		Wheat bran	12
		Palm-nut meal....	18
7...	March 31st to April 5th, inclusive	Hay....	123.56
		Corn meal........	18
		Wheat bran	12
		Palm-nut meal....	18
8...	April 7th to 12th, inclusive	Hay.............	123.63
		Corn meal........	18
		Wheat bran	12
		Cotton-seed meal..	18

January nineteenth, two pounds of cotton-seed meal were substituted for two pounds of corn meal in the daily ration, and upon January twenty-fourth another pound of corn meal was replaced by cotton-seed meal. On February sixteenth, the three pounds of cotton-seed meal were replaced by two pounds of palm-nut meal, and upon February eighteenth another pound of palm-nut meal was added to the ration.

Upon February seventeenth, the hay, which was mainly timothy, was changed to hay which contained a considerable amount of clover; the amount of hay, however, remained unchanged, and, upon March fourteenth, this clover-mixed hay was changed back to timothy, and from March fourteenth this daily ration was unchanged until April sixth, when three pounds of cotton-seed meal were substituted for the three pounds of palm-nut meal.

The following tables give the yield of milk and its average composition during the several periods of the investigation, as also the amounts of each constituent in the milk yielded:

Period.		Morning.	Evening.	Total.
		Pounds.	Pounds.	Pounds.
1...	Yield of milk	78.78	56.75	135.53
2...	Yield of milk	73.50	52.25	125.75
3...	Yield of milk	84.56	60.41	*144.98
4...	Yield of milk	66.22	49.00	115.22
5...	Yield of milk	58.56	42.31	100.88
6...	Yield of milk	57.53	41.06	98.59
7...	Yield of milk	57.48	40.28	97.75
8...	Yield of milk	57.22	42.13	99.41

AVERAGE PERCENTAGE COMPOSITION OF MILK.

PERIOD.	Solids.	Casein.	Sugar	Ash.	Fats.
1	14.32	3.29	5.40	.67	4.95
2	14.76	3.34	5.36	.63	5.44
3	15.05	3.40	5.33	.69	5.61
4	15.45	3.57	5.28	.57	6.02
5	15.54	3.62	5.09	.74	6.09
6	15.82	3.74	5.07	.76	6.25
7	15.82	3.85	5.04	.75	6.18
8	15.88	3.67	5.33	.76	6.10

* Seven-day period.

AMOUNT OF EACH CONSTITUENT IN MILK YIELDED.

PERIOD.	Solids.	Casein.	Sugar.	Ash.	Fats.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
1	19.41	4.46	7.32	.91	6.64
2	18.56	4.20	6.74	.79	7.05
3	21.82	4.93	7.73	1.00	7.97
4	17.80	4.11	6.08	.66	6.87
5	15.68	3.65	5.15	.75	6.15
6	15.60	3.69	5.00	.75	6.12
7	15.46	3.76	4.93	.73	6.00
8	15.78	3.65	5.30	.76	6.02

The following table gives the amount of butter obtained from the milk and the pounds of milk needed for each pound of butter produced during the several periods:

Period.	DATE.	Pounds milk.	Pounds butter.
1	January 13 to 18, inclusive	127.14	6.39
2	February 3 to 8, inclusive	119.36	7.11
3	February 9 to 15, inclusive	137.75	8.81
4	March 3 to 8, inclusive	104.75	6.75
5	March 17 to 22, inclusive	97.28	6.60
6	March 24 to 29, inclusive	89.55	6.13
7	March 31 to April 5, inclusive	87.58	6.24
8	April 7 to 12, inclusive	94.72	6.94

Period.	Pound milk to butter.	RATION.
1	19.9	Hay, corn meal, bran.
2	16.8	Hay, cotton-seed meal, corn meal, bran.
3	15.6	Hay, cotton-seed meal, corn meal, bran.
4	15.5	Hay, palm-nut meal, corn meal, bran.
5	14.7	Hay, palm-nut meal, corn meal, bran.
6	14.6	Hay, palm-nut meal, corn meal, bran.
7	14.05	Hay, palm-nut meal, corn meal, bran.
8	13.65	Hay, cotton-seed meal, corn meal, bran.

The following table gives the amount of albuminoids, carbohydrates and fats digested, so far as at present we are able to determine, during the several periods, as also the amount of fat actually found in the milk:

DIGESTED BY FLORA.

PERIOD.	Albuminoids.	Carbohydrates.	Fats.	Fats in milk.
	Pounds.	Pounds.	Pounds.	Pounds.
1	7.86	74.13	2.98	6.64
2	13.19	66.36	4.85	7.05
3	15.49	78.51	5.69	7.97
4	15.71	65.40	6.25	6.87
5	9.63	71.49	5.91	6.15
6	9.65	71.63	5.92	6.12
7	9.64	71.59	5.91	6.00
8	13.32	67.82	4.92	6.02

It will be seen from the above table that there appears to be no relation between the albuminoid constituents of the food digested and the amount of fats secured in the milk. There is, upon the other hand, especially during the fourth to seventh periods, a pretty close relation between the fats in the food and those recovered in the milk, the food during these periods having contained over ninety-five per cent of the fats found in the milk.

It is interesting to observe, also, that it was during these four periods (fourth to seventh inclusive) that palm-nut meal constituted a part of the ration, a substance peculiarly rich in fat, containing twelve and eighty-two one-hundredths per cent, with less than one-half of the albuminoids of cotton-seed meal.

It is hoped that experiments now in progress may help to throw more light upon this point, which is of both scientific and practical value to the dairyman.

The following table gives the percentage of fats found in the morning's and evening's milk during the eight periods, as also the actual amount of fat found in the milk yielded.

It will be seen that there was a considerable, though not uniform, increase in the percentage of fat in both morning's and evening's milk during the three months covered by the investigation, corresponding closely to the decrease in the amount of milk produced during this same period of three months.

RELATION OF FATS IN MORNING'S AND EVENING'S MILK.

PERIOD.	Average Per Cent of Fat in Milk.		Pounds Fat in Milk.		Days.
	Morning.	Evening.	Morning.	Evening.	
1	4.63	5.27	5.65	2.99	6
2	5.15	5.72	3.79	2.99	6
3	5.13	6.01	4.34	3.63	7
4	5.62	6.42	3.72	3.15	6
5	6.09	6.10	3.57	2.58	3
6	5.95	6.56	3.42	2.70	6
7	5.91	6.46	3.40	2.60	6
8	5.80	6.40	3.32	2.70	6

Dr. Sturtevant compiled a record of eighty cows, showing their falling off in the production of milk during the period of lactation, and it will be seen that the cow Flora was in this regard, despite change in food, closely in accord with the averages found by Dr. Sturtevant.

Average falling off in milk of eighty cows in months after calving :

First	100
Second	91.7
Third	83.1
Fourth	74.6
Fifth	65.9

FLORA, MILK YIELD.

DATE.	Morning.	Evening.	Total.	Per cent.
	Pounds.	Pounds.	Pounds.	Pounds.
December 24 to 30, inclusive	95.97	72.19	168.16	100
January 15 to 21, inclusive	90.00	66.02	156.02	92.8
February 15 to 21, inclusive	83.50	61.69	145.19	86.3
March 15 to 21, inclusive	71.00	48.31	119.31	70.9
April 15 to 21, inclusive	68.60	48.20	116.79	69.5

The following table shows the ratio of milk and of fats secreted by hours during the night and day, and it will be seen that while during the entire period the quantity of milk hourly secreted was practically the same during day and night, the amount of fat secreted was, upon an average, eleven and one-half per cent greater during the hours of the day than during those of the night.

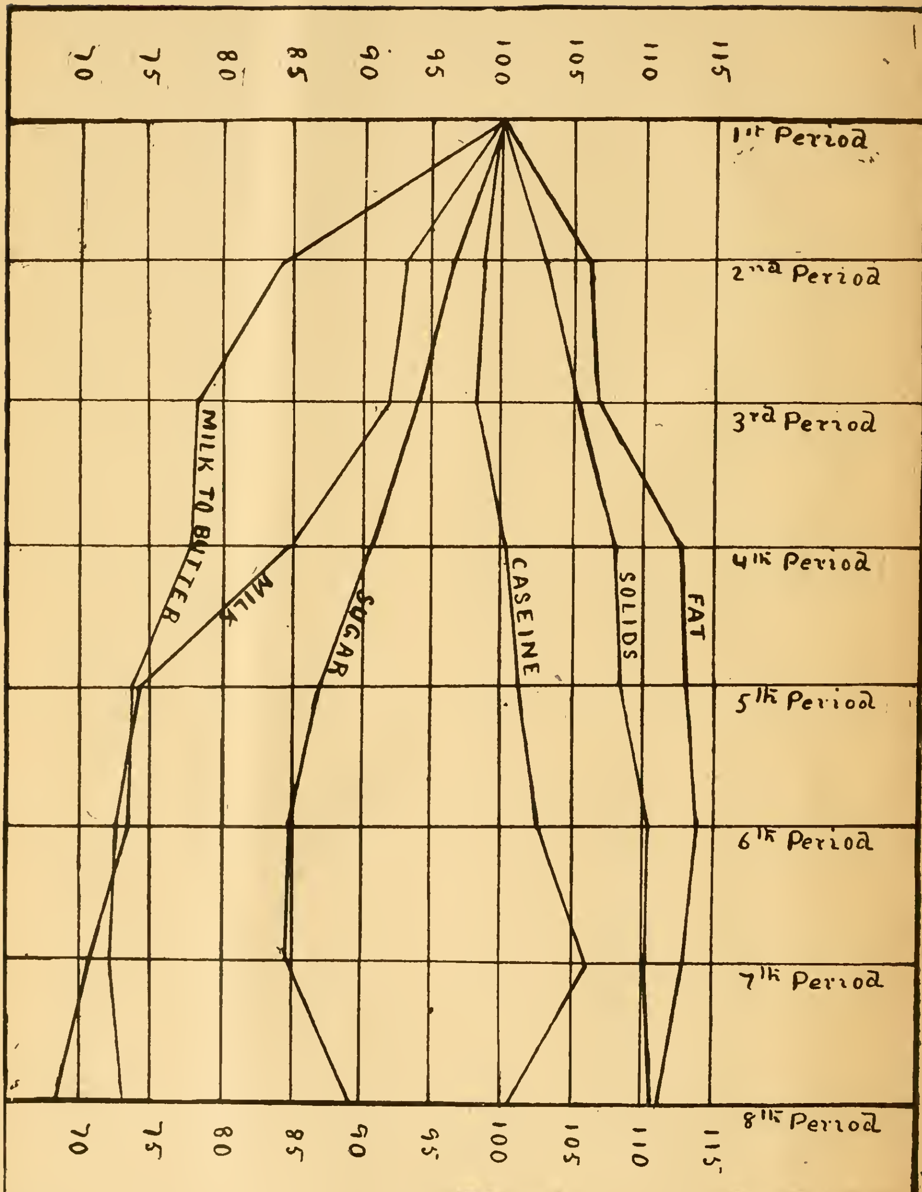
Ratio of milk and fat secreted by hours, night and day:

PERIOD.	RATIO MILK.		RATIO FAT.	
	Morning.	Evening.	Morning.	Evening.
1	100	100.8	100	115
2	100	99.5	100	110
3	100	100.1	100	117
4	100	103.6	100	118
5	100	101.1	100	101
6	100	99.9	100	110
7	100	98.1	100	107
8	100	103.1	100	114
Average	100	100.78	100	111.5

The following table presents the percentages of fats, casein and sugar in the total solids of Flora's milk during the several periods:

PER CENT OF TOTAL SOLIDS.

PERIOD.	Fats.	Casein.	Sugar.
1.	34 6	23.0	37.7
2.	36.9	22.7	36.3
3.	37.3	22.6	35.4
4.	39.0	23.1	34.2
5.	39.2	23.3	32.8
6.	39.5	23.6	32.0
7.	39.1	24.4	31.9
8.	38.4	23.1	33.6



70
75
80
85
90
95
100
105
110
115
1st Period
2nd Period
3rd Period
4th Period
5th Period
6th Period
7th Period
8th Period
MILK TO BUTTER
MILK
SUGAR
CASEINE
SOLIDS
FAT

The relative changes in the yield of milk and its several constituents may perhaps more clearly appear by taking the amount of each during the first period as 100, and the following table so represents the data secured during the experiment :

PERIOD.	Yield of milk.	Pounds milk for one pound butter.	Total solids in milk.	Fats in milk.	Sugar in milk.	Casein in milk.
1..............	100.	100.	100.	100.	100.	100.
2..............	92.8	84.4	103.1	106.1	96.3	98.7
3..............	91.7	78.4	105.1	107.8	93.9	98.3
4..............	85.0	77.9	107.9	112.7	90.7	100.4
5..............	74.4	73.9	108.5	113.3	87.0	101.3
6..............	72.7	73.4	110.5	114.1	84.9	102.6
7..............	72.1	70.6	110.5	113.0	84.6	106.1
8..............	73.3	68.6	110.9	111.0	89.1	100.4

The accompanying diagram graphically illustrates the changes in composition during the several periods, the yield of milk, the total solids, the amounts of fat, casein and sugar in milk and the number of pounds of milk required for a pound of butter during the first period being in each case taken as 100.

It will be seen at a glance that there is a rather steady decrease in the milk yield, and even more steady, though not so great, increase in the total solids; also, that the increase in fats closely corresponds to the decrease in sugar, while the casein varies but little in quantity during the eight periods.

The amount of milk required for a pound of butter diminishes far more rapidly during the first two periods than does the milk yield, and more rapidly than the fat increases during the same periods, but during the later periods the amount of milk required to make a pound of butter varies quite regularly with the increase of fats in the milk, showing that the creaming of the milk and churning qualities of the cream were quite uniform during the entire experiment, notwithstanding the frequent changes in food.

REGULARITY OF MILK SECRETION.

For five days (April nineteenth to twenty-third, inclusive) Flora was milked regularly at alternate intervals of fourteen and ten hours, the longer interval being from night to morning; during

April twenty-fourth to twenty-sixth, inclusive, she was milked at alternate intervals of sixteen and eight hours, the longer still being during night; during the twenty-eighth and twenty-ninth she was milked at equal intervals of twelve hours, and finally, from April thirtieth to May fourth, inclusive, she was milked at alternate intervals of fourteen and ten hours, as at the first.

The following table gives the milk yield from April nineteenth to May fourth, inclusive:

DATE.	Morning.	Evening.	Average Milk Secreted Per Hour.	
			Morning.	Evening.
	Pounds.	Pounds.	Ounces.	Ounces.
April nineteenth	9.69	7.16		
April twentieth	10.06	6.75		
April twenty-first	10.19	7.16	11.58	11.51
April twenty-second	10.31	7.09		
April twenty-third	10.41	7.84		
April twenty-fourth	11.31	5.78		
April twenty-fifth	11.75	5.41	11.48	10.96
April twenty-sixth	11.38	5.25		
April twenty-eighth	8.63	8.50	11.71	11.40
April twenty-ninth	8.94	8.59		
April thirtieth	9.44	7.06		
May first	9.06	6.63		
May second	9.56	7.22	10.57	11.05
May third	9.13	6.94		
May fourth	9.06	6.69		

The average for the fifteen days under consideration shows that during the night there was an hourly secretion of 11.238 ounces, and during the day of 11.246 ounces of milk, showing conclusively that for this particular cow there was a uniform rate of milk secretion during night and day, and that this uniformity was not disturbed by frequent and decided changes in the times of milking.

The experiments with the cow Ann were undertaken for the purpose of determining the source of the fat in the milk. During the earlier periods of the experiment wheat straw was used exclusively as the coarse food, with corn meal as the grain ration, which was to be substituted with gluten meal, a very highly nitrogenous food, containing about eighty per cent of albuminoids.

The experiments were divided into the following periods, with the following daily rations being eaten:

Number period.	DATE.	Number days.	Straw.	Corn meal.	Gluten meal.	Hay.	Wheat bran.
			Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1...	January 3 to 8..........	6	12.32	8	...	.....	...
2...	January 9 to 14.........	6	13.03	7	1	.....	...
3...	January 15 to 17........	3	13.50	6.5	1.5	.....	...
4...	January 18 to 24	7	13.29	6	2	....	...
5...	January 25 to 29........	5	11.94	5.5	2.5	.....	...
6...	January 30 to 31	2	11.81	4	1	.....	...
7...	February 1 to 13... .. .	12	11.82	6	2	.....	...
8..	February 14 to 24.......	11	.....	6	...	17.70	4
9...	February 25 to March 2..	6	.....	6	...	16.83	4

The pounds of albuminoids, carbohydrates and fats present in the above daily rations are given in the following table, as also the average daily milk yield, percentage of fat in milk and amount of fats obtained daily in the milk:

NUMBER OF PERIOD.	Albuminoids.	Carbohydrates.	Fats.	Pounds butter.	Per cent fat.	Fat in milk.
1	1.18	9.01	.46	8.65	5.083	.44
2	1.98	8.69	.43	8.06	4.380	.36
3	2.37	8.57	.42	7.99	5.080	.41
4	2.75	8.23	.40	7.88	5.504	.42
5	3.09	7.54	.37	7.76	5.225	.41
6	1.63	6.37	.30	7.02	4.960	.35
7	2.71	7.77	.38	6.63	5.528	.37
8	2.64	12.65	.94	7.13	.....	....
9	2.58	12.32	.91	7.86	.....	....

As in the experiment with the cow Flora, already given, so in this series there apparently exists no relation between the quantity of milk produced or the amount of fat in the milk and the nitrogenous constituents of the food, since the increase of the albuminoids in food by nearly 200 per cent was without effect in increasing the amount of milk or its butter content. It is also in this experiment at least noteworthy that the amount of fats in the food during the first seven periods (unfortunately analyses were not made of the milk during the last two periods) is identical with the amount found in the milk produced during these same periods.

An average of the milk during eleven days gave as the percentage of fat in the morning's milk 5.908, while that of the evening's milk, of these same days, averaged 5.913, or as 100 to 100.1, almost absolute equality.

During the entire period of the experiment the amount of milk secreted per hour during the night was to that secreted per hour during the day, as 100 to 98.8, and it is interesting to compare these results with those already recorded with the cow Flora, since it shows the danger of drawing conclusions from results secured from the individual, however carefully ascertained.

During four days (November twenty-second to twenty-fifth inclusive) the several cows under investigation, at present in milk, consisting of two Holsteins, three Jerseys, two Ayrshires, one Guernsey and one American Holderness, were milked regularly at intervals of twelve hours each, or as near that as was practicable, the exact time in each case being recorded. There were slight differences in the yield per hour, but not uniform for either animal, and the average results from these nine cows, of five different breeds, show that the amount, by weight, of milk secreted from 5 P. M. to 5 A. M. was the same as that secreted from 5 A. M. to 5 P. M. during these four days of trial, as will be seen by the following table giving the average results for each day:

AVERAGE POUNDS MILK, PER HOUR.

	Nov. 22.	Nov. 23.	Nov. 24.	Nov. 25.	Av'ge.
During night	.674	.690	.720	.701	.696
During day	.691	.710	.705	.693	.700

This is a difference of only six-tenths of one per cent more during the day.

The average percentage of fat in 118 samples of milk, fifty-nine being morning's and fifty-eight evening's milk, from three Jerseys, two Holsteins, two Ayrshires and one Guernsey, was as follows:

Morning's milk, 4.345 per cent; evening's milk, 4.673 per cent, as 100 : 107.55.

In connection with the experiments with Flora and Ann, the results recently obtained by Dr. Goessman in the investigation of the relative value of old and new process linseed meal are of interest. The trial was made with "five cows, grades of various description, all of fair milking qualities."

"The entire experiment extended over six successive months, and was subdivided into nine distinct periods."

The rations fed during the different periods were as follows:

1st. Corn meal, wheat bran, old process linseed meal, hay.

2d. Corn meal, wheat bran, old process linseed meal, hay, corn ensilage.

3d. Wheat bran, old process linseed meal, hay, carrots, fodder.

4th. Wheat bran, old process linseed meal, hay, carrots, corn stover.

5th. Wheat bran, new process linseed meal, hay, carrots, fodder corn.

6th. Corn meal, wheat bran, new process linseed meal, sugar beets, hay.

7th. Corn meal, wheat bran, old process linseed meal, sugar beets, hay.

8th. Corn meal, wheat bran, old process linseed meal, rowen.

9th. Corn meal, wheat bran, new process linseed meal, rowen.

The ration contained always three and one-quarter pounds of corn meal whenever it was fed, and the same amount of wheat bran and linseed meal. The grain, bran and meal fed, therefore, amounted in the second, third and fourth periods to six and one-half pounds daily, and in the other periods to nine and three-quarter pounds daily.

The average percentage of solids and fats in the milk during these successive periods, and also the average percentage of fats in total solids, and the percentage changes in solids and fats are given in the following table:

	Per cent solids in milk.	Per cent fats in milk	Per cent fats in solids.	Per cent changes in solids.	Per cent changes in fats.
First	13.68	4.27	23.8	100	100
Second	13.92	4.71	25.2	101.8	110.3
Third	14.54	5.28	26.6	106.3	123.7
Fourth	13.63	4.29	23.9	99.6	100.5
Fifth	13.16	4.47	25.3	96.2	104.7
Sixth	14.12	4.58	23.8	103.2	107.3
Seventh	13.93	4.59	24.8	101.1	107.5
Eighth	13.58	4.53	25.0	99.3	106.1
Ninth	13.67	4.09	22.9	100.0	95.8

It will be seen that there was a considerable increase in the total solids and nearly four times the relative increase in the fats upon leaving out corn meal during the third period; while the same seems to be true when corn meal was again introduced into the ration after the fifth period, since it will be seen that this resulted in an increase of both total solids and fats, the former being increased seven and one-third per cent and the latter two and one-half per cent by the change. The results become the more interesting when we consider that the increase during the third period was when these animals were receiving, in addition to their grain ration, carrots and fodder corn and having no corn meal, while the increase during the sixth period was upon leaving off carrots and fodder corn and again receiving corn meal.

The chief value of these experiments, aside from the object for which it was especially designed, is to emphasize the importance of more extended data in our feeding trials before attempting to draw too rigid conclusions as guides in practical work.

EXPERIMENTS IN FATTENING STEERS.

During the past year and a half we have been growing steers for the purpose of determining their relative development and fattening qualities. In this experiment a beginning was made with one Holstein, two American Holderness and two Guernseys. Unfortunately during the progress of this experiment we lost the Holstein by an attack of pneumonia, but, as the record will show, not before the valuable qualities relatively of this animal for beef production had been fully determined, and his place was filled by another steer donated by the American Holstein Breeders' Association from the herd of Wm. Singerly of Pennsylvania.

The following tables give the cost of some of the several foods fed these animals during the experiment, the estimated values of others and the composition of the mixed grain rations:

VALUATION OF FOOD FED STEERS.

	Per ton.
Hay	$10 00
Green forage	1 50
Roots	3 00
Ensilage, maize	3 00
Oil meal gruel, No. 1	1 50
Oil meal gruel, No. 2	3 00
Wheat bran	20 00
Linseed meal	26 50

	Per ton.
Oat meal....	$25 00
Wheat middlings....	20 00
Corn meal....	20 00
Skim milk....	10 00
Mixed grain, No. 1....	23 00
Mixed grain, No. 3....	22 50
Mixed grain, No. 4....	22 33
Mixed grain, No. 5....	22 00
Mixed grain, No. 7....	21 75
Mixed grain, No. 12....	21 20

GRAIN MIXTURES FOR STEERS.

	No. 1.	No. 3.	No. 4.	No. 5.	No. 7.	No. 12.
Wheat bran....	5	8	5	3	4	3
Linseed meal....	3	3	6	3	2	.....
Crushed oats....	2	6	4	2	2	.....
Wheat middlings....	....	2	5	2	2	1
Corn meal....	....	1	5	5	8	4
Cotton seed meal....	...	....	....	....	2	2
	10	20	25	15	20	10

The following tables show the value of the food fed each steer per month and their individual gain by months:

VALUE OF FOOD FOR STEERS BY MONTHS.

	AGE IN DAYS, APRIL 1, 1889.					GAIN BY MONTHS.				
	62.	222.	212.	37.	28.					
	Alexander Hamilton.	D. B. Hill.	Grover Cleveland.	Cathay.	Khaledan.	Alexander Hamilton.	D. B. Hill.	Grover Cleveland.	Cathay.	Khaledan.
April....	2.69	2.48	2.57	....	....	....	....	....	....	.....
May....	3.51	2.55	2.54	1.73	1.82	69	67	64	....	.....
June....	3.18	2.66	2.57	2.48	2.57	66	57	23	40	42
July....	2.46	3.01	2.89	2.64	2.69	54	43	51	38	48
August....	3.73	3.69	3.69	3.45	3.57	65	49	53	44	52
September....	2.73	3.69	3 63	3.35	3.38	67	57	63	49	68
October....	3.28	3.98	3.96	2.24	2.29	53	40	49	44	44
November....	3.17	3.99	3.57	2.15	2.37	37	54	35	23	32
December....	2 89	4.01	3.94	2.40	2.74	22	60	53	30	29
January....	1.15	3.99	3.91	2.10	2 21	38	50	60	39	41
February....	... .	4.22	3.18	2.35	2.56	....	39	43	32	30
March....	Singerly	3.70	3.63	2.04	2.37	Singerly	60	39	41	39
April....	4.07	4.58	4.26	2.82	3.14	38	34	21	22	39
May....	4.96	4.59	4.34	3.06	3.58	73	60	38	46	62
June....	4.62	4.39	4.15	2.84	2.71	27	10	....	18	34
July....	4.34	3.69	3.90	2.70	3.29	59	....	40	46	48
August....	4.42	3.69	4.18	2.97	3.70	55	27	70	34	57
September....	4.56	3.91	4.18	3.00	3.80	53	27	36	35	47
October....	4.84	3.49	4.03	2.98	3.38	43	13	4	16	15

The following table shows the cost per pound of gain of the food consumed by each individual by months:

COST PER POUND GAIN, CENTS.

	Alexander Hamilton.	D. B. Hill.	Grover Cleveland.	Cathay.	Khaledan.	Average per month for 1 lb. gain.	Average cost for food.
1889.							
April	....	......	......	......	......	......	2.58
May	5.09	3.81	3.97	.....	......	4.29	2.43
June	4.82	4.67	11.17	6.20	6.12	6.60	2.69
July	4.56	7.00	5.67	6.95	5.60	5.96	2 74
August	5 74	7.53	6.36	7.84	6.87	6.87	3.63
September	4.07	6.47	5.76	6.84	4.97	5.62	3.36
October	6.19	9.95	8.08	5.09	10.41	7.94	3.15
November	8 57	7.39	10.20	9.35	7.41	8.58	3.05
December	13.14	6.69	7.43	8.00	9.45	8.94	3.20
January	3.03	7.98	6.52	5.53	5.39	5.69	3.69
February	....	10.82	7.40	7.35	8.53	8.53	3.08
March	Singerly	6.17	9.31	4.98	6.08	6.64	2.94
April	10.71	13.47	20.29	12.82	8.05	13.07	3.77
May	6.79	7.65	11.42	6.65	5.77	7.66	4.11
June	17.11	43.90	......	15 78	7.97	21.19	3.74
July	7.36	......	9.75	5.87	6.85	7.46	3.58
August	8.04	13.67	5.83	8.74	6.49	8.55	3 79
September	8.60	14.48	11.61	8.57	8.09	10.27	3 89
October	11.26	26.85	......	18 63	22.53	19.82	3.74

RELATION OF FOOD CONSUMED TO INCREASE OF WEIGHT.

Estimating the amount of dry matter, albuminoids and ash in food for the months of September and October (and they were in all probability somewhat greater) as equal to the amounts in August, and we find that these animals consumed, in pounds, as follows:

	Dry matter.	Albuminoids.	Ash.	Gain in weight.	Dry matter to 1 lb. gain.
Alex. Hamilton and Singerly.	6,347	1,123	353	819	7.75
D. B. Hill	7,894	1,271	410	747	10.57
Grover Cleveland	7,860	1,266	403	734	10.71
Cathay	4,644	821	247	596	7.79
Khaledan	5,425	931	286	727	7.46
	32,170	5,412	1,699	3,622	.....

Since this gain in weight is about half water, it will be seen that upon an average these steers consumed about 18 pounds of dry matter for each pound of dry matter in flesh, and that therefore there must have been expelled from the body about 94.4 per cent of the food eaten, either as exhalations from lungs and skin or excretions in the liquid and solid manure.

Lawes and Gilbert* long ago showed that in a fattened ox there was in per cent of the live weight of the animal as follows:

	Per cent.
Mineral matter or ash	3.92
Nitrogenous matter, dry	14.60
Fat, dry	30.10
Water	45.50
Contents of stomach and intestines	5.98
Total	100.10

If we therefore calculate the gain of these steers according to the above, we have as follows:

	Pounds.
Mineral matter or ash	141.9
Nitrogenous matter, dry	528.5
Fat, dry	1088.9
Water	1646.3
Contents of stomach and intestines	216.4
Total	3622.0

It appears, therefore, that there was used in building up these steers 5.47 per cent of the total dry matter fed to them; 9.77 per cent of the nitrogenous matter, and 8.35 per cent of the mineral matter or ash present in their food.

In the eighth annual report of this Station, page 23, the results are given showing that in the feeding of eight cows, the daily ration of which cost 14.27 cents, there was recovered in the solid manure three and seven-eights cents worth of phosphoric acid, potash and nitrogen, and in the liquid manure six and one-sixth cents worth of these constituents, equal to seventy per cent of the market value of the food fed; the nitrogen being equal in value to fifty-one per cent of the market value of the food; the phosphoric acid to six and one-half, and the potash to twelve and seven-eighths per cent.

The average market value of the ration fed the steers was 10.736 cents daily. If, therefore, the same relative value of these three fertilizing constituents was secured in the manure, it would amount to 7.515 cents daily, leaving a net cost of ration of 3.22 cents per day.

* Journal Royal Agricultural Society, vol. 21, Part II, page 457.

The actual number of days during which these steers were fed amounts in the aggregate to 2,787 up to November 1, 1890, and the aggregate cost of their rations amounts to $299.21.

If now we assume that the proportionate value of the nitrogen compounds recovered in the manure from these steers was equal to that actually secured in the experiments with the cows already referred to, viz., fifty-one per cent of the value of the ration fed, we should have an amount valued at $152.60. But as we have seen, the amount of nitrogenous matter in the food, which, according to the data furnished by the investigations of Lawes and Gilbert was used in building up the bodies of these five steers, was but 9.77 per cent of that present in the food, or 528.5 pounds out of an actual 5412 pounds, as shown by analysis, thus leaving an overplus of 4883.5 pounds to be accounted for, and as four-twenty-fifths of this is nitrogen, we have 781.4 pounds, which, at nineteen cents per pound, the valuation we have placed upon it throughout, amounts to $148.46, which very closely agrees with the amount estimated from our experiments with the cows already reported.

For the purpose of comparison and partial confirmation of the preceding results, the records of the heifers of the several breeds, most of which were received as calves, are of value. The records have been tabulated for each animal from the time it was received at the Station up to the time of dropping a calf, and in the other cases up to September 1, 1890. The record includes four heifers each of Holsteins and Ayrshires, two each of Guernseys and American Holderness and three Jerseys.

The following table gives the aggregate and average results of this feeding, showing the amount in pounds of several of the constituents of the food consumed by the animals and the aggregate gain in weight:

NUMBER OF DAYS.	Dry matter.	Ash.	Albuminoids.	Fat.	Gain.
6,311	75909	4413	10774	3268	7475
Average	10.16	.590	1.441	.437	1

Lawes and Gilbert found that a "Half Fat Ox," which we assume to have approximately the same composition as these adult heifers, contained as follows:

	Per cent.
Mineral matter or ash	4.66
Nitrogenous matter (dry)	16.90
Fat (dry)	18.70
Water	51.50
Stomach and intestines	8.19
Total	99.95

If now, as in the case of the steers, we calculate the total gain of these fifteen heifers according to the above analysis representing their approximate composition, and deduct the amount of these several constituents from the amounts found in the food, we have:

	In food eaten.	In gain of weight.	Amount not utilized.	Per cent of amount in food excreted.
Mineral matter	4413	348	4065	92.11
Nitrogenous matter (dry)	10774	1264	9510	88.27
Fat (dry)	3268	1399	1869	57.20
Total dry matter	75909	3011	72898	96.03

From this it follows that less than four per cent of the dry matter in the food existed in the structures of these animals, less than eight per cent of the mineral matter, less than twelve per cent of the nitrogenous matter, while there remained in their bodies nearly forty-three cent of the fat which was found in their food; but it is worthy of note that the food eaten by these animals contained more than twice the calculated amount of fat stored up in their bodies.

However, then, we may approach this question of feeding, whether for simple growth or maintenance, for the production of muscular force, of meat or of milk, the consideration of these waste products becomes of paramount importance, since the economical use of them renders many productive operations of the farm sources of considerable profit, which otherwise could not without great loss be carried on.

The following tables present the details of feeding and the proximate composition of the foods during the experiments:

HOLSTEIN-FRIESIAN — ALEXANDER HAMILTON — (STEER).

	OCTOBER.		NOVEMBER.		DECEMBER.		JANUARY.		FEBRUARY.		MARCH.		Total for four months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	62.1	2.0	35.3	2.7	66.3	3.2	16.1	1.6	......	......	......	......	179.8
Oat hay	......	......	91.7	3.0	65.5	2.1	26.3	1.1	......	......	......	......	183.5
Oat and pea hay	......	......	......	......	......	......	......	......	......	......	......	......	....
Barley, oat and pea hay	......	......	......	......	......	......	......	......	......	......	......	......	....
Maize ensilage	163.7	16.4	111.5	15.9	168.0	16.0	131.9	8.8	......	......	......	......	575.1
Golden tankard mangolds	......	......	336.9	14.6	......	......	......	......	......	......	......	......	336.9
Maize forage, No. 1	119.4	23.9	57.1	5.7	......	......	......	......	......	......	......	......	176.5
Maize forage, No. 2	112.1	11.2	......	......	......	......	......	......	......	......	......	......	112.1
Alfalfa forage	120.0	20.0	......	......	......	......	......	......	......	......	......	......	120.0
Oil meal gruel	246.6	8.0	......	......	......	......	......	......	......	......	......	......	246.0
Mixed grain, No. 5	189.5	6.1	......	......	......	......	......	......	......	......	......	......	189.5
Mixed grain, No. 7	......	......	167.2	5.6	181.4	5.9	68.0	2.7	......	......	......	......	416.6

HOLSTEIN-FRIESIAN — ALEXANDER HAMILTON — (STEER).

	OCTOBER.		NOVEMBER.		DECEMBER.		JANUARY.		FEBRUARY.		MARCH.		Total for four months only.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	2482.3	80.07	1673.0	55.77	1064.0	34.32	331.2	10.68	......	......	......	......	5550.5
Water in food	414.1	13.68	446.5	14.88	167.1	5.39	104.4	3.37	......	......	......	......	1132.1
Dry matter eaten	368.4	11.9	353.2	11.77	314.1	10.13	137.9	4.45	......	......	......	......	1173.6
Ash	18.6	.60	19.7	.66	15.1	.49	5.8	.19	......	......	......	......	59.2
Albuminoids Nx 6.25	61.1	1.97	46.1	1.54	45.2	1.46	27.8	.90	......	......	......	......	180.2
Crude fiber	67.4	2.18	65.8	2.19	58.9	1.90	25.2	.81	......	......	......	......	217.3
Nitrogen-free extract	216.7	6.99	208.3	6.94	180.6	5.83	81.5	2.63	......	......	......	......	687.1
Fat	17.8	.57	13.3	.44	14.2	.46	6.9	.22	......	......	......	......	52.2
Invert sugar	10.9	.35	10.6	.35	8.3	.27	1.1	.04	......	......	......	......	30.9
Sucrose	8.3	.27	22.3	.74	3.0	.10	2.6	.08	......	......	......	......	36.2
Starch	134.0	4.32	127.2	4.24	129.7	4.18	57.6	1.86	......	......	......	......	448.5
Albuminoid nitrogen	8.5	.28	6.4	.21	6.5	.21	2.5	.08	......	......	......	......	23.9
Amide nitrogen	1.3	.04	1.0	.03	0.7	.02	3.9	.12	......	......	......	......	6.9
Increase in live weight and daily gain	53.0	1.70	37.0	1.23	22.0	.71	*38.0	*1.22	......	......	......	......	....
Live weight	614.0	......	651.0	......	673.0	......	635.0	......	......	......	......	......	....
Dry matter for each pound of gain	6.9	......	9.5	......	14.3	......	......	......	......	......	......	......	....
Dry matter eaten per 1,000 pounds live weight.	598.0	......	542.6	......	466.7	......	217.1	......	......	......	......	......	....

* Loss.

HOLSTEIN-FRIESIAN — SINGERLY — (STEER).

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	148.3	4.8	150.2	4.8	144.9	4.8	**443.4**
Barley hay	104.4	8.4	......	......	......	......	......	......	......	......	......	......	**104.4**
Clover and timothy hay	25.5	8.5	258.7	9.1	......	......	......	......	......	......	......	......	**284.2**
Timothy hay	61.0	9.4	......	......	......	......	......	......	......	......	......	......	**61.0**
Barley, oat and pea hay	39.7	6.6	......	......	......	......	......	......	......	......	......	......	**39.7**
Kentucky Blue grass hay	......	......	21.4	8.6	146.4	5.4	......	......	......	......	......	......	**167.8**
Mixed grasses	......	......	......	......	365.5	16.6	......	......	......	......	......	......	**365.5**
Red clover	......	......	......	......	......	......	264.0	26.4	......	......	......	......	**264.0**
Oats and vetches	......	......	......	......	......	......	502.3	23.9	......	......	......	......	**502.3**
Oats and peas	......	......	......	......	......	......	......	.....	453.6	28.3	......	......	**453.6**
Maize ensilage	......	......	507.7	18.4	460.3	15.3	......	......	422.7	28.2	738.0	29.5	**2191.7**
Mixed roots	480.6	17.4	......	......	......	......	......	......	......	......	......	......	**480.6**
Mixed grain No. 7	201.3	7.5	248.0	8.0	268.4	8.9	267.7	8.6	247.0	8.0	239.9	8.0	**1472.3**
Sorghum forage	......	......	......	......	......	......	......	......	......	......	150.0	30.0	**150.0**

HOLSTEIN-FRIESIAN — SINGERLY — (STEER).

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	907.5	30.25	1513.5	48.8	1530.9	51.0	1625.3	52.4	1336.1	43.1	1006.1	33.5	**7919.4**
Water in food	489.6	16.32	500.9	16.16	687.6	22.92	586.9	18.93	730.7	23.57	749.4	24.98	**3745.1**
Dry matter eaten	422.9	14.10	597.9	19.29	553.0	18.43	595.3	19.20	542.8	17.51	523.4	17.45	**3235.3**
Ash	23.8	.79	30.1	1.00	29.1	1.00	31.1	1.00	33.4	1.08	25.7	.86	**173.2**
Albuminoids Nx 6.25	63.1	2.10	96.5	3.11	87.3	2.91	93.5	3.02	104.8	3.38	80.6	2.69	**525.8**
Crude fibre	84.2	2.81	116.4	3.75	102.9	3.43	129.9	4.19	128.6	4.15	96.9	3.23	**658.9**
Nitrogen-free extract	237.4	7.91	316.6	10.21	306.9	10.23	315.2	10.17	348.0	11.23	285.5	9.52	**1809.6**
Fat	16.4	.55	28.3	.91	26.6	.89	26.1	.84	28.5	.92	25.3	.84	**151.2**
Invert sugar	13.4	.45	14.8	.48	8.4	.28	18.4	.59	15.0	.49	16.5	.55	**86.5**
Sucrose	30.3	1.01	11.9	.38	11.1	.37	14.3	.46	10.6	.34	9.9	.33	**88.1**
Starch	132.3	4.41	193.3	6.23	195.3	6.51	184.6	5.96	218.1	7.03	199.9	6.66	**1123.5**
Albuminoid nitrogen	8.3	.28	11.5	.37	10.3	.34	12.0	.39	11.0	.36	9.0	.30	**62.1**
Amide nitrogen	1.9	.06	4.0	.13	3.7	.12	3.1	.10	5.8	.19	3.9	.13	**22.4**
Increase in live weight and daily gain	38.0	1.36	73.0	2.35	27.0	.90	59.0	1.90	55.0	1.77	53.0	1.77	....
Live weight	1036.0	......	1109.0	......	1136.0	......	1195.0	......	1250.0	......	1303.0	......	....
Dry matter for each pound of gain	11.1	......	8.2	......	20.5	......	10.1	......	9.9	......	9.9	......	....
Dry matter eaten per 1,000 pounds live weight	408.2	......	539.1	......	486.8	......	498.2	......	434.2	......	401.7	......	....

AMERICAN HOLDERNESS — D. B. HILL — (STEER).

	October.		November.		December.		January.		February.		March.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	64.8	2.1	30.6	2.3	......	......	......	......	......	......	......	......	95.4
Oat hay	......	......	104.2	3.5	80.6	2.6	71.8	2.3	187.2	6.7	......	......	443.8
Oat and pea hay	......	......	......	......	......	......	......	......	......	......	108.9	5.2	108.9
Barley, oat and pea hay	......	......	......	......	......	......	......	......	......	......	60.1	6.0	60.1
Maize ensilage	188.4	18.8	139.	19.8	620.0	20.0	618.4	19.9	......	......	536.0	17.3	2101.8
Golden tankard mangolds	......	......	377.4	16.4	......	......	......	......	527.8	18.8	......	......	905.2
Maize forage No. 1	129.1	25.8	91.5	9.1	......	......	......	......	......	......	......	......	220.6
Maize forage No. 2	127.9	12.8	......	......	......	......	......	......	......	......	......	......	127.9
Alfalfa forage	148.1	24.7	......	......	......	......	......	......	......	......	......	......	148.1
Mixed grain No. 5	279.0	9.0	......	......	......	......	......	......	......	......	......	......	279.0
Mixed grain No. 7	......	......	226.8	7.6	246.0	7.9	248.0	8.0	224.0	8.0	188.5	6.1	1133.3

AMERICAN HOLDERNESS — D. B. HILL — (STEER).

	October.		November.		December.		January.		February.		March.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	1229.9	39.67	1187.8	39.59	1145.0	36.94	1022.8	32.99	883.6	31.56	957.6	30 89	6426.7
Water in food	479.1	15.45	529.1	17.64	518.6	16.73	461.8	14.90	509.5	18.20	428.1	13.81	2926.2
Dry matter eaten	458.2	14.77	440.3	14.68	428.0	13.81	476.4	15.37	429.5	15.34	465.4	15.01	2697.8
Ash	21.3	.69	23.8	.79	20.1	.65	18.7	.60	25.7	.92	23.0	.74	132.6
Albuminoids Nx 6.25	69.4	2.24	59.1	1.97	60.7	1.96	63.5	2.05	56.9	2.03	65.3	2.11	374.9
Crude fiber	76.6	2.47	78.1	2.60	73.5	2.37	74.3	2.40	77.6	2.77	100.7	3.25	480.8
Nitrogen-free extract	270.5	8.73	262.6	8.75	255.0	8.22	291.5	9.40	252.4	9.02	253.3	8.17	1585.3
Fat	20.5	.66	16.7	.56	18.4	.59	25.5	.82	15.7	.56	21.0	.68	117.8
Invert sugar	12.5	.40	13.9	.46	9.8	.31	2.0	.06	7.4	.27	10.5	.34	56.1
Sucrose	10.3	.33	25.3	.84	3.4	.11	8.4	.27	36.2	1.29	8.1	.26	91.7
Starch	130.6	4.21	166.3	5.54	186.3	6.01	215.6	6.95	142.1	5.07	182.7	5.89	1023.6
Albuminoid nitrogen	9.7	.31	8.3	.28	9.7	.31	8.6	.28	8.1	.29	8.6	.28	53.0
Amide nitrogen	1.5	.05	1.2	.04	.9	.03	1.6	.05	1.2	.04	1.9	.06	8.3
Increase in live weight and daily gain	40.0	1.29	54.0	1 80	60.0	1.93	50.0	1.61	39.0	1.39	60.0	1.94	....
Live weight	759.0	......	813.0	......	873.0	......	923.0	......	962.	......	1022.0	......	....
Dry matter for each pound of gain	11.5	......	8.2	......	7.1	......	9.5	......	11.0	......	7.8	......	....
Dry matter eaten per 1.000 pounds live weight	603.7	......	541.6	......	490.3	......	516.2	......	446.4	......	455.3	......	....

AMERICAN HOLDERNESS — D. B. HILL — (STEER).

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	91.9	3.0	121.1	3.9	121.2	4.0	334.2
Barley hay	83.7	6.7	......	......	......	......	......	......	......	......	......	......	83.7
Clover and timothy hay	24.5	8.2	174.8	6.1	......	......	......	......	......	......	......	......	199.3
Timothy hay	57.5	8.8	......	......	......	......	......	......	......	......	......	......	57.5
Barley, oat and pea hay	54.6	6.8	......	......	......	......	......	......	......	......	......	......	54.6
Kentucky Blue grass hay	......	......	18.5	7.4	99.4	3.7	......	......	......	......	......	......	117.9
Mixed grasses	......	......	......	......	327.9	14.9	......	......	......	......	......	......	327.9
Red clover	......	......	......	......	......	......	198.3	19.8	......	......	......	......	198.3
Oats and vetches	......	......	......	......	......	......	430.5	20.5	......	......	......	......	430.5
Oats and peas	......	......	......	......	......	......	......	......	303.4	19.0	......	......	303.4
Maize ensilage	......	......	612.8	19.8	481.9	16.1	......	......	293.0	19.5	464.7	18.6	1852.4
Mixed roots	573.5	19.1	......	......	......	......	......	......	......	......	......	......	573.5
Mixed grain, No. 7	240.0	8.0	248.8	8.0	268.1	8.9	253.2	8.2	221.7	7.2	232.0	7.7	1463.0
Sorghum forage	......	......	......	......	......	......	......	......	......	......	100.0	20.0	100.0

AMERICAN HOLDERNESS — D. B. HILL — (STEER).

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	1016.1	33.87	1324.9	42.7	1645.4	54.8	1552.2	50.1	1417.3	45.7	1172.2	39.1	**8128.1**
Water in food	573.3	19.11	517.2	16.68	667.1	22.23	482.0	15.55	507.5	16.37	487.6	15.92	**3234.7**
Dry matter eaten	460.5	15.35	536.9	17.32	510.2	17.0	491.9	15.87	431.7	13.92	430.3	14.33	**2861.5**
Ash	25.3	.84	26.0	.84	29.1	.97	24.9	.80	22 1	.71	21.2	.71	**148.6**
Albuminoids Nx 6.25	70.7	2.36	85.2	2.75	102.3	3.41	80.0	2.58	75.6	2.45	70.0	2.33	**483.8**
Crude fiber	83 4	2.78	96.8	3.12	93.5	3.12	99.9	3.22	79.5	2.56	76.4	2.54	**529.5**
Nitrogen-free extract	263.0	8.77	290.8	9.38	340.7	11.36	265.6	8.57	235.4	7 59	241.5	8.05	**1637.0**
Fat	17.7	.59	25.4	.82	28.9	.96	21.9	.71	19.4	.63	21.7	.72	**135.0**
Invert sugar	14.9	.50	11.2	.36	7.9	.26	14.1	.45	11.2	.36	13.0	.43	**72.3**
Sucrose	32.5	1.08	10.5	.34	12.7	.42	12.3	.40	8.5	.28	7.8	.26	**84.3**
Starch	148.9	4.96	186.9	6.03	188.7	6.3	160.7	5.18	152.8	4.93	174.3	5.81	**1012.3**
Albuminoid nitrogen	9.3	.31	10.4	.33	12.3	.41	10.4	.33	8.6	.28	8.1	.27	**59.1**
Amide nitrogen	2 2	.07	3.8	.12	4.2	.14	2.5	.08	3.6	.12	3.1	.10	**19.4**
Increase in live weight and daily gain	34.0	1.13	60.0	1 94	10.0	.33	......	......	27.0	.87	27.0	.90	....
Live weight	1056.0	......	1116.0	......	1126.0	......	1126.0	......	1153.0	......	1180.0	......	....
Dry matter for each pound of gain	13.5	......	8.9	......	51.0	......	......	......	16.0	......	15.9	......	....
Dry matter eaten per 1,000 pounds live weight,	436.0	......	481.1	......	453.1	......	436.9	......	374.4	......	364.7	......	....

AMERICAN HOLDERNESS — GROVER CLEVELAND — (STEER).

	October.		November.		December.		January.		February.		March.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	63.8	2.1	28.7	2.2	......	......	......	......	......	......	......	......	92.5
Oat hay	......	......	93.3	3.1	77.1	2.5	68.4	2.2	181.8	6.5	......	......	420.6
Oat and pea hay	......	......	......	......	......	......	......	......	......	......	106.8	5.1	106.8
Barley, oat and pea hay	......	......	......	......	......	......	......	......	......	......	47.1	4.7	47.1
Maize ensilage	190.5	19.0	132.0	18.9	583.8	18.8	573.7	18.5	......	......	535.0	17.3	2015.0
Golden tankard mangolds	......	......	370.8	16.1	......	......	......	......	550.4	19.7	......	......	921.2
Maize forage No. 1	121.6	24.3	75.1	7.5	......	......	......	......	......	......	......	......	196.7
Maize forage No. 2	115.3	11.5	......	......	......	......	......	......	......	......	......	......	115.3
Alfalfa forage	145.2	24.2	......	......	......	......	......	......	......	......	......	......	145.2
Mixed grain No. 5	278.8	9.0	......	......	......	......	......	......	......	......	......	......	278.8
Mixed grain No. 7	......	......	197.1	6.6	246.0	7.9	248.0	8.0	224.0	8.0	188.5	6.1	1103.6

AMERICAN HOLDERNESS — GROVER CLEVELAND — (STEER).

	October.		November.		December.		January.		February.		March.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	994.5	32.1	825.6	27.52	917.2	29.6	855.5	27.6	652.1	23.29	758.0	24.45	5002.9
Water in food	465.7	15.02	501.4	16 81	489.9	15.8	430.9	13.90	528.2	18.86	424.9	13.71	2844.0
Dry matter eaten	449.5	14.50	392.6	13.09	417.0	13.45	459.2	14.81	428.0	15.29	452.5	14.60	2598.8
Ash	20.8	.67	21.6	.72	19.4	.63	18.0	.58	25.7	.92	22.1	.71	127.6
Albuminoids Nx 6.25	68.6	2.21	52.4	1.75	59.9	1.93	62.2	2.01	57.9	2.07	64.5	2.08	365.5
Crude fiber	74 2	2.39	69.8	2.33	70.3	2.27	69.5	2.24	76.2	2.72	96.1	3.10	456.1
Nitrogen-free extract	265.7	8.57	234.2	7.81	249.1	8.03	282.0	9.10	252 6	9.02	248.2	8.01	1531.8
Fat	20.2	.65	14.7	.49	17.9	.58	24.6	.79	15.5	.55	20.6	.66	113.5
Invert sugar	12.1	.39	12.5	.42	9.4	.30	1.9	.06	7.6	.27	7.6	.25	51.1
Sucrose	10.1	.33	24.5	.82	3.3	.11	8.2	.26	35.5	1.27	7.6	.25	89.2
Starch	128.1	4.13	145.4	4.85	183.0	5.90	208.0	6.71	140.9	5.03	180.3	5.82	985.8
Albuminoid nitrogen	9.5	.31	7.3	.24	8.6	.28	8.4	.27	8.1	.29	8.5	.27	50.3
Amide nitrogen	1.4	.05	1.1	.04	.9	.03	1.5	.05	1.3	.04	1.8	.06	8.0
Increase in live weight and daily gain	49.0	1.32	35.0	1.16	53.0	1.71	60.0	1.94	43.0	1.54	39.0	1.26	....
Live weight	793.0	......	828.0	......	881.0	......	941.0	......	984.0	......	1023.0	......	....
Dry matter for each pound of gain	9.2	......	11.2	......	7.9	......	7.6	......	9.9	......	11.3	......	....
Dry matter eaten per 1,000 pounds live weight	566.8	......	474.2	......	473.3	......	488.0	......	434.9	......	432.5	......	....

AMERICAN HOLDERNESS — GROVER CLEVELAND — (STEER).

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	115.6	3.7	136.8	4.4	124.2	4.1	376.6
Barley hay	59.7	4.8	......	......	......	......	......	......	......	......	......	......	59.7
Clover and timothy hay	16.9	5.6	149.6	5.2	......	......	......	......	......	......	......	......	166.5
Timothy hay	47.3	7.3	......	......	......	......	......	......	......	......	......	......	47.3
Barley, oat and pea hay	41.0	5.1	......	......	......	......	......	......	......	......	......	......	41.0
Kentucky Blue grass hay	......	......	17.9	7.2	97.5	3.6	......	......	......	......	......	......	115.4
Mixed grasses	......	......	......	......	224.0	10.2	......	......	......	......	......	......	224.0
Red clover	......	......	......	......	......	......	178.0	17.8	......	......	......	......	178.0
Oats and vetches	......	......	......	......	......	......	355.6	16.9	......	......	......	......	355.6
Oats and peas	......	......	......	......	......	......	......	......	384.4	24.0	......	......	384.4
Maize ensilage	......	......	527.1	17.0	385.3	12.8	......	......	342.8	22.9	572.1	22.9	1827.3
Mixed roots	551.6	18.4	......	......	......	......	......	......	......	......	......	......	551.6
Mixed grains, No. 7	239.2	8.0	248.0	8.0	267.5	8.9	268.1	8.6	247.4	8.0	240.0	8.0	1510.2
Sorghum forage	......	......	......	......	......	......	......	......	......	......	118.3	23.7	118.3

AMERICAN HOLDERNESS — GROVER CLEVELAND — (STEER).

	APRIL.		MAY.		JUNE.		JULY.		AUGUST.		SEPTEMBER.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	814.7	27.15	1066.3	34.4	1396.8	46.6	1506.2	48.6	1363.9	44.0	1064.2	35.5	**7212.1**
Water in food	545.2	18.17	450.0	14.5	513.1	17.1	421.6	13.6	613.4	19.79	589.2	19.64	**3132.5**
Dry matter eaten	450.9	15.03	492.6	15.9	461.2	15.4	495.7	15.99	497.9	16.06	465.4	15.51	**2863.7**
Ash	22.1	.74	23.6	.76	23.0	.77	25.1	.81	25.6	.82	23.0	.77	**142.4**
Albuminoids Nx 6.25	64.9	2.16	82.3	2.65	77.1	2.57	82.1	2.65	86.9	2.80	74.8	2.49	**468.1**
Crude fiber	66.7	2.22	85.5	2.76	76.4	2.55	98.5	3.18	92.8	2.99	83.7	2.79	**503.6**
Nitrogen-free extract	240.8	8.03	267.7	8.63	262.2	8.74	268.2	8.65	269.7	8.70	261.0	8.70	**1569.6**
Fat	16.0	.53	23.5	.76	22.3	.74	22.1	.71	22.4	.72	23.3	.78	**129.6**
Invert sugar	13.3	.44	9.9	.32	6.3	.21	14.1	.45	13.1	.42	14.1	.47	**70.8**
Sucrose	34.5	1.15	9.8	.32	9.5	.32	12.0	.39	9.9	.32	8.6	.29	**84.3**
Starch	140.9	4.7	175.7	5.67	174.2	5.80	166.7	5.38	174.2	5.62	186.6	6.22	**1018.3**
Albuminoid nitrogen	8.5	.28	9.8	.32	9.2	.31	10.6	.34	9.8	.32	8.6	.28	**56.5**
Amide nitrogen	2.0	.07	3.4	.11	3.2	.10	2.7	.09	4.2	.14	3.4	.11	**18.9**
Increase in live weight and daily gain	21.0	.70	38.0	1.23	......	......	40.0	1.29	70.0	2.26	.36	1.20	....
Live weight	1044.0	......	1082 0	......	1082.0	......	1122.0	......	1192.0	......	1228.0	......	....
Dry matter for each pound of gain	21.5	......	12.9	......	......	......	12.4	......	7.1	......	12.9	......	....
Dry matter eaten per 1,000 pounds live weight.	431.0	......	455.2	......	426.2	......	441.8	......	417.7	......	379.0	......	....

GUERNSEY — CATHAY — (STEER).

	October.		November.		December.		January.		February.		March.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	35.3	1.1	21.5	1.7	......	......	......	......	......	......	......	......	56.8
Oat hay	......	......	56.1	1.9	52.3	1.7	51.4	1.7	119.3	4.3	......	......	279.1
Oat and pea hay	......	......	......	......	......	......	......	......	......	......	81.7	3.9	81.7
Barley, oat and pea hay	......	......	......	......	......	......	......	......	......	......	44.7	4.5	44.7
Maize ensilage	76.0	7.6	62.6	8.9	310.9	10.0	325.4	10.5	......	......	253.4	8.2	1,028.3
Golden tankard mangolds	......	......	108.5	4.7	......	......	......	......	306.1	10.9	......	......	414.6
Maize forage, No. 1	64.4	12.5	......	......	......	......	......	......	......	......	......	......	64.4
Maize forage, No. 2	62.2	6.2	46.5	4.6	......	......	......	......	......	......	......	......	108.7
Alfalfa forage	69.7	11.3	......	......	......	......	......	......	......	......	......	......	69.7
Oil meal gruel	330.0	10.7	295.2	9.8	285.0	9.2	......	......	......	......	......	......	910.2
Mixed grain, No. 5	120.0	3.9	......	......	......	.....	......	......	......	......	......	......	120.0
Mixed grain, No. 7	......	......	94.8	3.2	123.9	4.0	124.0	4.0	119.0	4.2	94.3	3.0	556.0

GUERNSEY — CATHAY — (STEER).

	October.		November.		December.		January.		February.		March.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	514.7	23.05	695.4	23.18	557.0	17.97	455.6	14.70	405.0	14.46	563.4	18.17	3391.1
Water in food	221.5	7.14	192.5	6.42	264.5	8.53	244.0	7.87	284.5	10.16	211.5	6.82	1418.5
Dry matter eaten	242.8	7.83	229.8	7.66	256.2	8.26	256.7	8.25	259.9	9.28	262.6	8.47	1508.0
Ash	11.9	.38	12.5	.42	12.7	.41	10.4	.34	15.2	.54	13.7	.44	76.4
Albuminoids Nx 6.25	43.3	1.40	36.8	1.23	42.6	1.37	33.0	1.07	32.3	1.15	37.4	1.21	225.4
Crude fiber	39.6	1.28	43.0	1.43	43.5	.14	43.1	1.39	47.8	1.71	62.8	2.03	279.8
Nitrogen-free extract	136.1	4.39	127.9	4.26	145.6	4.69	155.7	5.02	144.6	5.16	137.1	4.42	846.9
Fat	11.7	.38	9.9	.33	11.9	.38	13.5	.44	8.9	.32	11.4	.37	67.3
Invert sugar	6.1	.20	6.0	.20	6.0	.19	1.1	.04	4.3	.16	4.5	.15	28.0
Sucrose	5.3	.17	8.6	.29	2.4	.08	4.3	.14	20.8	.74	4.2	.14	45.6
Starch	67.1	2.20	83.6	2.79	103.6	3.34	134.0	4.32	90.4	3.23	95.7	3.09	574.4
Albuminoid nitrogen	6.6	.21	5.4	.18	6.1	.20	4.5	.14	4.5	.16	4.8	.15	31.9
Amide nitrogen	.8	.03	.6	.02	.6	.02	.8	.03	.7	.02	1.1	.04	4.6
Increase in live weight and daily gain	44.0	1.42	23.0	.76	30.0	.97	38.0	1.23	32.0	1.14	41.0	1.32	....
Live weight	395.0	......	418.0	......	448.0	......	486.0	......	518.0	......	559.0	......	....
Dry matter for each pound of gain	5.5	......	10.0	......	8.5	......	6.5	......	8.1	......	6.4	......	....
Dry matter eaten per 1,000 pounds live weight	612.2	......	549.7	......	571.9	......	507.7	......	501.7	......	469.7	......	....

GUERNSEY — CATHAY — (STEER).

	APRIL.		MAY.		JUNE.		JULY.		AUGUST.		SEPTEMBER.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	85.6	2.8	88.0	2.8	85.3	2.8	258.9
Barley hay	66.1	5.3	......	......	......	......	......	......	......	......	......	......	66.1
Clover and timothy hay	18.0	6.0	186.3	6.5	......	......	......	......	......	......	......	......	204.3
Timothy hay	37.9	5.8	......	......	......	......	......	......	......	......	......	......	37.9
Barley, oat and pea hay	40.7	5.1	......	......	......	......	......	......	......	......	......	......	40.7
Kentucky Blue grass hay	......	......	16.3	6.5	105.8	3.9	......	......	......	......	......	......	122.1
Mixed grasses	......	......	......	......	241.6	11.0	......	......	......	......	......	......	241.6
Red clover	......	......	......	......	......	......	158.2	15.8	......	......	......	......	158.2
Oats and vetches	......	......	......	......	......	......	328.6	15.6	......	......	......	......	328.6
Oats and peas	......	......	......	......	......	......	......	......	304.4	19.0	......	......	304.4
Maize ensilage	......	......	241.2	7.8	145.0	4.8	......	......	239.2	15.9	404.6	16.2	1030.0
Mixed roots	349.3	11.6	......	......	......	......	......	......	......	......	......	......	349.3
Mixed grain, No. 7	136.0	4.5	155.0	5.0	175.3	5.8	174.8	5.6	178.5	5.8	180.0	6.0	999.6
Sorghum forage	......	......	......	......	......	......	......	......	......	......	90.0	18.0	90.0

GUERNSEY — CATHAY — (STEER).

	APRIL.		MAY.		JUNE.		JULY.		AUGUST.		SEPTEMBER.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	596.0	19.87	955.8	30.8	1065.3	35.5	1207.6	39.0	975.1	31.5	846.8	28.2	5646.6
Water in food	352.2	11.74	232.9	7.51	338.8	11.29	372.0	12.0	455.0	14.68	422.3	14.08	2173.2
Dry matter eaten	295.8	9.86	365.8	11.80	328.9	10.96	375.2	12.1	355.0	11.45	337.6	11.25	2058.3
Ash	16.7	.56	18.9	.61	17.9	.60	19.4	.62	18.2	.59	16.5	.55	107.6
Albuminoids Nx 6.25	44.2	1.47	59.9	1.93	54.3	1.81	59.4	1.92	62.5	2.02	54.6	1.82	334.9
Crude fiber	58.9	1.96	73.2	2.36	61.4	2.05	80.4	2.59	65.0	2.10	59.4	1.98	398.3
Nitrogen-free extract	164.6	5.49	116.4	3.75	180.2	6.01	199.8	6.44	193.5	6.24	190.2	6.34	1044.7
Fat	11.3	.38	17.4	.56	15.9	.53	16.5	.53	16.1	.52	17.0	.57	94.2
Invert sugar	9.6	.32	10.2	.33	5.4	.18	11.4	.37	9.3	.30	11.3	.38	57.2
Sucrose	22.3	.74	7.5	.24	7.0	.23	9.1	.30	7.2	.23	6.4	.21	59.5
Starch	90.4	3.01	112.9	3.64	114.2	3.81	110.5	3.57	124.2	4.00	136.7	4.56	688.9
Albuminoid nitrogen	5.7	.19	7.4	.24	6.5	.22	7.6	.25	7.1	.23	6.3	.21	40.6
Amide nitrogen	1.4	.05	2.3	.07	2.1	.07	1.9	.06	3.0	.10	2.4	.08	13.1
Increase in live weight and daily gain	22.0	.73	46.0	1.48	18.0	.60	46.0	1.48	34.0	1.10	35.0	1.17	....
Live weight	581.0	......	627.0	......	645.0	......	691.0	......	725.0	......	760.0	......	....
Dry matter for each pound of gain	13.4	......	7.9	......	18.2	......	8.2	.....	10.4	......	9.6	......	....
Dry matter eaten per 1,000 pounds live weight.	509.2	......	583.5	......	509.9	......	543.0	......	489.7	......	444.2	......	....

GUERNSEY — KHALEDAN — (STEER).

	October.		November.		December.		January.		February.		March.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	38.8	1.2	21.9	1.7	......	......	......	......	......	......	......	......	60.7
Oat hay	......	......	69.2	2.3	61.6	2.0	60.7	2.0	150.6	5.4	......	......	342.1
Oat and pea hay	......	......	......	......	......	......	......	......	......	......	89.3	4.3	89.3
Barley, oat and pea hay	......	......	......	......	......	......	......	......	......	......	50.2	5.0	50.2
Maize ensilage	83.5	8.3	67.7	9.7	366.0	11.8	371.4	12.0	......	......	315.0	10.2	1203.6
Golden tankard mangolds	......	......	108.8	4.7	......	......	......	......	291.9	10.4	......	......	400.7
Maize forage, No. 1	79.5	15.9	57.3	5.7	......	......	......	......	......	......	......	......	136.8
Maize forage, No. 2	72.0	7.2	......	......	......	......	......	......	......	......	......	......	72.0
Alfalfa forage	70.0	11.7	......	......	......	......	......	......	......	......	......	......	70.0
Oil-meal gruel	330.0	10.7	278.0	9.9	290.0	9.4	......	......	......	......	......	......	898.0
Mixed grain, No. 5	120.0	3.9	......	......	......	......	......	......	......	......	......	......	120.0
Mixed grain, No. 7	......	......	109.9	3.7	124.0	4.0	124.0	4.0	126.0	4.5	110.5	3.6	594.4

GUERNSEY — KHALEDAN — (STEER).

	October.		November.		December.		January.		February.		March.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	778.1	25.10	699.6	23.32	706.5	22.79	523.3	16.88	546.4	19.51	698.2	22.52	**3952.1**
Water in food	246.2	7.94	206.2	6.87	308.7	9.96	276.6	8.92	288.6	10.31	259.1	8.36	**1585.4**
Dry matter eaten	255.7	8.25	262.6	8.75	276.9	8.93	279.5	9.01	279.9	10.00	305.9	9.87	**1660.5**
Ash	12.5	.40	14.3	.48	13.9	.45	11.5	.37	17.1	.61	15.8	.51	**85.1**
Albuminoids, Nx 6.25	44.3	1.43	41.6	1.39	44.3	1.43	34.7	1.12	35.3	1.26	43.4	1.40	**243.6**
Crude fiber	43.0	1.39	49.8	1.66	49.7	1.60	48.9	1.58	57.9	2.07	72.0	2.32	**321.3**
Nitrogen-free extract	142.4	4.59	146.7	4.89	157.3	5.07	168.8	5.45	159.5	5.69	161.2	5.20	**935.9**
Fat	12.2	.40	11.3	.38	12.7	.41	14.7	.47	10.0	.36	13.4	.43	**74.3**
Invert sugar	6.8	.22	6.8	.23	5.3	.17	1.2	.04	4.5	.16	5.3	.17	**29.9**
Sucrose	5.5	.14	8.9	.30	2.6	.08	4.6	.15	20.3	.74	4.9	.16	**46.8**
Starch	70.0	2.26	95.0	3.17	109.7	3.54	123.2	3.98	89.7	3.21	113.2	3.65	**600.8**
Albuminoid nitrogen	6.4	.21	6.0	.19	6.4	.21	4.7	.15	4.9	.18	5.6	.18	**34.0**
Amide nitrogen	.8	.03	.7	.02	.7	.02	.9	.03	.7	.03	1.3	.04	**5.1**
Increase in live weight and daily gain	44.0	1.42	32.0	1.06	29.0	.93	41.0	1.32	30.0	1.07	39.0	1.26	....
Live weight	444.0	......	476.0	......	505.0	......	546.0	......	576.0	......	615.0	......	....
Dry matter for each pound of gain	5.8	......	8.2	......	9.5	......	6.8	......	9.3	......	7.8	......	....
Dry matter eaten per 1,000 pounds live weight	572.7	......	551.7	......	548.3	......	511.8	......	485.9	......	497.5	......	....

GUERNSEY — KHALEDAN — (STEER).

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	96.8	3.1	105.1	3.4	100.8	3.4	302.7
Barley hay	76.1	6.1	......	......	......	......	......	......	......	......	......	......	76.1
Clover and timothy hay	20.9	7.0	198.7	7.0	......	......	......	......	......	......	......	......	219.6
Timothy hay	44.7	6.9	......	......	......	......	......	......	......	......	......	......	44.7
Barley, oat and pea hay	49.5	6.2	......	......	......	......	......	......	......	......	......	......	49.5
Kentucky Blue grass hay	......	......	17.8	7.1	97.1	3.6	......	......	......	......	......	......	114.9
Mixed grasses	......	......	......	......	248.2	11.2	......	......	......	......	......	......	248.2
Red clover	......	......	......	......	......	......	196.1	19.6	......	......	......	......	196.1
Oats and vetches	......	......	......	......	......	......	402.7	19.2	......	......	......	......	402,7
Oats and peas	......	......	......	......	......	......	......	......	370.2	23.1	......	......	370.2
Maize ensilage	......	......	427 7	13.8	391.5	13.1	......	......	355.0	23.7	597.5	23.9	1774.7
Mixed roots	352.6	11.8	......	......	......	......	......	......	......	......	......	......	352.6
Mixed grain, No. 7	152.0	5.1	170.5	5.5	186.9	6.2	216.2	7.0	217.7	7.0	210.0	7.0	1152.6
Sorghum forage	......	......	......	......	......	......	......	......	......	......	124.0	24.0	124.0

GUERNSEY — KHALEDAN — (STEER).

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	750.6	25.02	996.8	32.2	1093.8	36.5	1222.7	39.4	1027.2	33.1	916.7	30.6	6007.8
Water in food	362.0	12.07	374 2	12.07	527.3	17.58	456.9	14.74	604.7	19.51	608.5	20.28	2933.6
Dry matter eaten	338.8	11.13	450.5	14.53	399.4	13.31	454.9	14.67	442.5	14.27	423.8	14,13	2504.9
Ash	18.9	.63	22.4	.72	20.7	.69	23.4	.75	22.6	.73	20.8	.69	128.8
Albuminoids Nx 6.25	49.8	1.66	70.1	2.26	62.5	2.08	72.4	2.33	77.3	2.49	67.4	2.24	399.5
Crude fiber	68.3	2.28	88.0	2.84	74.1	2.47	96.4	3.11	81.5	2.63	76,5	2.55	484.8
Nitrogen-free extract	183.8	6.13	239.0	7.71	222.8	7.43	242.9	7.84	241.5	7.79	238.2	7.94	1368.2
Fat	12.9	.43	20.8	.67	19.1	.64	20.1	.65	20.0	.64	21.2	.71	114.1
Invert sugar	10.6	.35	11.2	.36	5.8	.19	13.6	.44	11.3	.36	13.0	.43	65.5
Sucrose	23.2	.77	8.7	.28	7.8	.26	11.2	.36	8.7	.28	8.1	.21	67.7
Starch	102.3	3.41	139.2	4.5	142.1	4.7	144.3	4.65	154.6	4.99	168.7	5.62	851.2
Albuminoid nitrogen	6.5	.22	8.3	.27	6.4	.21	9.3	.30	8.7	.28	7.6	.25	46.8
Amide nitrogen	1.6	.05	2.9	.09	2.8	.09	2.3	.07	3.8	.12	3.2	.11	16.6
Increase in live weight and daily gain	39.0	1.30	62.0	2.0	34.0	1.13	48.0	1.55	57.0	1.84	47.0	1.57	....
Live weight	654.0	......	716.0	......	750.0	......	798.0	......	855.0	......	902 0	......	....
Dry matter for each pound of gain	8.5	......	7.3	......	11.7	......	9.5	......	7.8	......	9.0	......	....
Dry matter eaten per 1,000 pounds live weight	510.4	......	629.1	......	532 5	......	570.0	......	517.6	......	469.9	......	....

FOOD VALUES OF FEEDING STUFFS.

A recent report of the Department of Agriculture at Washington gives the following number of animals upon the farms of the United States and in the State of New York, with their values January, 1891:

	United States.	Value.	New York.	Value.
Horses ...	14,056,750	$941,823,222	640,253	$59,831,051
Mules.....	2,296,532	178,847,370	5,288	509,882
Cows......	16,019,591	346,379,900	1,536,849	41,817,661
Other cattle	36,875,648	544,127,908	783,634	21,118,774
Sheep.....	43,431,136	108,397,447	1,393,583	5,313,035
Hogs......	50,625,106	210,193,923	672,595	4,404,558
Total...	163,304,763	$2,329,787,770	5,032,202	$132,994,961

If we estimate the annual cost of food necessary for the maintenance of these animals as averaging fifty dollars each for horses and mules; twenty-five dollars each for cows and other cattle; and five dollars each for sheep and hogs, we have as follows:

	ANNUAL COST OF MAINTENANCE.	
	United States.	New York.
Horses and mules...........	$817,644,100 00	$32,277,050 00
Cows, oxen, etc..............	1,322,380,975 00	58,012,075 00
Sheep and hogs.............	470,281,210 00	10,330,890 00
Total....................	$2,610,326,285 00	$100,620,015 00

Each for himself may estimate the cost, but it is obvious that for New York State especially there is little reason to suppose the above estimates excessive, and, as is seen, the aggregate amounts to something over $100,000,000 annually, a sum equal to eighty-three per cent of the total estimated value of all our leading farm crops for 1888, viz., our cereal, potato, tobacco, and hay crop.

Anything therefore which may aid in the economy with which this vast number of animals may be fed, without in any way diminishing their practical value on the farm, whether in the production of labor or of farm products, is of interest to every farmer and may be of great value in increasing the profits of the farm.

During the past quarter of a century the development of those large manufacturing interests of the country which depend for their raw material upon one or another of our agricultural products, has placed at the disposal of the farmer a large quantity of various waste products so that in addition to the bran, shorts and middlings of the various grains used by the flouring mills, we have cotton-seed and linseed meal, gluten meal from the glucose and starch factories, malt sprouts from the maltsters, brewers' grains and distillery refuse from the manufacturers of beer and whiskey, and many other similar products of varied composition, and nearly all of them of very high feeding value.

While, therefore the feeder has at his disposal so large a number of products, so great is the diversity in their composition that there is need of increased intelligence as to the function of the several food constituents in order to secure the greatest economy in feeding, as also for the purpose of maintaining the animal in full health and vigor.

It is notorious that so often is our leading cereal corn, a food of acknowledged value, injudiciously fed, and so often have disastrous if not fatal results followed such injudicious use, that by some it has come to be regarded as only adapted to swine and poultry feeding, dangerous for horses and useless for cows; but equally unfortunate results have followed the use of several of the highly concentrated food products of the manufactories by those who were unfamiliar with the composition and nature of the material and the necessary precaution to be observed in its use.

COMMERCIAL AND FOOD VALUATION OF VARIOUS FEEDING STUFFS.

Having been thrown upon the market as refuse products of manufacture, as we have seen these materials to have been, their price was governed at first by the demand which their use created without much, if any, reference to their actual or relative feeding value or to any cost of their production; but, so extensive has become their use, and so generally acknowledged their feeding value, that their market value has risen greatly with the increased demand, and they have now, in many cases, become one of the sources of profit to the manufacturers producing them.

But so far are we as yet from knowing by careful experiment the relative value of the several constituents of food in the production of, for example, butter, beef or pork, that we are unable to fix a relative value upon these various foods with the differences of composition of which chemical analysis has made us familiar.

The problem is similar in character to an attempt to place a crop-producing value upon potash, phosphoric acid or nitrogen; a problem which no agricultural chemist, or few at most, would attempt to solve. Numerous carefully conducted experiments have demonstrated, that in certain cases some one of these three fertilizing ingredients showed a crop-producing value very many times in excess of either of the others, which others indeed, by comparison, were in this particular case shown to be without value.

Immense crops have been grown on lands practically barren, by the addition only of an abundant supply of available phosphoric acid, crops which were not appreciably increased when potash and nitrogen compounds were added, and, in like manner, compounds of potash have produced enormous increase in yield of crop, which was not further increased when phosphoric acid and nitrogen compounds were added to the potash; and the same has been shown in many other cases to be true of the compounds of nitrogen.

It is therefore manifestly as impossible to place a relative crop-producing value upon the several fertilizing constituents, phosphoric acids, potash and nitrogen, as it is upon the butter, beef or pork producing value of the several nutritive constituents of the various foods.

Of late, and with good reason, there has been repeated attention called to the value of the fertilizing constituents in these foods, which, in the aggregate, amounts to a very large percentage of the market value of the foods, and in some cases fully equals it. Indeed, so well is this fact recognized by the manufacturers of commercial fertilizers, that some of them have been accustomed to use certain of these foods, as cotton-seed meal and malt sprouts for example, as constituents of their fertilizers, furnishing as these do, at reasonable cost, a large per cent of nitrogen and very appreciable amounts of phosphoric acid and potash. It follows, therefore, that, if these manufacturers can afford to use these foods, sacrificing entirely their very great value as foods, it is for the interest of the farmer who uses these feeds to see to it that he secures, by careful saving of the manure obtained from his animals, these valuable fertilizing constituents which these and all other foods contain, and thus in large measure making it unnecessary for him to purchase commercial fertilizers in order to maintain or increase the fertility of his lands.

COMMERCIAL VALUATION OF FERTILIZING CONSTITUENTS OF FOODS.

The determination of the commercial value of the potash, phosphoric acid and nitrogen in foods, as in commercial fertilizers, is comparatively easy and approximately accurate, since, owing to the great demand for fertilizers, there has been in every country large amounts of capital invested in the several industries which have been created to supply this increasing demand, and the natural competition of legitimate business enterprise has resulted in gradually bringing the prices of the fertilizing constituents to as uniform a standard as are the prices of any other product of manufacture.

The rock phosphate of South Carolina, the refuse bone-black of the sugar refineries, the phosphatic guanos of the West Indies, and other such natural sources, furnish the raw material upon which the value of phosphoric acid mainly depends; while the potash salts found in such abundance in the German deposits furnish the basis for the estimation of the value of this constituent. Sulphate of ammonia from the gas-works and the nitrate of soda of Chili, fix the price for nitrogen in its most available and therefore most valuable form; while the refuse from the slaughter-houses, the pomace left after expressing the oil from fish, and such other refuse organic material containing nitrogen, furnish the data by which the value of these less valuable forms of nitrogen are determined.

It can not be too clearly understood that in the fixing of these prices upon these several constituents the agricultural chemist has nothing to do. These prices are determined by the same laws of trade which regulate the price of nails, sugar, flour and other commodities. The agricultural chemist is in a position to know from the quotations of the market how much nitrogen is worth in Chili niter or in sulphate of ammonia, how much if in the form of dried blood or fish scrap; how much potash is worth in the form of the chloride or muriate, and how much in the form of sulphate; also, how much phosphoric acid is worth in a soluble or available form, since he has at command the very sources of information which are in possession of the fertilizer manufacturers themselves, viz.: The market quotations by which they are able to intelligently prepare and place a price upon their products.

THE COMMERCIAL VALUATION OF THE FOOD CONSTITUENTS OF FOODS.

As we have seen, therefore, it is only necessary, in any given sample of food, to determine by chemical analysis the amount of nitrogen, potash and phosphoric acid in such food, and then, by simple calculation, to estimate the value of these according to the market rates, in order to determine the commercial value of the fertilizing constituents in such sample.

But in the determination of the food value, commercially, of the different food constituents of a sample of food, we have a far more difficult task, and can hope at best, with our present knowledge, to only approximate it.

These food constituents are the albuminoids, the carbohydrates (starch and sugars), and the fats or oils; we may include also the crude fiber.

All the ordinary forms of cattle foods contain each of the above constituents in very varying proportions, but in affixing a value to these we have not, as is the case with fertilizing constituents, any one food consisting wholly or mainly of one of these food constituents, which we may use as a basis for valuation. It is true that sugar, starch, albumen and fat are found pure in the market, but these have been produced to meet other demands of the market, and the cost of their production is such as to render them valueless as means by which their value in any food containing them may be determined.

The following table gives the percentage composition of twelve foods in more or less extended use, the present prices per ton approximately, and the number of pounds of the several food constituents present in 2,000 pounds of each of these foods which are digested, calculated from many digestion experiments made by different chemists upon these or similar foods:

	Cost per ton.	Percentage Composition.				Digestible in 2,000 Pounds.			
		Alb.	Fiber.	N. free.	Fat.	Alb.	Fiber.	N. free.	Fat.
Linseed meal, o. p.	$27 00	31.96	9.82	35.24	7.97	522.4	21.0	514.8	145.4
Linseed meal, n. p.	26 00	32.85	9.46	38.29	3.08	537.2	18.9	559.4	56.1
Cotton-seed meal	26 00	42.15	5.73	22.98	13.30	732.2	......	374.1	250.0
Gluten meal	27 00	28.26	2.30	52.61	6.62	448.8	24.0	895.8	95 4
Starch feed	7 00	6.17	3.19	22.52	3.18	96.9	38.4	412.6	53.8
Hominy feed	25 00	9.82	3.50	64 94	7.93	159.0	43.4	1208.0	119.0
Rye feed	24 00	13.56	2.75	65.80	2.60	211.6	18.1	1046.0	35.8
Malt sprouts	18 00	22.85	10.72	48.59	1.79	367.7	35.3	816.8	32.2
Corn meal	25 00	9.50	1.65	68.35	4.27	150.0	20.4	1251.5	68.1
Wheat bran	24 00	15.19	9.33	53.72	3.68	237.0	54.1	827.8	50.8
Wheat middlings	24 00	15.91	4.45	60.07	4.17	248.3	25.9	925.7	57.5
Rye bran	24 00	15.28	3.52	63.66	2.46	238.4	23.2	981.6	33.9
Total	$277 00	243.51	66.42	596.77	61.05	3949.5	322.7	9814.1	1003.0
Average for	1 00	17.6	4.8	43.1	4.4	14.3	1.2	35.4	3.6

From this table it will be seen that upon an average, at the above prices, a certain number of pounds of albumen, fiber, carbohydrates and fats, of which the number of pounds of each given are digestible, may be bought for one dollar.

German and English authorities have, as an average, assigned the following prices for the several constituents, viz.: Albuminoids and fats 3.68 cents, and carbohydrates .75 cents per pound, valuing the albuminoids and fats as approximately worth five times as much per pound as the carbohydrates; but it will be seen that these prices are too high if applied to the total amount of food constituents present, and too low if applied to the digestible quantities of each.

Professor Wulff of the Indiana Experiment Station gives, as the value of the digestible constituents, the following prices, viz.: Three and one-third cents per pound for the albuminoids and fats, and nine-tenths of a cent for the carbohydrates. At these prices the average value would amount to ninety-two and one-fourth cents instead of one dollar, but as these prices were given two years ago, February, 1889, they should be increased about ten per cent, and that would bring his valuation to but one and one-half per cent above the actual cost of these products.

Dr. Jenkins, of the Connecticut Experiment Station, places a much higher valuation relatively upon the fats, and gave two years ago, January, 1889, the following prices upon the total amount of these constituents present in the several foods, viz.: Albuminoids, one and six-tenths cents; fats, four and two-tenths cents; carbohyrdates (nitrogen-free extract and fiber), ninety-six hundredths cents per pound. If we apply these prices we find that we have ninety-two and six-tenths cents as the calculated value of our one dollar's worth of food, and if, owing to the increase of prices during the past two years, we add ten per cent also to the values fixed by Dr. Jenkins, the value would be 101.9 cents, or less than two per cent in the excess of the actual cost.

There appears to be pretty general agreement among agricultural chemists, that, since the fats are capable of performing in certain of the functions of the animal economy about two and one-half times the service of the carbohydrates, that, in determinations of nutritive value they should be counted at two and one-half times the value of an equal weight of carbohydrates, and there would appear, therefore, reason to estimate their commercial value in the same proportion, unless clear reasons for the contrary appear. It has been observed that the German and English authorities quoted value the albuminoids and fats alike, and, since upon the average we find them equally digestible and their food value is admittedly very great, it would seem that, unless reasons clearly appear to show that whatever their actual value in the animal economy, they are sold in the market in the various feeds at a less price per pound upon the average than the fats, it would appear that they should receive an equal valuation.

The following table gives the calculated value of one ton of each of the twelve feeds taken as a basis for determining the relative values of the several food constituents. The columns headed Wulff and Jenkins give the values according to their prices, to which ten per cent has been added for reason already given. The column headed Collier is computed by allowing two and one-half cents a pound for total albuminoids and fats, and one cent a pound for total carbohydrates and fiber. At these prices the average dollars worth of food is worth two and nine-tenths cents more than a dollar.

	Cost.	Wulff.	Jenkins.	Collier.
Linseed meal, old process......	$27 00	$29 79	$28 13	$28 98
Linseed meal, new process.....	26 00	27 48	24 50	27 52
Cotton-seed meal	26 00	39 72	33 19	33 47
Gluten meal..............	27 00	27 06	27 66	27 52
Starch feed..................	7 00	9 99	10 54	9 82
Hominy feed	25 00	22 58	24 14	22 56
Rye feed....................	24 00	19 61	21 65	21 79
Malt sprouts	18 00	23 10	22 22	24 18
Corn meal....................	25 00	20 59	22 07	20 89
Wheat bran...................	24 00	19 28	22 06	22 05
Wheat middlings	24 00	20 63	23 08	22 94
Rye bran.....................	24 00	19 93	21 84	22 31
Total	$277 00	$279 76	$281 08	$284 03

It will be seen that there is approximate agreement between the actual cost and the calculated value of these several foods differing so widely as they do in relative composition, even though the calculations are made upon the basis of either of the scale of prices for the several food constituents.

Owing, therefore, to this close agreement, and for the reason that the total amount of the several food constituents is obtained with far greater accuracy by analysis than is the amount capable of digestion, and also since there does not appear to be sufficient reason for placing a higher value upon the fats than upon the albuminoid constituents of the foods, while the method of calculation is most simple, I have adopted in the following table, which gives most of the food products of the farm, as also those mill foods already considered, two and one-half cents per pound as the value of the albuminoids and fats found present by analysis, and one cent per pound for the nitrogen-free extract or carbohydrates, including fiber.

It is obvious, however, that, since by a large number of experiments made in this country, as also in Europe, it has been found that a larger percentage of the several food constituents in grains and mill products is digested and assimilated by the animal than of those constituents when present in hays, straws and other coarse foods, that the grains and mill feeds have a higher nutritive value than is indicated simply by their larger percentage of food constituents.

The average of twenty-nine feeding experiments with thirteen different coarse foods, including hay, straw, corn fodder, corn stover and ensilage, shows that the following percentages of each food constituent was digested:

	Per cent.
Total dry matter	59.0
Albuminoids	62.4
Fiber	59.4
Carbohydrates	63.8
Fats	53.8

Similar feeding experiments, including corn meal, cotton-seed meal, corn and cob meal, and malt sprouts, show that the following percentages of each food constituent present was, upon the average, digested:

	Per cent.
Total dry matter	77.8
Albuminoids	78.0
Fiber	30.6
Carbohydrates	77.3
Fat	92.6

It appears, therefore, that the coarser foods possessed a food value twenty-two and six-tenths per cent less than their chemical composition would assign to them in comparison with the richer grain and mill feeds, and in the table following there is deducted from the calculated food values of the hays, straws and green foods, except the roots, twenty-two and six-tenths per cent.

In estimating the food value of the farm products, it is to be oberved that the same value is given to the digested food as the farmer is called upon to pay when purchasing the mill products, and it is also to be noted that good prices are allowed as the market value of the several farm products, so that the last three columns which give the per cent of food value to cost, the per cent of fertilizing value to cost, and the per cent of total value to cost of the food is under rather than over the truth

In estimating the fertilizing value of a food, it is obvious that only that portion can be recovered which is not appropriated by the animal in its growth of muscle and bone, but after maturity this demand ceases, and from the food such portions are taken as suffice, with the cow for example, for the production of the milk yielded.

Now an experiment made with five cows, representing as many, different breeds, shows that during the month, when their flow of milk was at its maximum, the amount of casein in their milk averaged for one month twenty-six and one-half per cent of the amount of the albuminoids present in the food consumed by them. It is necessary, therefore, for accuracy, to deduct from the amount of nitrogen in the table valued as a fertilizing constituent about one-fourth the quantity given with each food.

	Percentage Composition.			
	Albumen.	Fiber.	Carbo-hydrates.	Fat.
Hays.				
Timothy hay	6.17	28.81	45.82	2.22
Orchard grass hay	8.12	31.14	35.73	3.53
Kent, blue grass hay	6.53	27.29	43.64	3.03
Tall meadow oat grass hay	6.96	29.42	40.21	3.14
Meadow fox-tail hay	9.62	26.80	49.40	3.59
Meadow fescue hay	6.49	29.51	40.01	3.08
Hungarian grass hay	7.22	28 25	49.41	2.14
Mixed grass hay	6.37	32.30	40.57	2.46
Red clover hay	12.41	19.25	39.62	2.71
White clover hay	14.90	25.60	34.30	3.50
Alsike clover hay	11.44	24.95	38.37	3.34
Alfalfa hay	12.91	28.91	32.26	3.04
Straw.				
Oat straw	4.00	39.50	36.20	2.00
Wheat straw	3.00	40.00	36.90	1.20
Rye straw	3.00	44.00	33.30	1.30
Barley straw	3.50	40.00	36.70	1.40
Buckwheat straw	8.13	45.88	33.21	1.56
Pea straw	6.50	40.00	35.20	2.00
Bean straw	10.20	34.00	33.50	1.00
Clover straw	9.40	42.00	25.00	2.00
Maize stover	5.70	24.61	41.80	1.57
Green Feed.				
Maize ensilage	2.58	6.90	17.70	1.59
Clover ensilage	3.34	6.66	10,21	1.02
Fodder corn	1.54	6.10	10.14	.58
Sorghum	1 11	6.24	13.07	.36
Prickley comfrey	2.94	2.61	7.13	.51
Pumpkins	1.20	1.50	5.20	.10
Roots.				
Mangolds	1.53	.86	4.67	.15
Carrots	1.22	1.45	7.86	.46
Turnips	.95	1.00	5.50	.10
Parsnips	1.60	1.00	8.40	.20
Potatoes	2.00	1.10	21.00	.30
Grain.				
Corn	10.64	1.39	69.54	5.43
Oats	11.13	10.46	59.32	4.73
Peas	20.77	4.06	55.75	1.43
Rye	11.00	3.50	69 20	2.00
Buckwheat	9.00	15.00	59.60	2.50
Barley	9.25	7.75	66.25	2.50
Sorghum	10.49	1.84	70.30	4.21
Mill Feeds.				
Linseed meal, O. P	31.96	9.82	35.24	7.97
Linseed meal, N. P	32.85	9.46	38.29	3.08
Cotton-seed meal	42.15	5.73	22.98	13.30
Gluten meal	28.26	2.30	52.61	6.62
Starch feed	16.04	13.02	58.14	6.08
Hominy feed	9.82	3.50	64.94	7.93
Rye feed	13.56	2.75	65.80	2.60
Malt sprouts	22.85	10.72	48.59	1.79
Wheat bran	15.19	9.33	53.72	3.68
Wheat middlings	15.91	4.45	60.07	4.17
Rye bran	15.28	3.52	63.66	2.46
Brewers' grains	20.07	11.34	53.10	5.91

Fertilizers, Pounds in Ton.			Different Values Per Ton.				Values in Per Cent of Cost.		
Nitrogen.	Phosphoric acid.	Potash.	Market value.	Food value.	Fertilizing value.	Total value.	Food.	Fertilizing.	Total.
19.7	5.0	27.5	$11 00	$14 80	$4 47	$23 59	135.0	41.0	176.0
26.0	8.2	38.5	11 00	14 86	6 08	25 28	135.0	55.0	190.0
20.9	7.3	29.2	11 00	14 68	4 85	23 82	134.0	44.0	178.0
22.3	6.4	34.4	11 00	14 68	5 26	24 23	134.0	48.0	182.0
30.8	8.8	43.8	11 00	13 82	7 08	24 93	125.0	64.0	189.0
20.8	7.1	34.7	11 00	14 47	5 07	23 76	152.0	46.0	107.0
23.1	7.0	25.6	11 00	15 54	5 00	25 21	142.0	46.0	187.0
20.4	9.6	39.8	10 00	14 70	5 38	24 37	147.0	54.0	201.0
39.7	5.2	22.4	8 00	13 96	7 25	26 58	187 0	91.0	278.0
47.7	20.2	25.1	11 00	16 39	9 40	30 58	149.0	85.0	234.0
36.5	7.5	48.5	8 00	15 52	8 07	28 12	194.0	101.0	295.0
41.3	9.3	27.8	10 00	15 64	7 96	28 17	156.0	80.0	236.0
12.8	1.2	27.0	9 00	14 04	3 20	21 34	156.0	36.0	192.0
9.5	2.0	10.5	9 00	13 53	2 01	19 49	150.0	22.0	172.0
9.5	1.9	6.6	11 00	13 63	1 83	19 44	124.0	17.0	141.0
11.2	1.7	9.8	9 00	13 77	2 14	19 93	153.0	24.0	177.0
26.0	12 2	48.4	5 00	16 15	6 75	27 61	323.0	135.0	458.0
20.8	7.0	19.8	6 00	14 93	4 40	23 69	249.0	73.0	322.0
32.6	9.8	53.7	6 00	15 56	7 85	27 95	259.0	131.0	390.0
30.1	5.2	22.4	6 00	14 78	5 81	24 91	246.0	97.0	343.0
18.2	2.0	13.2	6 00	13 10	3 43	20 35	218.0	57.0	275.0
8.3	1.2	5.7	3 00	5 43	1 57	8 58	181.0	52.0	233.0
10.7	2.6	9.2	3 00	4 30	2 16	7 71	143.0	72.0	215.0
4.9	.7	3.4	2 00	3 34	93	5 24	167.0	47.0	207.0
3.6	1.7	7.6	2 00	3 56	97	5 57	178.0	49.0	227.0
9.4	2.1	14.9	2 00	2 84	2 20	5 87	142.0	110.0	252.0
3.8	....	....	2 00	1 54	57	2 11	77.0	29.0	106.0
4.9	.2	.9	3 00	1 95	79	2 74	65 0	26.0	91.0
3.8	2.2	6.4	4 00	2 70	98	3 68	68.0	25.0	93.0
3.0	2.1	6.1	2 00	1 83	85	2 68	92.0	43.0	135.0
5.1	2.1	7.1	3 00	2 78	1 20	3 98	93 0	40.0	113.0
6.4	3.6	11.2	10 00	5 57	1 66	7 23	56.0	17.0	73.0
34.1	13.4	8.1	25 00	22 22	6 22	28 44	89 0	25.0	114.0
35.6	14.1	10.3	35 00	21 89	6 58	28 47	63.0	19.0	82.0
66.5	19.4	22.7	38 00	23 06	12 09	35 15	61.0	32.0	93.0
35.2	18.2	11.5	30 00	21 04	6 80	27 84	70.0	23.0	93.0
28.8	10.3	4.9	27 00	20 67	5 11	25 78	77.0	19.0	96.0
29.6	16.7	15.8	27 00	20 68	6 07	26 75	77.0	22.0	99.0
33.6	17.0	6.7	25 00	21 78	6 28	28 06	87.0	25.0	112.0
102.3	39.6	28.8	27 00	28 98	18 82	47 80	107.0	70.0	177.0
105.1	39.6	28.8	26 00	27 52	19 24	46 76	106.0	74.0	180.0
134.9	58.1	36.9	26 00	33 47	25 09	58 56	129.0	96.0	225.0
91.7	9.0	1.2	27 00	28 42	14 30	42 72	105 0	53.0	158.0
19.7	9.0	1.2	20 00	25 29	3 50	28 79	126.0	18.0	144.0
31.4	23.8	12.2	25 00	22 56	6 47	29 03	90.0	26.0	116.0
43.4	27.8	18.0	24 00	21 79	8 85	30 64	91.0	37.0	128.0
73.1	28.0	32.0	18 00	24 18	13 95	38 13	134.0	77.0	211.0
48.6	56.0	24.6	24 00	22 05	11 48	33 53	92.0	48.0	140.0
50.9	30.9	13.1	24 00	22 94	9 92	32 86	96.0	41.0	137.0
48 9	27.8	18.0	24 00	22 31	9 67	31 98	93.0	40.0	133.0
64.2	22.0	3.6	18 00	25 88	11 00	36 88	144.0	61.0	205.0

It will be seen that, taking the average of all the foods, the fertilizing value is almost exactly two-fifths of their food value, and the same is true very nearly of the averages of the different groups of foods as the following table shows:

	Average Ratio of Food and Fertilizing Value.		Ratio.
	Food value. Per cent of cost.	Fertilizing value. Per cent of cost.	
Twelve hays	148	63	100 : 42.6
Nine straws	209	66	100 : 31.5
Six green feeds	148	60	100 : 40.4
Five roots	75	30	100 : 40.4
Seven grains	75	24	100 : 31.5
Twelve mill feeds	109	53	100 : 48.8
Average	....	....	100 : 39.2

It will be seen, also, that if we compare the total food and fertilizing value of the coarse farm products, hays, straws and green forage, with the mill feeds, we find the former to have a far higher value (over half their cost) than the latter.

	Total value to cost.
Twelve hays	211 per cent
Nine straws	275 per cent
Six green feeds	208 per cent
Average	231

	Total value to cost.
Twelve mill feeds	162 per cent

We have already seen that, upon an average, the mill feeds are almost exactly half as valuable (48.8 per cent) for the fertilizers which they produce as for the food they furnish, while cottonseed meal furnishes an amount of fertilizing material equal in value almost exactly to the market value of the meal and nearly three-fourths the value of the food which it contains. In other words, its food value is twenty-nine per cent over its cost and its fertilizing value is nearly seventy-five per cent of its cost.

But, notwithstanding the excessive value, which is generally admitted, of cotton-seed meal, and which, for total value, stands highest in the group of mill products, it will be seen by the above table that it is surpassed by the average of hays, straws and green forage, cotton-seed meal being worth for food and fertilizing material 125 per cent more than it costs, while the average coarse foods of the farm, even at liberal prices, are found to furnish an amount of food and fertilizing material worth 131 per cent more than their average cost.

It seems clear, therefore, that $100 worth of good hay will, upon the average, furnish half more digestible food than will $100 worth of mill feed upon the average, and in addition the hay will furnish, upon an average, ten dollars worth more of fertilizing material than will the average $100 worth of mill feed.

In the case of the straws we find, upon an average, that $100 worth will furnish more than twice the amount of digestible food furnished by $100 worth of average mill feed, and, in addition, thirteen dollars worth more of fertilizing material than will the $100 worth of average mill feed.

The practical conclusion is, that for twenty-five years, at least, hay and straw have been worth, as sources of animal and plant food, at least twice their market prices, and, if to anybody, to the farmer himself, who has animals and fields both needing those supplies of food.

But, unfortunately, the above conclusion is only true upon the condition that the farmer always has animals worth feeding, which in the case of our cows is far from being true. In fact, if we leave out the manure as a product, the full value of which is to be taken into account, it is beyond question true that two-thirds of our dairy cattle must be regarded as not worth, in the value of their product, the food they eat and the expense of caring for them; but, as this is equally true when the more expensive mill products are bought and fed such animals, the only possible way by which profit can be assured is by careful testing and the selection of the better animals and weeding out of all those individuals proven to be worthless; and there are, perhaps, few farmers having a herd of a dozen cows who may not find certain ones which are absolutely not repaying them for their food and care.

By reference to the table it will be seen that roots upon the average are barely worth their cost, even when their fertilizing value is taken into consideration. This is due to the very large amount of water which they contain, on an average about ninety per cent, and the consequently small amount of food constituents. It may be due to having put upon them an excessive market value, although as to the cost price assigned to these and the other foods every person may fix his own prices and by a simple calculation determine the corresponding food and fertilizing value of any particular food given in the table.

From the table, it is clear that potatoes can never be economically used as food for cattle when their market value is ten dollars a ton, and the same is true of mangolds and carrots at three and four dollars per ton respectively. But in this connection the value of roots as a constituent in the daily ration may often be greater than depends wholly upon the actual amount of food furnished.

It will be seen also that on the average the grain foods barely return in food and fertilizing material an equivalent of their market value, and this is due to the relatively higher prices which they command in the market, and especially at the present.

It will be of interest to consider the several dairy products, milk, skim milk, buttermilk and whey, as to their actual and relative food and fertilizing values.

	Per cent of albumen.	Per cent of carbohydrates.	Per cent of fats.	Pounds in Ton.			Food value per ton.	Fertilizing value per ton.	Total value per ton.
				Nitrogen.	Phosphoric acid.	Potash.			
Milk	3.40	4.80	3.40	10.9	4.9	2.9	$4 36	$2 04	$6 40
Skim milk	3 50	4.90	.70	11.2	5.2	3.1	3 06	2 10	5 16
Buttermilk	3.50	4.00	.60	11.2	4.5	2.7	2 85	2 05	4 90
Whey	1.02	4 96	.15	3.3	4.0	2.4	1 58	82	2 40

From the above it will be seen that their relative food value is 100 : 70 : 65 : 36, and their relative total value is 100 : 81 : 77 : 38.

It will also be seen that it requires the addition of less than three per cent of fat to skim milk or buttermilk to render them the equivalent in food value of fresh milk, while whey requires both nitrogenous matter and fat, although containing a little more sugar than either of the others. It is also noteworthy that the fertilizing value of both skim and buttermilk is fully two dollars per ton, an amount rendering them valuable for this purpose alone.

"Many a little makes a mickle," and the farmer should remember that as food and fertilizing material every pound of coarse straw is worth to him over a cent, every pound of hay is worth over a cent and a quarter, if only these products are properly utilized, and that it is mainly through the production and consumption of these upon the farm, in the production of other agricultural commodities, as milk, butter, cheese, eggs, poultry, pork, mutton, beef, horses and those vegetable products, the aggregate weight of which is small as compared with the price which they bring in the market, upon which he should depend for his profit, since to no one are these coarser foods, the raw materials of the farm products, so valuable as to the farmer himself who knows how best to utilize them.

After an experience of half a century among the most intelligent, economical and successful farmers of the world, it is useless to inveigh against the great value of the so-called commercial fertilizers, but it was pithily and truly said at one of our recent farmers' institutes, that "those farmers were the most successful in the use of commercial fertilizers who were most successful without using them;" and from the point of an economical conduct of his business, what shall be said of the farmer who will consent to sell good hay from his farm even at ten dollars a ton, which contains an average amount of fertilizing material worth six dollars and one-half, besides an average amount of food constituents worth fifteen dollars, both fertilizer and food being estimated at the same prices which that farmer is compelled to pay when he buys commercial fertilizers or mill feed?

During the past twenty-five years the average amount of hay which could be bought for ten dollars in this State has contained an amount of nitrogen, phosphoric acid and potash, which was worth six dollars and thirty-seven cents, so that the farmer has sold an average of fifteen dollars worth of food for three dollars and sixty-three cents, and while this has been going on many million dollars worth of commercial fertilizers have been bought in this State alone.

INVESTIGATIONS WITH POULTRY.

Attention is directed to the results already secured in our poultry experiments, detailed in the report of the first assistant, which appear to demonstrate that the results of careful investigation of this branch of the agricultural industry are likely to prove of as great practical value as similar investigations with dairy cattle and swine. Although thus far but two seasons have been given to this work, it will be seen that with the larger breeds of fowls a difference of twenty-five per cent, and with the smaller breeds a difference of fifty per cent, in egg production was found, according to the general character — carbonaceous or nitrogenous — of the ration fed these fowls.

These results are, so far as I know, the only ones which have been secured by investigations extending through two entire seasons, and their practical value is so evident that there is every reason why they should be carried forward and extended to the investigation of other questions connected with this industry, where so much assertion and so little actual knowledge scientifically determined now exists.

There appears no reason for doubt that by careful breeding and selection there may, within a few years, be secured a strain of fowls from certain of our breeds now most distinguished for egg production as far surpassing the average of the breeds from which they may be selected, as do certain strains of dairy cattle surpass the average in the profitable production of milk and cheese. Toward this end, so far as I know, little, if anything, has been attempted, but it offers a field for experiment full of promise to the future of this important industry.

EXPERIMENTS WITH SORGHUM.

Attention is directed to an experiment mentioned in the report of the first assistant, which will prove of great practical value to the sugar grower and manufacturer, in case it shall be found by future experiment that these results may be obtained. The increase of fully ten per cent in the amcunt of sugar in the cane is not an unexpected result, since it accords with results found in the investigations of Dr. T. L. Phipson of the sugar cane soils of Louisiana and Demerara, as also the similar results secured by myself in 1882.

A DAIRY SCHOOL.

In partial accord with what was in my last annual report earnestly recommended, there was held at the Experiment Station, under the general management of the officers of the State Dairyman's Association, a dairy school extending through four days, and the large attendance and steadily increasing interest during the sessions could not but carry conviction to all that this was an effort in the right direction and one which was heartily appreciated by those whom it was sought to benefit by the practical instruction given.

Careful notes were taken by the enrolled students, and examinations held upon the points presented, so that although the school was carried through the short period of but four days, it was in its entire conduct rather a school than an institute.

In view of the success which attended this first effort at the Station, where it was evident so much conspired to add value to the instruction given, I can not but repeat my recommendations of a year ago in the hope that a school may be established at or in connection with the Station, of at least a month's duration, where, in connection with our well-equipped dairy, practical instruction in butter and cheese making may be given, and where the characteristics of the leading dairy breeds and their relative adaptability to the needs of different sections could be carefully studied and all the details of care and feeding could be thoroughly taught and fully exhibited in practice.

In view of the great importance of the dairy industry in our State, the wide range in the quantity as also in the quality of the manufactured products as shown by the intrinsic and market value of butter and cheese, these differences being due almost entirely to ignorance of the fundamental principles of milk, butter and cheese production, or a failure on the part of those engaged in this industry to appreciate the importance of a careful observance of these principles, it seems to me that it would be wise if there should be established a dairy school somewhat similar to those already established in several of the leading dairy sections of Europe. In this school, excluding military instruction, the classics and modern languages, there should be given instruction only in those technical branches directly relating to the science and practice of dairying.

Such a school should be located upon a good dairy farm, provided with cows of several breeds, with facilities for giving daily instruction by personal inspection and study, on the part of those in attendance, of the several technical operations of the dairy.

Such a school might be made nearly, if not quite, self-supporting, and would, I have no doubt, be welcomed by many young men and women who desire the specific instruction it would afford them, and would do much to render the $400,000,000 at present estimated as the capital invested in the dairy interests of the State, a source of greatly increased profit to our dairymen and farmers.

It was practically such a school which furnished the instruction that enabled Jesse Williams, thirty-eight years ago, to establish the first cheese factory in the State, the results of which are now manifest in every dairy section of the country; but even to-day there is no provision, should fifty, more or less, of our young men and women desire to secure the information which opened the way of success to this pioneer in the dairy industry of the State.

Recent inquiry has revealed the remarkable fact that in an art, one of the oldest in existence, and to-day in practice more extended than ever before in the history of the world, an art to which of late years and at present the attention of the inventive genius of the world and the researches of science have been directed to a remarkable degree, the demand for those who are in possession of the information discovered by science relating to the dairy industry, who are practically informed concerning the convenient technical devices of the inventors, far exceeds the present supply and the testimony from other States is to the same effect. Other professions and occupations appear fully supplied or overstocked with those fairly equipped for the work devolving upon them; but there yet remains room and remunerative employment for those competent to intelligently conduct the creameries, cheese factories and leading dairies of the State, and abundant room for an increased development of this industry in each of its branches.

THE GRASS CROP.

Owing to the paramount importance of the grass crop in every rational system of agriculture, the Station has from the first given unusual attention to the subject of grasses, and at present is preparing to extend its work still further in this direction.

According to statistics, it appears that even in a country as highly cultivated as the United Kingdom over fifty-five per cent of the cultivated area is in permanent pasture, the different countries having as follows:

COUNTRY.	Cultivated area.	Area laid down to permanent pasture.	Percentage in pasture of cultivated area.
	Acres.	Acres.	Acres.
England	24,991,015	12,700,574	50.7
Wales	2,853,917	1,949,417	68.3
Scotland	4,888,425	1,215,872	24.8
Ireland	15,066,941	10,919,745	72.4
United Kingdom	47,931,165	26,816,092	55.8

But the above does not present fully the importance of the grass crop in the United Kingdom, since in addition to permanent pastures there is nearly thirteen per cent more of the cultivated area which is given up to grasses and clovers grown in the rotation of their crops, as follows:

COUNTRY.	Acres in rotation grasses.	Percentage of cultivated area in rotation grasses.
England	2,887,386	11.5
Wales	318,131	11.1
Scotland	1,671,781	34.1
Ireland	1,261,625	8.3
United Kingdom	6,188,502	12.9

Nearly seventy per cent of the cultivated land in the United Kingdom is given up to the grass crop.

According to the census of 1880 there were in the State of New York in

	Acres.
Farm lands	23,780,754
Improved lands	17,717,862
Grass in rotation as pasture or meadow	12,400,649
Permanent meadows, pastures, orchards and vineyards	5,317,213

From this it appears that of the cultivated area in the United Kingdom nearly double the percentage amount is laid down in permanent pastures to that in New York, while in our rotation system a far larger proportionate area of our cultivated land is temporarily in pasture or meadow.

It would seem, therefore, that even with their relatively intensive methods of agriculture, the farmers of Great Britain and Ireland have found it profitable to devote 55.8 per cent of their tillable land to permanent pasture, and there is little doubt but that in our own State and country many acres now under the plow will yield greater profit when they are laid down in permanent meadow and pasture, with the increase in flocks and herds which such change will involve, and the retention of and increase in fertility of our lands which must naturally follow such a system of agriculture.

For the purpose of calling general attention to this matter, an extended collection of the various grasses, under more or less general cultivation, was prepared and exhibited at the State fair and several other fairs in the State, and at each place of exhibition attracted great attention. For the purpose of information concerning this exhibit, the following circular was prepared, and widely distributed at these fairs:

GRASS WORK AND EXHIBIT.

The importance of the grass crop may be, and we think generally is, overlooked by most people. The value of our hay crop in New York State was, in 1888, more than three-fourths of a million dollars greater than that of all the corn, wheat, rye, barley, oats, buckwheat and tobacco crops combined. Counting all these [including hay] at 100 per cent, the hay crop comprised 53.2 per cent and all the others only 46.8 per cent.

But more striking even than this is the rate at which the hay crop has been falling off while the most important of the other crops have nearly or quite held their own.

Dividing the time from 1862 to 1888 into three nine-year periods, and using the first as a base, or calling each crop for that period of nine years 100 per cent, gives the following, according to statistics from the United States Department of Agriculture:

	Corn.	Wheat.	Rye.	Barley	Oats.	Buck-wheat.	Pota-toes.	Hay.	To-bacco.
First nine years...	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Second nine years	109.0	99.8	91.6	99.2	108.8	99.2	79.2	95.6	100.1
Third nine years..	99.0	99.3	78.6	101 0	95.1	67.8	75.3	80.5	146.6

This steady decline in the hay crop has gone on, in part, no doubt, from the fact that the average farmer uses his manure on the cultivated crops, which the hay crop has thus been regularly contributing to support, while itself neglected. Not only is the value greater, but the acreage of this crop stands to that of all the others as 55 to 45.

This showing does not include pasture grass, which supports almost the whole of our dairy, sheep and growing stock about half the year, and is second to no other than the hay crop itself, if indeed it is second in value to that.

It seems desirable that some special attention be given to improved methods of culture to finding out the best species for hay and grazing, and finally, for diffusing a better knowledge of some of the forage species of this great family of useful plants.

Station Work with Grasses.

Our annual reports show there has been an interest in grass cultivation ever since the Station was organized. A large number of plats were early sown with the most valuable grasses known to cultivators and others which though not known to be valuable may be worthy of cultivation. All these plats have been continued and additions made nearly every year. In 1884–5 many root washings were made. [See annual reports for those years.]

In the years 1888 and 1889 these variety grass plats were supplemented by fertilizer plats, occupying some two and one-half acres in the former and three and one-half in the latter season, exclusive of the paths and alleys separating the plats. The object of these supplementary plats was to make a soil test and learn what class of fertilizers could be used to advantage in top dressing for the hay crop. There were tried chemical salts, bone black, Canada ashes, stable manure, wheat bran and cottonseed meal, and the resulting crops shows unmistakably that on this farm some of them could be profitably used. The past summer the special work with grass has been the collection of samples of grass at several stages of growth for analysis and comparisons.

First. As to what stage of growth is the best time to cut grass in order to secure the most and best quality of hay.

Second. Which grasses should be cultivated under the light of this investigation? That is, how do grasses compare in yield of nutritive substance under the like conditions of soil and climate to which they have been subjected.

It has been shown that the same grass may vary widely in its chemical composition as well as in the amount of crop it is capable of producing. This investigation aims to throw more light on this important subject which has been well begun but which has not yet been given the analytical attention which this season's work aims to accomplish. The samples are secured for the chemical analyses comprising forty species and varieties of twenty-one genera, many of them being among the best hay and pasture plants, while others are of somewhat doubtful value, and a few which may not be capable of profitable returns for cultivation. There are some species not now generally cultivated which seem to promise well for the agriculturist who will give them a fair trial under favorable conditions.

There seems to be a field open for some careful farmers to raise grass seeds of known purity if they are willing to clean fields and make the attempt.

This exhibit of grasses shows in representative form some of the most valuable for both hay and pasture as red-top, timothy, Kentucky blue, orchard, oat and rye and other grasses many of which though worthy of cultivation are less known, and some which are a positive nuisance in cultivated grounds and wheat fields. A very few as the little Bouteloua and Kœleria are more curious than valuable here though of considerable account on the western plains. Even the quack grasses are valuable for hay in suitable places. One of the most valuable families of grazing grasses (Festucae) is represented by two species valuable for hay besides a number of excellent pasture species.

There are four families of leguminous plants represented by one or more species. The alfalfa and pea-vine clover are the second growths of the season. Of these, one (the lotus) has not been grown long enough to prove its value. Black medick comes into our pastures, fields and roadsides of itself and grows a considerable crop where the soil is in good condition. It can not fail to do good in its self-appointed mission to make glad the waste places.

Alfalfa has grown well here for several years and high hopes are entertained of its continuing to yield luxuriant crops on an enlarged area. The other two clovers are too well known to need special mention any more than timothy with which they are usually sown. It would be worth while to fill up between the timothy stools with red top, or to sow with the clover tall fescue, orchard or oat grasses which are ready to be made into hay at about the same time with the smaller clover.

It is a matter of common remark that our pasture lands have during the past half century greatly deteriorated, that as a rule they fail to supply the abundant and nutritious grasses which formerly characterized them, and that in consequence farm animals are dependent more and more upon forage crops for their support.

If this belief in the deterioration of our pastures is well-founded, it may be accounted for partly through the climatic changes which seem to have attended the clearing up of vast areas of territory, more perhaps from changes in the character of our soils, which denuded of their protecting forests have ceased to retain the moisture necessary to the best development of the grasses; while over those areas under cultivation, where grasses are alternating in one system of rotation or another, it is doubtless true that those native grasses which by centuries of selection had by their survival found themselves best adapted to the existing conditions, have been eradicated and given place to foreign varieties more convenient for use in seeding.

It is doubtless true that careful search would reveal here and there stragglers of these ancient races which have survived the warfare made upon them by our modern methods of agriculture, and which, again being sought out and properly cared for, might be made to resume their former places, from which they were expelled.

One can not but have observed, even upon closely kept lawns, how certain varieties of grass have in certain localities entirely appropriated the ground, having through roots and creeping stems reached out and encroached upon neighboring grasses which, too feeble to withstand them, have been quite driven out; and yet, strangely enough, this method of propagation has rarely, if ever, been made available upon an extended scale. If, upon ground already occupied, any given variety of grass may thus establish itself, why, under the most favorable conditions of thoroughly clean plats, may it not be expected that these same and many other varieties, which have proved to be desirable, will not rapidly spread until the entire area is fully occupied? Already at the Connecticut station in New Haven, and at a branch station at South Manchester, this system is being entered upon, and it is intended to enter upon the same line of work at this Station, the plan being to select such clumps of grasses as may here and there be found in this neighborhood and State or elsewhere, and by transplanting them into clean plats permit their spread and development until it is proven that they are desirable for extended propagation.

It is doubtless true that many of these most valuable varieties will be found to be those furnishing little seed, and from this very circumstance it may have frequently happened that they have been, in their native field, overrun and driven out by inferior varieties, which seeded more heavily, though possessing no quality rendering them desirable acquisitions in either pasture or meadow.

Fertilizer Control.

The following bulletin, 10,000 copies of which have been distributed throughout the State, presents in detail the work thus far accomplished under an act passed at the last session of the Legislature, entitled "An act for the protection and education of farmers and manufacturers in the purchase and sale of fertilizers." (Laws of New York, chap. 437; approved by the Governor May 24, 1890.)

It will be observed that in accordance with section 2 of the act it was impracticable to begin work before the last of July, since which time every effort has been made to comply with its conditions, and the work thus far has met with enthusiastic approval from all portions of the State, as is evidenced by the testimony of those agents who have been employed in the collection of samples in accordance with section 6 of this act.

BULLETIN No. 25—NEW SERIES.

Notice.—This series of bulletins is issued for the benefit of the farmers of New York State. As each bulletin will be a continuation of the preceding one, it will be well for those interested to preserve the early issues for future reference.

These and all other bulletins issued by the Station will be mailed to any citizen of New York State on application.

THE NEW YORK STATE FERTILIZER CONTROL AND FERTILIZER ANALYSES.

I. Introduction.

This is the first of a series of bulletins, treating of fertilizers, to be issued by the Station for the benefit of the farmers of New York State. This first number is intended mainly as an introduction to the series; following is an outline of its contents:

1. Statement of plan of proposed fertilizer bulletins.
2. Copy of the law regarding fertilizers.

3. Object of the law.

4. Names of manufacturers and agents who have complied with section two of the law.

5. Organization of the work.

6. Methods of sampling.

7. Laboratory methods.

8. Guarantees.

9. Gratuitous analysis of commercial fertilizers for farmers.

10. Tabulated statement of results of analyses of samples collected by agents of the Station.

1. Statement of Plan of Proposed Fertilizer Bulletins.

The law recently enacted by the New York State Legislature, establishing a fertilizer control, has a twofold object, as indicated by the title, "*An act for the protection and education of farmers and manufacturers in the purchase and sale of fertilizers.*" The law pertains to the education, in regard to fertilizers, of the parties most interested, as well as to their protection.

In accordance with the educational feature of the law, it is considered desirable to issue several bulletins, explaining in as clear a way as possible such general and special facts regarding fertilizers as the farmers of this State will be interested to know.

Hence, each bulletin will consist of two quite distinct parts. The first part of each will treat of one or more topics of interest regarding fertilizers, each topic following the preceeding systematically according to a definite plan. The second or remaining portion of each bulletin will contain a tabulated statement of the analytical results obtained by the Station, as the analyses are completed.

The Director and the Chemist of the Station will co-operate in the preparation of these fertilizer bulletins. The order of topics to be treated may be changed or new topics may be added; but, as far as plans are matured at present, the following outline will give an idea of the nature and scope of the proposed bulletins:

I. Introduction.

II. Outline of the history of commercial fertilizers.

III. The principles underlying the use of fertilizers.

  1. Constituents of plants.
  2. Constituents of soils.
  3. Relations of soils and plants.

IV. Description and sources of fertilizing elements.

V. Economical purchase and rational use of some fertilizing elements.

VI. Factory and home-made fertilizers.
VII. What constitutes a good fertilizer.
VIII. Prices of raw materials.
IX. How to determine the commercial value of fertilizers.
X. Extent to which fertilizers are used in New York State.
XI. Summary.

As to the frequency with which these bulletins will be issued, no definite statement can be made at present, but an effort will be made to issue them at the intervals of one or two months.

In order that some of the terms used in stating the results of analysis might be understood from the beginning, an explanation of such terms might be regarded as desirable in this bulletin. But it is believed that such explanation cannot be made clear and, at the same time, brief; that the terms can be satisfactorily comprehended only when approached in a systematic way. To those who carefully follow the series of bulletins for several numbers, the analytical data will doubtless be intelligible in the future, if not at the outset.

2. Copy of the New York State Fertilizer Law.

LAWS OF NEW YORK—By Authority.

[Every law, unless a different time shall be prescribed therein, shall commence and take effect throughout the State, on and not before the twentieth day after the day of its final passage, as certified by the Secretary of State. Section 12, title 4, chapter 7, part I, Revised Statutes.]

Chapter 437.

An Act for the protection and education of farmers and manufacturers in the purchase and sale of fertilizers.

Approved by the Governor May 24, 1890. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. All commercial fertilizers which shall be offered for sale, to be used in this state, shall be accompanied by an analysis stating the percentages contained therein of nitrogen or its equivalent ammonia, of soluble and available phosphoric acid, the available phosphoric acid either to be soluble in water or in a neutral solution of citrate of ammonia as determined by the methods agreed upon by the American Society of Agricultural Chemists, and of potash soluble in distilled water. A legible statement of the analysis of the goods shall be printed on, or attached to each package of fertilizers offered for sale for use in the state; and where fertilizers are sold in bulk, to be used in this state, an analysis shall accompany the same, with an affidavit that it is a true representation of the contents of the article or articles.

§ 2. Manufacturers residing in this state, and agents or sellers of fertilizers made by persons residing outside the limits of this State, shall between the first and twentieth days of July, in each year, furnish to the director of the New York State Agricultural Experiment Station at Geneva a list of the commercial fertilizers they manufacture or offer for sale for use in this state, with the names or brands by which they are known on the market, and the several percentages of nitrogen or its equivalent of ammonia, of phosphoric acid soluble and available, and of potash, either single or combined, contained in said fertilizer, as called for in section one of this act. Whenever any fertilizer or fertilizing ingredients are shipped or sold in bulk, for use by farmers in this state, a statement must be sent to the director of the New York State Agricultural Experiment Station, at Geneva, giving the name of the goods so shipped, and accompanied with an affidavit from the seller, giving the analysis of such percentage guaranteed.

§ 3. Whenever a correct chemical analysis of any fertilizer offered for sale in this State shall show a deficiency of not more than one-third of one percentum of nitrogen or its equivalent of ammonia, or one-half of one percentum of soluble or available phosphoric acid and one-half of one percentum of potash soluble in distilled water, such statements shall not be deemed false within the meaning of this act. This act shall apply to all articles of fertilizers offered or exposed for sale for use in the State of New York, the selling price of which is ten dollars per ton or higher, and of which they are part or parcel, and of any element into which they enter as fertilizing materials, among which may be enumerated nitrate of soda, sulphate of ammonia, dissolved bone black and bone black undissolved, any phosphate rock, treated or untreated with sulphuric or other acids, ashes from whatever source obtained, potash salts of all kinds, fish scrap, dried or undried, also all combinations of phosphoric acid, nitrogen or potash, from whatever source obtained, as well as all and every article that is or may be combined for fertilizing purposes.

§ 4. All manufacturers or dealers exposing or offering for sale in this state, fertilizers, containing roasted leather or any other form of inert nitrogenous matter shall in legible print, state the fact on the packages in which the fertilizers are offered or exposed for sale.

§ 5. Every person, firm or corporation, violating any of the provisions of this act, shall upon conviction thereof, for the first offense be punished by a fine of not less than fifty dollars, nor more than two hundred dollars, and for the second offense by double the amount in the discretion of the court; such fines to be paid to the officer whose duty it is to enforce the provisions of this act, to be used by him for that purpose, and to be accounted for to the comptroller.

§ 6. The director of the New York State Agricultural Experiment Station at Geneva, is charged with the enforcement of the provisions of this act, and shall prosecute in the name of the people, for violations thereof; and for that purpose he may employ agents, counsel, chemists and experts, and the court of special sessions shall have concurrent jurisdiction to hear and determine charges for violating the provisions of this act committed in their respective counties, subject to the power of removal provided in chapter one of title six, of the Code of Criminal Procedure.

§ 7. And the said director of the New York State Agricultural Experiment Station at Geneva or his duly authorized agents, shall have full access, egress and ingress to all places of business, factories, buildings, cars, vessels, or other places where any manufactured fertilizer is sold, offered for sale, or manufactured. Such director shall also have power to open any package, barrel, or other thing containing manufactured fertilizer, and may take therefrom sufficient samples; and whenever any such fertilizer is so taken for samples, it may be divided into different portions and one or more portions sealed in such a way that it cannot be opened without upon examination giving evidence of having been opened to the person sealing the same, and delivered to the person from who said sample is taken, or any other person that may be agreed upon, by the said director or his agents who takes the same and the person from whom it is taken, which portions so delivered may, upon the consent of the parties, be delivered to a chemist for the purpose of being analyzed other than the chemist employed by said director.

§ 8. The sum of twenty thousand dollars, or so much thereof as may be necessary, is hereby appropriated out of any money in the treasury not otherwise appropriated, to be used by said director of the New York State Agricultural Experiment Station at Geneva, as shall be authorized by the board of control thereof, in enforcing the provisions of this act. Said sum shall be paid to said director by the treasurer upon the warrant of the comptroller, upon vouchers to be approved by the comptroller, in such sums and at such times as said director may require, who shall file a statement for what purposes he desires the same.

§ 9. Agents, representatives or sellers of manufactured fertilizers or fertilizing material made or owned by parties outside of this state, and offered for sale for use in this state, shall conform to the provisions of this act, and shall be subject to its penalties, and in all particulars shall take the place of their non-resident principals.

§ 10. Chapter two hundred and twenty-two of the laws of eighteen hundred and seventy-eight is hereby repealed.

§ 11. This act shall take effect immediately.

STATE OF NEW YORK,
OFFICE OF SECRETARY OF STATE. } *ss.:*

I have compared the preceding with the original law on file in this office, and do hereby certify that the same is a correct transcript therefrom and of the whole of said original law.

FRANK RICE,
Secretary of State.

3. OBJECT OF THE LAW.

The object of the law is simply to require that the fertilizers offered for sale shall contain such ingredients and in such proportions as the manufacturer claims. No standard is prescribed by the law for the composition of a commercial fertilizer. Each manufacturer makes his own standard for each brand, the guarantee analysis showing what that standard is. The law proposes simply to see to it that the manufacturer shall keep his goods up to the standard set by himself.

4. NAMES OF THE MANUFACTURERS AND AGENTS *who have forwarded to the director of this station the names of the brands of commercial fertilizers manufactured or sold by them.* (See section 2 of the law.)

In the following list, it is deemed advisable, in order to avoid useless repetition, to omit many names of agents of fertilizers manufactured outside of the State, where the manufacturers themselves have forwarded the necessary information.

NAMES OF MANUFACTURERS.	Names of agents.	Names of brands.
H S. Miller & Co., Newark, N. J.	W. E. Culver, East Beekmant'n, Clinton Co., N. Y.	Standard super-phosphate of lime. Ammoniated dissolved bone phosphate. Potato fertilizer. Dissolved raw bone. Bone meal.
Richard H. Stone, Trumansburgh, N. Y.	Rich. H. Stone, Trumansburgh, N. Y.	Eureka. King.
Williams & Clark Fertilizer Co., 81 Fulton st., New York, N. Y.	....	Prolific crop producer. Potato phosphate. Pure bone meal. High grade special. Ammoniated bone. Super-phosphate. Ammoniated dissolved bones. Royal bone phosphate.
The Quinnipiac Co., New London, Conn.	....	Quinnipiac fish, bone and potash. Quinnipiac ammoniated dissolved bone. Quinnipiac climax phosphate. Quinnipiac potato phosphate. Quinnipiac Mohawk fertilizer. Quinnipiac Mohegan fertilizer.
Lorentz & Rittler, 301 Exchange place, Balt., Md.	....	Alkaline bone. L. & R. Powhattan guano.
Springfield Fertiliz'r Co., Springfield, Ohio.	A. J. Blackman, Wales, Erie Co., N. Y.	Soluble bone phosphate.
Dambmann Bros. & Co., Baltimore, Md.	....	Dissolved S. C. bone. Dissolved animal bone. Dissolved bone black. Fine ground bone. Alpha soluble bone and potash. Pride of Maryland. Arlington bone. Arlington "A." Arlington "B." Arlington for truck. Wheat, corn and oats fertilizer. Special potato fertilizer. Special grass manure. Special orange and peach tree fertilizer (for young trees). Special orange and peach tree fertilizer (for bearing trees).
Northwestern Fertilizi'g Co., Chicago, Ill.	Lawton Johnson, Ripley, N. Y.	Horseshoe brand pure ground bone. Horseshoe brand potato grower. Horseshoe brand dissolved raw bone. Horseshoe brand prairie phosphate. Horseshoe brand challenge corn grower. Horseshoe brand ammoniated dissolved bone. Horseshoe brand national bone dust. Horseshoe brand Ralston's bone meal. Horseshoe brand fine raw bone. Horseshoe brand twenty-six dollar phosphate. Horseshoe brand Garden City super-phosphate. Horseshoe brand tobacco grower.
George B. Forrester, 169 Front St., New York, N. Y.	....	Forrester's potato manure. Forrester's asparagus manure. Forrester's cabbage manure. Forrester's peas manure. Forrester's corn manure.

Names of manufacturers.	Names of agents.	Names of brands.
George B. Forrester, 169 Front St., New York, N. Y.	....	Forrester's fruit tree manure. Forrester's carrot manure. Forrester's melon manure. Forrester's rye manure. Forrester's strawberry manure. Forrester's cucumber and pickle manure. Forrester's tomato manure. Forrester's wheat manure. Forrester's oat manure. Forrester's onion manure. Forrester's celery manure. Forrester's turnip manure. Forrester's root manure. Forrester's grass manure. Forrester's lawn dressing.
J. H. Devins, Utica, N. Y.	....	J. H. Devins' fertilizer for all crops. J. H. Devins' bone fertilizer.
Peter Cooper's glue factory, 17 Burlington Slip, New York, N. Y.	....	Peter Cooper's pure bone dust.
Henry Stappenbeck, Utica, N. Y.	....	Home trade. Bone meal.
E. A. Cross, North Parma, N. Y.	....	The king. The queen. The parma.
The Tygert Allen Fertilizer Co., 2 Chestnut st., Philadelphia, Pa.	....	Star bone. Soluble bone and potash.
L. Eggers & Son, West Troy, N. Y.	....	Novelty Bone Works phosphate.
Chemical Company of Canton, Baltimore, Md.	C. B. Dunning, Lyons and Cuddebacks, N. Y.	Baker's standard high grade guano. Resurgam phosphate. Ontario brand.
The Allentown Mfg. Co., Allenton, Penn.	....	Pure ground bone. Complete bone phosphate. Complete bone manure. Germania phosphate. Lehigh phosphate. Soluble phosphate and potash. Soluble rock phosphate.
Walker Fertilizer Co., Phelps, N. Y.	....	Old Pittsburg. Walker's ammoniated phosphate. Walker's Victoria bone.
Sheldon Bros., Weedsport, N. Y.	....	Sheldon's compound.
The Zell Guano Co., Baltimore, Md.	....	Zell's quick grower. Zell's tobacco fertilizer. Zell's economizer. Zell's fruit tree invigorator. Zell's pure ground raw bone. Zell's grape grower. Zell's special compound for potatoes, etc. Zell's ammoniated bone superphosphate. Zell's Calvert guano. Zell's electric phosphate. Zell's pure dissolved animal bone. Zell's dissolved bone phosphate.

NAMES OF MANUFACTURERS.	Names of agents.	Names of brands.
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	....	Ammoniated bone super-phosphate Potato, hop and tobacco phosphate. Wheat and corn phosphate. Vegetable bone super-phosphate. New rival ammoniated super-phosphate. Practical ammoniated super-phosphate. Special potato manure. No. 2 super-phosphate. Pure ground bone. Pure ground meal. Muriate of potash. Nitrate of soda. Kainit. Dissolved bone black. Pure dissolved bone with potash.
Bowker Fertilizer Co., 43 Chatham street, Boston, Mass.	....	Stockbridge special complete manures. Bowker's hill and drill phosphate. Bowker's ammoniated dissolved bone phosphate. Bowker's sure crop bone phosphate. Bowker's super-phosphate. Bowker's super-phosphate with potash. Bowker's fish and potash. Bowker's pure dry ground fish. Bowker's alkaline bone. Bowker's fresh ground bone. Chemicals.. { Kainit. Nitrate of soda. Dissolved bone black. Muriate of potash.
The Chesapeake Guano Co., Baltimore, Md.	Ed. F. Cooke, 123 West Main street, Rochester, N. Y.	Oriole guano. Chesapeake guano. Chesapeake bone phosphate. Oriole alkaline bone. Oriole acid phosphate. "Special Niagara fertilizer." Livingston county phosphate.
Read Fertilizer Co., New York city.	D. H. Foster, 100 South Clinton Street, Syracuse, N. Y.	Farmer's friend. Empire State. Lion brand. Original alkaline bone. Leader brand. High grade farmer's friend. "Samson" brand. Soluble bone. Dissolved bone.
John S. Reese & Co., 10 South street, Baltimore, Md.	....	Bay State. New England favorite. Unicorn. Mayflower. King Philip. Pilgrim. Defiance. Reese's half and half. Crown phosphate and potash. Atlas phosphate. Elm phosphate.
Bradley Fertilizer Co., 27 Kilby street, Boston, Mass.	....	Bradley's patent super-phosphate. B D sea fowl guano. Bradley's ammoniated dissolved bone. Farmer's new method fertilizer. Alkaline bone. German potash salts or kainit. Bradley's potato fertilizer. Bradley's Niagara phosphate. Bradley's dissolved bone, justice brand.

NAMES OF MANUFACTURERS.	Names of agents.	Name of brands.
Bradley Fertilizer Co., 27 Kilby street, Boston, Mass.	....	Bradley's dissolved bone black, justice brand. Bradley's fine ground bone. Bradley's circle brand bone and potash.
Frederick Ludlam, 140 Maiden Lane, New York, N. Y.	....	A. B. F brand. Cecrops or Dragon's Tooth brand. Sickle brand. Cereal brand.
E. Frank Coe, 16 Burling Slip, New York, N. Y.	....	Ralston's Knickerbocker bone super-phosphate. Ralston's Knickerbocker hop grower. Ralston's potato fertilizer. High grade ammoniated bone super-phosphate. Ammoniated bone super-phosphate Alkaline bone. "X X V" ammoniated bone super-phosphate. Peach tree, fruit and grape-vine fertilizer. Potato fertilizer. Excelsior guano. Red brand excelsior guano. Blue brand excelsior guano. Gold brand excelsior guano. Soluble bone and potash. Fish guano and potash. Ground bone.
Milsom Rendering and Fertilizer Co., East Buffalo, N. Y.	....	Cyclone pure bone meal. Erie King. Dissolved bone and potash. Buffalo guano. Potato, hop and tobacco phosphate. Pure dissolved bone. Vegetable bone fertilizer. Buffalo fertilizer. Buffalo wheat phosphate.
Rochester Fertilizer Co., Rochester, N. Y.	....	Rochester alkaline bone guano. Rochester bone and blood guano. Rochester blood and bone guano. Rochester blood and bone high grade.
Michigan Carbon Works, Detroit, Mich.	....	Homestead. Jarves drill phosphate.
Oneonta Fertilizer Co., Oneonta, N. Y.	....	Domestic phosphate. Ammoniat'd bone super-phosphate. Tobacco phosphate. Hop and potato phosphate. Wheat and corn phosphate. Pure bone meal. Pure granulated bone.
Farmers' Fertilizer Co., Syracuse, N. Y.	....	Standard ammoniated bone phosphate. Standard ammoniated bone phosphate (special formula). The reaper. The fair and square. Fish and potash. Alkaline bone. Empire soluble bone. Empire guano. The anchor brand. The phœnix. Pure ground bone. Pure ground bone and potash. Onondaga chief.

NAMES OF MANUFACTURERS.	Names of agents.	Names of brands.
Lister's Agricultural Chemical Works, Newark, N. J.	....	Lister's celebrated ground bone. Lister's ammoniated dissolved bone Lister's U. S. phosphate. Lister's lawn fertilizer. Lister's standard super-phosphate of lime. Lister's success fertilizer. Lister's crescent bone. Lister's perfect fertilizer. Lister's Harvest Queen fertilizer. Lister's hop fertilizer.
New Process Fertilizer Co., Hart Lot, N. Y.	....	New process for all crops.
W. D. Stewart & Co., 73 Exchange place, Boston, Mass.	....	Soluble Pacific guano. Nobsque guano. Dissolved bone phosphate.

5. ORGANIZATION OF THE WORK.

As the regular laboratory accommodations of the Station were already insufficient for the previous work of the Station, the first step in organizing the work was to secure rooms temporarily at 155 Exchange street, Geneva, and to fit them up for the work of the present season. A chemical laboratory, on the Station grounds, for the accommodation of the fertilizer work, is expected to be in readiness for the work of the spring season.

Two assistant chemists were placed in charge of the work, under the immediate supervision of the Station chemist. Arrangements were completed for work as soon as the fall fertilizers were distributed through the State.

The next important step in organizing the work was the appointment of agents of the Station to collect samples of fertilizers for analysis. The appointment of suitable persons for this part of the work is of the first importance, since the analysis of a fertilizer will be valueless, unless the sample analyzed fairly represents the average composition of that fertilizer. In order to get a fair sample for analysis, great care must be exercised in taking the sample. As a result of the experience furnished by the fertilizer controls of other States, this Station furnishes each agent with a sampling tube, which takes a section or core out of the entire length of the package, and thus insures fair sampling.

In the appointment of agents of the Station to collect samples of fertilizers for analysis, it is the aim to select men who fairly represent the more intelligent and progressive element in the farming community, and who are known and respected by both purchasers and sellers of fertilizers. So far, no complaints whatever have been received in regard to the sampling.

The names of the agents of the Station who have been and are now collecting samples are the following: F. E. Dawley, Syracuse; J. L. Colvin, Geneva; W. H. Gilbert, Richland; E. F. Dibble, Lima; John McCann, Elmira; James D. McCann, Elmira; G. E. Aldrich, Mattituck; F. S. Stebbins, Rochester; C. J. Fenner, Orchard Park.

Each agent is furnished with a sampling tube, blanks for describing samples, etc., together with printed instructions regarding their use.

Following is a copy of instructions to agents for collecting samples:

DIRECTIONS TO BE FOLLOWED BY AGENTS IN SAMPLING FERTILIZERS.

New York State Agricultural Experiment Station,
Fertilizer Control Department, Geneva, N. Y.

1. The sampling tube furnished by the Station must be used in taking samples. In using the tube, proceed as follows: Lay down in a nearly horizontal position the package (bag or barrel) containing the fertilizer which is to be sampled. Close the slit in the sampling tube, hold the tube in a nearly horizontal position, and insert it into the fertilizer with the slit side up. After the sampler is inserted its full length, open the slit, allow the inside tube to fill, then close the slit and withdraw the tube. In taking samples, proceed according to the detailed directions following.

2. Select at least three full, unbroken, average packages of the fertilizer, weigh each separately, and enter these actual weights in the blank form provided.

3. Open the packages that have been weighed and take from different parts of each package with the sampling tube, in the manner above described, at least five samples. Place these samples, fifteen in all, on a piece of rubber cloth provided for the purpose, and mix thoroughly but quickly, to avoid loss or gain of moisture. With this mixture fill a clean and dry quart glass fruit can. Then fill out fully and legibly the blank form provided for agents; inclose in an envelope and send to the address given below; inclose the remaining portion of the form in the fruit can with the sample of fertilizer, and close the can tightly. Wrap each can separately in heavy paper, pack for transportation in a wooden box, properly closed, and forward by express, directed to The New York Agricultural Experiment Station, Dr. Peter Collier, Director, Geneva, N. Y.

4. Send with each sample, wrapped around the can, any printed circular, pamphlet, analysis or statement, that accompanies the fertilizer or is used in its sale.

5. When a sample has been taken, it should *always* be bottled and the form for its description should be filled out *completely* and the can should be closed *before* beginning to sample another fertilizer.

SPECIAL PRECAUTIONS TO BE OBSERVED BY AGENTS IN TAKING SAMPLES OF FERTILIZERS.

1. In cases where moist articles put up in bags or common barrels have become dry on the outside, it is absolutely necessary to empty out and thoroughly mix the dry and moist portions before sampling. Also, in case of dry, coarse articles, such as ground bone, there is liable to be a separation of coarse and fine parts on handling; in such cases, the coarse and fine must be carefully mixed before sampling.

2. Agents must not take samples from lots of less than one ton.

3. In sampling fertilizers found upon farms, agents should ascertain the following facts:

First. That the samples are not taken from stock of a past season or from stock which has been carelessly stored.

Second. That they were received in good condition, and have since been so stored that a noticeable loss or gain of moisture has been prevented.

4. In sampling fertilizers found at dealers' storehouses, agents should also ascertain whether the fertilizers are of old (last season's) or of new stock. Preference should always be given to the present season's goods. Circumstances may, however, make it advisable to sample old stock; in such cases, this fact must be distinctly stated by the agent in his report to the Station's director.

5. If fertilizers are found stored in piles only, agents should cause six or more bags to be filled from different portions of the piles; from these bags the samples may be taken in the usual manner.

Following is a copy of the blank form used by agents in describing samples:

No. ..... STATION NO........................

Received at Station....................

BRAND..

Manufacturers' name and address ....

Dealer's name and address..

....

Date..................Is it stated to be fresh stock?..............

Amount of stock............Dealer's cash ton price...............

No. of packages from which sample was taken......................

Weight branded on each package ....

Actual weight of three packages ....

GUARANTEE.

Nitrogen.......	The above-described sample was fairly taken by me.
(Ammonia..............)	
Soluble phosphoric acid	
Reverted phosphoric acid........	....
(Available phosphoric acid......)	Agent of the Station.
Insoluble phosphoric acid........	
Total phosphoric acid	
Potash........................	

No...... STATION NO ....

Tear this off and put in the glass jar with the sample.

As a rule the Station will not analyze samples —

1. From dealer's stock of less than one ton.

2. From stock which has lain over since last season.

3. From stock which is evidently improperly stored, as in bags on wet ground or exposed to the weather, etc.

Each agent should especially note on this blank any apparent failure on the part of manufacturer or seller to comply with the fertilizer laws.

The agent is requested to secure a sample of every brand of fertilizer which he can find on sale in his territory, and also duplicates of the same brand sold by different dealers. By securing different samples of the same brand from different parts of the State, it can be ascertained, if suspected, whether manufacturers are sending a poorer quality of the same brand to any particular locality. In no case are agents permitted to take samples at factories. As many samples will be collected as it is in the power of the Station to analyze, with its present facilities.

7. LABORATORY METHODS.

After reaching the Station, the samples of fertilizers collected for analysis are transferred by the director to the chemist, together with the agent's description forms. The names of the brands are entered upon an index book and numbered. The cans are then opened by the chemist, the portion of the description form placed in the can for identification by the agent is removed, after which the cans are closed and labeled with the Station number corresponding to that on the index book. The cans, each bearing only a simple number for identification, are then placed in the hands of the assistant chemists for analysis. The analysts who carry out the details of anaylsis know absolutely nothing as to what brand of fertilizer they have in hand. The analytical methods used are strictly those adopted by the Association of Agricultural Chemists. Every determination is duplicated once at least.

The results of analysis and other data are arranged by the chemist and are finally inspected by the director before publication.

In cases where several duplicates of the same brand have been sampled, several of these samples, taken in different localities of the State, are selected, and one hundred grams taken from the well mixed contents of each can. These several portions thus taken are thoroughly mixed, and then the sample for analysis is taken from the mixture thus prepared.

If the results of the analysis of the first sample correspond to the guarantee, then no other samples of that brand will, as a rule, be analyzed during the present season. If, however, in the first case, the analysis gives results lower than the guarantee, then numerous other individual samples will be analyzed. It is believed that this method will do justice to all parties concerned more surely and satisfactorily than any other method.

Only samples collected by duly appointed agents of the Station will be analyzed and reported upon officially.

8. Guarantees.

In every case, the Station's analyses of brands are compared with the manufacturer's guarantee. The data are so arranged in the tables of analytical results that comparison can readily be made by anyone.

9. Gratuitous Analysis of Commercial Fertilizers for Farmers.

The Station will continue, as in the past, to make analyses of commercial fertilizers for farmers, without charge, on the following conditions: (1.) That the samples are taken by consumers from stock of present season, and in accordance with the Station instructions for sampling. (2.) That the samples are fully described on the Station "Form for Description of Sample," or otherwise, as may be required. (3.) That the Station is free to publish the results, if it sees fit.

Instructions and forms for taking samples, of which the following is a copy, will be sent on application:

GRATUITOUS ANALYSIS OF COMMERCIAL FERTILIZERS.

NEW YORK STATE AGRICULTURAL EXPERIMENT STATION,
GENEVA, N. Y.

To insure justice to manufacturers, dealers and consumers alike, the Station will make gratuitous analyses of commercial fertilizers on samples taken by the agents of the Station, or on such others as are properly authenticated by the certificate of the person drawing the sample and in addition the witness of some competent person. The expense of making the analysis and the importance of the published results for good or evil to the manufacturer require that every precaution be taken for carrying out the directions given below for sampling.

DIRECTIONS TO BE FOLLOWED IN SAMPLING COMMERCIAL FERTILIZERS.

1. Provide a teacup, some large papers, and for each sample a glass fruit can holding about one quart, that can be tightly closed, all to be clean and dry.

2. Weigh separately at least three full, unbroken, average packages of the fertilizer, or, if there are more than thirty, weigh every tenth package, and enter their actual weights in the blank form for description of sample.

3. Open the packages that have been weighed and mix well together the contents of each down to at least half its depth, emptying out upon a clean floor, if necessary, and crushing any soft moist lumps unbroken, so that the sample shall exhibit the texture and mechanical condition of the fertilizer.

4. Take out five equal cupfuls from different parts of the mixed portion of each package. Pour them, fifteen in all, over one another on the paper, intermix again thoroughly, but quickly, to avoid loss or gain of moisture. Fill the glass fruit can from this mixture, inclose a plainly written copy of the printing upon the bag or package, and close tightly. Wrap each can in heavy paper, pack for transportation in a wooden box, properly closed, and forward by express, directed to The New York State Agricultural Experiment Station, Dr. Peter Collier, Director, Geneva, N. Y.

5. Send with each sample any printed circular, pamphlet, analysis or statement that accompanies the fertilizer or is used in its sale.

6. When a sample is taken, it should always be bottled and the form for its description should be filled out completely and the can should be closed before beginning to sample another fertilizer.

ADDITIONAL REMARKS ON SAMPLING.

In case of a fine, uniform and moist or coherent article, a butter-tryer or a tin tube, like a dipper handle, put down well into the packages in half a dozen places, will give a fair sample with great ease.

With dry, coarse articles, such as ground bone, there is liable to be a separation of coarse and fine parts in handling. Moist articles put up in bags or common barrels may become dry on the outside. It is in these cases absolutely necessary to mix thoroughly the coarse and fine, the dry and the moist portions before sampling.

The quantity sent should not be too small. When the material is fine and uniform, a pint is enough, but otherwise, and especially in the case of ground bone, which must be mechanically analyzed, the sample should not be less than one quart.

It is important that the samples for analysis should be taken at the time when the fertilizer is purchased and *immediately dispatched* to the Station. Moist fish, blood or cotton seed meal will soon decompose and lose ammonia if bottled and kept in a warm place. Superphosphates containing much organic nitrogen will suffer reversion of their soluble phosphoric acid under similar circumstances. Most of the moist fertilizers will lose water unless tightly bottled, but some of the grades of potash salts will gather moisture from the air and become a slumpy mass if not thoroughly protected.

FORM FOR DESCRIPTION OF SAMPLE.

Station No........ Received at Station .... 189..

Each sample of fertilizer sent for analysis must be accompanied by one of these forms with the blanks filled out legibly and as fully as possibly.

1. Brand of fertilizer..... ....
2. Name and address of manufacturer........................
....
3. Name and address of dealer from whose stock this sample is taken.. .. ..
4. Date of taking this sample ....
5. Is it stated to be fresh stock..............................
6. Amount of stock ....
7. Dealer's cash price per ton ....
8. Selling weight claimed for each package weighed............
9. Actual weight of several packages opened............. .....
10. Number of packages from which this sample is taken.... ......
11. Copy all the printing upon the bag or package..............
....
....

a. Soluble phosphoric acid.............................
b. Reverted phosphoric acid.............................
c. Available phosphoric acid.............................
d. Insoluble phosphoric acid.............................
e. Total phosphoric acid.............................
f. Nitrogen.............................
g. Ammonia.............................
h. Potash.............................

CERTIFICATE OF PERSON TAKING THE SAMPLE.

I, the undersigned, certify that the accompanying sample marked
....
was taken by me from the full packages, and in accordance with the Station's instructions for sampling, and to the best of my knowledge and belief fairly represents the stock from which it was drawn, and that said stock when sampled was properly housed and in good condition. I also certify that the foregoing description is correct.

Signature.............................
Post-office address.............................

Witness.

The above described sample was drawn in my presence.

Signature.............................
Township.............................
Post-office address.............................

Except in rare cases, there will be little or no occasion for analysis of fertilizers for private parties in the near future, when the Station has fully developed the work of the fertilizer control.

All official analyses are made from samples taken by authorized agents of the Station. These only will be published, and are sufficient as final evidence as to whether or not the guaranteed composition is maintained.

10. TABULATED STATEMENT OF RESULTS OF ANALYSES OF SAMPLES OF COMMERCIAL FERTILIZERS COLLECTED BY AGENTS OF THIS STATION.

The analyses presented in this bulletin are from a comparatively limited section of the State. As soon as the first lot of samples came in, work was immediately begun upon them, instead of waiting for a larger number. Accordingly, these first analyses do not represent the variety of samples from different localities that analyses of the future will.

A full discussion of the results embodied in the following tables is reserved until the season's analyses are completed:

RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS

Composition of fertilizers as guaranteed by manufacturers and

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Agent taking sample.	Station number	
Read Fertilizer Co., New York city.	High grade farmers' friend	Syracuse.	F. E. Dawley	6	Guaranteed Found.
Read Fertilizer Co., New York city.	Original alkaline bone.	Syracuse.	F. E. Dawley.	7	Guaranteed Found.
Read Fertilizer Co., New York city.	Lion brand.	Syracuse.	F. E. Dawley.	8	Guaranteed Found.
Read Fertilizer Co., New York city.	Farmers' friend	Syracuse.	F. E. Dawley.	14	Guaranteed Found.
Read Fertilizer Co., New York city.	Empire State brand.	Syracuse.	F. E. Dawley.	15	Guaranteed Found.
Read Fertilizer Co., New York city,	Empire State brand.	Syracuse.	F. E. Dawley.	24	Guaranteed Found.
Read Fertilizer Co., New York city.	Leader phosphate.	Syracuse.	F. E. Dawley.	44	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Farmers' new method.	Cicero.	F. E. Dawley.	17	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Farmer's new method.	Canandaigua	J. L. Colvin.	171	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Ammoniated dissolved bones.	Cicero.	F. E. Dawley.	18	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Ammoniated dissolved bones.	Victor. Canandaigua Lima. Mt. Morris.	J. L. Colvin. E. F. Dibble.	169, 261 303, 334	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Bradley's patent superphosphate.	Hopewell.	J. L. Colvin.	179	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Bradley's patent superphosphate.	Milo Center, Victor. Moscow.	J. L. Colvin. E. F. Dibble.	260, 284 331	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Bradley's sea fowl guano.	Canandaigua	J. L Colvin.	170	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Alkaline bone.	Seneca Castle	J. L. Colvin.	173	Guaranteed Found.

IN NEW YORK STATE FOR THE FALL OF 1890.

as found by chemical analysis — estimated in parts per hundred.

Nitrogen.		Phosphoric Acid. (P_2O_5.)			Potash — Soluble in Water.	
Determined as nitrogen.	Determined as ammonia, (NH_3.)	Available.	Insoluble.	Total.	Determined as K_2O.	Determined as sulphate. (K_2SO_4.)
....	4 to 5 3.83	5 to 6 6.69	....	.... 8.05	10 to 11 10.96	....
....	....	10 to 12 9.50	1 to 2 1.95	11 to 14 11.36	3.20 to 4.30 3.93	6 to 8 7.27
....	1 to 2 1.13	8 to 10 7.89	2 to 4 1.54	....	4.30 to 5.40 4.23	8 to 10 7.83
....	2.5 to 3.5 2.33	9 to 11 9.54	2 to 3 1.87	11 to 14 11.42	2.15 to 3.20 2.63	4 to 6 4.87
....	1.5 to 2.5 1.52	9 to 11 9.33	2 to 3 2.77	11 to 13 12.10	2.15 to 3.20 2.10	4 to 6 3.89
....	1.5 to 2.5 1.80	9 to 11 9.76	2 to 3 2.52	11 to 13 12.28	2.15 to 3.20 2.30	4 to 6 4.26
....	1 to 2 1.53	7 to 9 7.01	1 to 2 1.60	8 to 10 8.61	2.15 to 3.20 3.25	4 to 6 6.01
....	1 to 2 1.43	8 to 10 9.47	....	10 to 12 10.72	2.15 to 3.20 2.52	4 to 6 4.66
....	1 to 2 1.82	8 to 10 9.19	....	10 to 12 10.02	2.15 to 3.20 2.43	4 to 6 4.50
....	2 to 3 1.90	7 to 9 9.97	....	8 to 10 10.92	1 to 2 2.39	1.85 to 3.70 4.42
....	2 to 3 2.46	7 to 9 9.90	....	8 to 10 11.45	1 to 2 1.81	1.85 to 3.70 3.33
....	2.5 to 3.5 2.38	8 to 10 9.90	....	10 to 12 11.30	1.5 to 2.5 1.76	....
....	2.5 to 3.5 2.34	8 to 10 10.17	....	10 to 12 11.63	1.5 to 2.5 2.20	....
....	2.5 to 3.5 2.29	8 to 10 10.41	....	10 to 12 12.22	1.5 to 2.5 2.53	....
....	....	11 to 15 10.54	1 to 2 1.99	....	2.40 to 3.50 2.52	4.5 to 6.5 4.66

RESULT OF ANALYSES OF COMMERCIAL

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Agent taking sample.	Station number.	
Bradley Fertilizer Co., Boston, Mass.	Potato fertilizer.	Delhi.	J. W. McCann.	407	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Dissolved bone with potash.	Penn Yan.	J. L. Colvin.	273	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Niagara phosphate.	Lima.	E. F. Dibble.	302	Guaranteed Found.
Bradley Fertilizer Co., Boston, Mass.	Eureka phosphate.	Avon.	E. F. Dibble.	319	Guaranteed Found.
Bowker Fertilizer Co., Boston and N. York.	Stockbridge for roots.	Syracuse.	F. E. Dawley.	10	Guaranteed Found.
Bowker Fertilizer Co., Boston and N. York.	Stockbridge for vines.	Syracuse.	F. E. Dawley.	11	Guaranteed Found.
Bowker Fertilizer Co., Boston and N. York.	Ammoniated bone phosph.	Syracuse.	F. E. Dawley.	13	Guaranteed Found.
Bowker Fertilizer Co., Boston and N. York.	Sure crop.	Syracuse.	F. E. Dawley.	5, 26	Guaranteed Found.
Bowker Fertilizer Co., Boston and N York.	Hill and drill.	Clay.	F. E. Dawley.	27	Guaranteed Found.
Bowker Fertilizer Co., Boston and N. York.	Super-phosphate.	Syracuse.	F. E. Dawley	1, 9, 21	Guaranteed Found.
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Ammoniated super-phosphate.	Hart Lot.	F. E. Dawley.	53	Guaranteed Found.
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Dissolved bone black.	Hopewell.	J. L. Colvin..	175	Guaranteed Found.
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Queen city phosphate.	Delhi.	J. W. McCann	409	Guaranteed Found.
Chemical Company of Canton, Baltimore, Md.	Dissolved bone phosphate.	Lyons.	F. E. Dawley.	45,56,67	Guaranteed Found.
Cleveland Dryer Co., Cleveland, Ohio.	Ohio seed maker.	York.	E. F. Dibble.	330	Guaranteed Found.
Chesapeake Guano Co., Baltimore, Md.	Oriole alkaline bone.	Lima.	E. F. Dibble.	304	Guaranteed Found.

FERTILIZERS, ETC. — (*Continued*).

NITROGEN.		PHOSPHORIC ACID (P_2O_5.)			POTASH — SOLUBLE IN WATER.	
Determined as nitrogen.	Determined as ammonia, (NH_3.)	Available.	Insoluble.	Total.	Determined as K_2O.	Determined as sulphate. (K_2SO_4.)
....	2.5 to 3.5 2.61	9 to 10 9.19	....	11 to 12 10.02	3.20 to 4.30 3.45	6 to 8 6.38
....	1 to 2 1.44	8 to 10 9.22	....	10 to 12 10.96	4 to 6 4.07	....
....	1 to 2 1.66	7 to 9 9.10	....	8 to 10 10.83	2 to 3 2.42	....
....	....	9 to 12 11.33	....	....	3.20 to 4.30 2.99	6 to 8 5.53
2.5 to 3.25 2.66	3 to 4 3.22	9 to 11 9.59	....	....	2 to 4 3.92	....
3.25 to 4.50 3.16	4 to 5 3.84	7 to 8 9.66	....	8 to 10 11.51	5 to 6 5.26	....
1.5 to 2.25 1.52	2 to 3 1.85	8 to 10 10.33	....	10 to 12 12.71	2 to 3 3.13	....
....	1 to 2 1.62	8 to 10 8.17	....	10 to 12 10.61	1 to 2 1.83	....
2 to 3 1.89	2.5 to 3.5 2.30	8 to 10 9.45	....	10 to 12 11.56	2 to 3 4.25	....
....	....	10 to 12 10.31	....	12 to 14 11.89	1 to 2 2.71	....
....	3.5 to 4.5 3.53	8 to 12 9.70	1 to 2 1.14	....	1.10 to 1.60 2.19	2 to 3 4.07
....	....	15 to 18 16.72	....	....	....	....
....	2 to 2.5 2.16	8 to 12 8.54	1 to 2 1.45	....	1.10 to 2.20 2.20	2 to 4 4.09
....	....	12 to 14 11.65	2 to 4 2.17	14 to 18 13.82	....	....
....	1.5 to 2.5 1.34	10 to 12 11.62	....	15 to 17 14.15	....	....
....	....	10 to 11 10.14	....	....	1.60 to 2.30 1.97	3 to 4.25 3.65

RESULT OF ANALYSES OF COMMERCIAL

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Agent taking sample.	Station number.	
E. Frank Coe, New York, N. Y.	Alkaline bone.	Caledonia.	E. F. Dibble.	327	Guaranteed Found.
E. Frank Coe, New York, N. Y.	XXV ammoniated bone.	Benton Center.	J. L. Colvin..	252	Guaranteed Found.
Armour & Co., Chicago, Ill.	Dried blood.	Syracuse.	F. E. Dawley.	36	Guaranteed Found.
Farmers' Fertilizer Co., Syracuse, N. Y.	Reaper brand.	DeWitt.	F. E. Dawley.	37	Guaranteed Found.
Farmers' Fertilizer Co., Syracuse, N. Y.	Standard ammoniated bone phosphate, special formula.	DeWitt.	F. E. Dawley.	40	Guaranteed Found.
Farmers' Fertilizer Co., Syracuse, N. Y.	Standard ammoniated bone phosphate.	Stanley.	J. L. Colvin..	180	Guaranteed Found.
Farmers' Fertilizer Co., Syracuse, N. Y.	Empire guano.	DeWitt.	F. E. Dawley.	41	Guaranteed Found.
Farmers' Fertilizer Co., Syracuse, N. Y.	Standard ammoniated bone phosphate.	N. Bloomfield Penn Yan.	E. F. Dibble. J. L. Colvin..	301 163,274	Guaranteed Found.
Great Eastern Fertilizer Co., New York, N. Y.	G. E. general wheat special.	Caledonia.	E. F. Dibble.	326	Guaranteed Found.
Great Eastern Fertilizer Co., New York, N. Y.	G. E. general universal plant food.	Caledonia.	E. F. Dibble.	325	Guaranteed Found.
Listers' Ag'l Chemical Works, Newark, N. J.	Ammoniated dissolved bone.	Stanley.	J. L. Colvin..	188	Guaranteed Found.
Listers' Ag'l Chemical Works, Newark, N. J.	Dissolved bone black.	East Bloomfl'ld, Weedsport.	J. L. Colvin. F. E. Dawley.	255 48, 70	Guaranteed Found.
Listers' Ag'l Chemical Works, Newark, N. J.	German potash salts.	Weedsport.	F. E. Dawley.	46, 69	Guaranteed Found.
Listers' Ag'l Chemical Wks., Newark, N. J.	Perfect fertilizer.	Geneseo.	E. F. Dibble.	349	Guaranteed Found.

FERTILIZERS, ETC.—(*Continued*).

Nitrogen.		Phosphoric Acid. (P_2O_5.)			Potash — Soluble in Water.	
Determined as nitrogen.	Determined as ammonia, (NH_3.)	Available.	Insoluble.	Total.	Determined as K_2O.	Determined as sulphate, (K_2SO_4.)
1 to 1.5 1.09	1 to 2 1.32	9 to 12 10.94	2 to 3 1.34	....	1.60 to 2.20 1.94	3 to 4 3.60
0.83 to 1.23 0.70	1 to 1.5 0.85	7 to 9 11 17	2 to 3 1.91	....	1.5 to 2.25 1.60	....
....	15.50 15.88	....	....	....	....	....
....	2 to 3 1.87	5.5 to 7 5.86	....	7.5 to 9 6.39	4.30 to 5.40 5.23	8 to 10 9.69
....	1 to 2 0.99	8 to 10 8.08	1 to 2 0.94	10 to 12 9.02	2.20 to 3 20 2.86	4 to 6 5.30
....	1 to 2 0.89	8 to 10 8.57	1 to 2 0.57	10 to 12 9.14	2.20 to 3.20 2.44	4 to 6 4.51
....	....	6 to 7.5 7.79	1 to 2 0.85	7.5 to 9 8.64	2.20 to 3.25 4.08	4 to 6 7.55
....	1 to 2 2.09	9 to 11 9.05	2 0.54	11 to 13 9.59	3.20 to 4.30 4.58	6 to 8 8.48
....	2 to 2.5 1.6	8 to 12 8.71	1 to 3 1.15	....	1.60 to 2.70 2.78	3 to 5 5.14
....	1.25 to 2 1.82	8 to 12 8.81	1 to 2 1.35	....	1.90 to 2.70 2.35	3.5 to 5 4.36
....	2.2 to 2.5 2.39	9 to 10 9 28	2 to 3 1.71	....	1.5 to 2 1.62	....
....	....	13 to 16 12.57	....	....	....	....
....	....	....	....	....	11.90 to 13.50 14.76	22 to 25 27.29
....	1.25 to 2 2.66	10.5 to 12 10.82	....	....	1.5 to 2.5 2.56	....

RESULTS OF ANALYSES OF COMMERCIAL

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Agent taking sample.	Station number.	
Listers' Ag'l Chemical Works, Newark, N. J.	Dried blood.	Weedsport.	F. E. Dawley.	73, 47	Guaranteed Found.
Michigan Carbon W'ks, Detroit, Mich.	Homestead super-phosphate.	Penn Yan.	J. L. Colvin.	282	Guaranteed Found.
Michigan Carbon W'ks, Detroit, Mich.	Homestead tobacco grower.	Livonia.	E. F. Dibble.	307	Guaranteed Found.
H. S. Miller & Co., Newark, N. J.	Ammoniated dissolved bone.	Hopewell.	J. L. Colvin.	176	Guaranteed Found.
C. Meyer, Jr., Maspeth, L. I.	Superior superphosphate.	Stanley.	J. L. Colvin.	184	Guaranteed Found.
Milsom Render'g and Fertilizer Co., East Buffalo, N. Y.	Buffalo guano.	Rushville.	J. L. Colvin.	183	Guaranteed Found.
Milsom Render'g and Fertilizer Co., East Buffalo, N. Y.	Wheat phosphate.	Phelps.	J. L. Colvin.	154	Guaranteed Found.
Milsom Render'g and Fertilizer Co., East Buffalo, N. Y.	Erie king.	Geneseo.	E. F. Dibble.	341	Guaranteed Found.
Maryland Fertilizer Co., Baltimore, Md.	Linden superphosphate.	Mount Morris.	E. F. Dibble.	336	Guaranteed Found.
Maryland Fertilizer Co., Baltimore, Md.	Alkaline bone.	Mount Morris, Lima.	E. F. Dibble.	335, 305	Guaranteed Found.
Pacific Guano Co., Boston, Mass.	Soluble Pacific guano.	Seneca Castle, Stanley, Durham'le,	J. L Colvin.	172, 185 288	Guaranteed Found.
Quinnipiac Co., New London, Conn.	Climax phosphate.	North Bloomfield.	J. L. Colvin.	265	Guaranteed Found.
Sheldon Bros., Weedsport, N. Y.	Sheldon's compound.	Weedsport.	F. E. Dawley.	55, 72	Guaranteed Found.
Standard Fertilizer Co., Boston, Mass.	Stand'rd guano	Avon.	E. F. Dibble.	316	Guaranteed Found.

FERTILIZERS, ETC.—(*Continued*).

Nitrogen.		Phosphoric Acid. (P_2O_5.)			Potash—Soluble in Water.	
Determined as nitrogen.	Determined as ammonia, (NH_3.)	Available.	Insoluble.	Total.	Determined a K_2O.	Determined as sulphate, (K_2SO_4.)
....	10 to 13 10.61	....	....	....	....	....
....	2.25 to 3.15 2.36	8 to 11 8.54	....	....	1.50 to 1.90 1.77	2.75 to 3.5 3.27
3 to 4 3.08	3.56 to 4.75 3.70	10 to 11 12.05	....	....	3.50 to 4 3.24	6.5 to 7.5 6.00
....	2.25 to 2.5 2,16	9 to 10 8.88	1.5 to 2.5 1.38	....	2.5 to 3 3.42	....
....	1.5 to 2 2.33	.... 11.27	....	8 to 9 11.98	4 to 5 5.62	....
....	2 to 3 2.23	7 to 11 8.22	3 to 4 1.76	10 to 15 9.98	1 to 2 1.37	....
....	2 to 4 2.11	8 to 10 7.79	2 to 3 2.43	10 to 13 10.21	2 to 3 3.67	....
....	1 to 2 2.24	8.45 to 10.45 9.80	4 to 5 2.90	12.45 to 15.45 12.70	1.90 to 2.10 2.39	....
....	....	10 to 13 10.12	1 to 2 0.54	....	2 to 4 5.70	....
....	....	11 to 15 10.96	....	....	3 to 4.5 3.11	....
....	2.5 to 3.5 2.87	8 to 10 10.16	....	11 to 14 11.46	1.5 to 2.5 3.68	....
....	1 to 2 1.67	9 to 10 10.43	....	11 to 12 11.38	4 to 5 3.50	....
....	0.75 to 1.5 0.88	5 to 7 5.18	2 to 3 0.31	....	2 to 3 3.31	....
1 to 2 1.12	1.5 to 3 1.36	8 to 12 7.86	2 to 3 3.82	10 to 15 11.68	2.15 to 3.20 2.19	4 to 6 4.06

RESULTS OF ANALYSES OF COMMERCIAL

MANUFACTURER.	Trade mark or brand.	Locality where sample was taken.	Agent taking sample.	Station number.	
W. D. Stewart & Co., New York and Boston.	Nobsque guano	Stanley.	J. L. Colvin.	186	Guaranteed Found.
W. D. Stewart & Co., New York and Boston.	A No. 1.	Durhamville.	J. L. Colvin.	290	Guaranteed Found.
Walker Fertilizer Co., Phelps, N. Y.	Walker's am-mo'ted phosphate.	Rushville.	J. L. Colvin.	187	Guaranteed Found.
Williams & Clark Fertilizer Co., New York, N. Y.	Royal bone.	York.	E. F. Dibble.	329	Guaranteed Found.
Zell Guano Co., Baltimore, Md.	Zell's economizer.	Cheshire, Stanley.	J. L. Colvin.	165, 190	Guaranteed Found.

FERTILIZERS, ETC.—(*Continued*).

Nitrogen.		Phosphoric Acid. (P_2O_5.)			Potash—Soluble in Water.	
Determined as nitrogen.	Determined as ammonia, (NH_3.)	Available.	Insoluble.	Total.	Determined as K_2O.	Determined as sulphate, (K_2SO_4.)
....	1.4 to 2 1.32	9 to 12 9.36	....	....	2 to 3 2.86	....
1.25 to 2 1.32	....	7 to 9 8.25	2.83 1.81	....	1.5 to 2.5 1.56	....
....	2 to 3 2.17	7 to 9 7.73	....	....	1 to 2 1.91	....
0.5 to 2 1.52	1 to 2 1.84	7 to 9 8.32	....	8 to 10 10.12	2 to 3 4.90	....
....	1 to 2 1.23	9 to 11 10.86	2 to 3 1.28	11 to 14 12.14	1 to 2 2.10	....

It is gratifying to find in the analyses made up to this time no evidences of fraud, but there is in the guaranteed analyses of the manufacturers a danger that the purchaser of these fertilizers may be mislead, since it is but natural to suppose that when a fertilizer is represented, as containing, for example, from four to six per cent of any constituent, that the average samples of this brand will be found to contain five, and that these maximum and minimum amounts guaranteed, represent the inequalities of composition of those raw materials used in the manufacture.

Since obviously the guarantee can be binding only upon the minimum amount, and since it appears clear that it is in the power of the manufacturers to keep their products within a pretty narrow margin of their minimum guarantee, it appears that their maximum limits had better be abolished in order that there should be no probability of misunderstanding upon the part of the purchaser.

On the other hand, an average of twenty-two analyses shows an excess of 15.5 per cent of potash over the maximum amount guaranteed; eight analyses show an average of 8.3 per cent of available phosphoric acid over the maximum guarantee; and five analyses show an average excesss of 7 2 per cent of ammonia over the maximum amount guaranteed.

AVERAGE COMPOSITION OF THE SIXTY-FOUR FERTILIZERS ANALYZED.

	Minimum guaranteed.	Maximum guaranteed.	Found.
Nitrogen	1.68	2.57	1.80
Ammonia	2.33	3.20	2.47
Available phosphoric acid	8.49	10.72	9.50
Insoluble phosphoric acid	1.73	2.76	1.63
Total phosphoric acid	10.16	12.47	11.04
Potassium oxide	2.23	3.31	3.25
Potassium sulphate	4.84	6.68	6.02

	Per cent of minimum found.	Per cent of maximum found.
Nitrogen	107.1	70.0
Ammonia	110.1	77.2
Available phosphoric acid	111.9	88.6
Insoluble phosphoric acid	94.2	59.1
Total phosphoric acid	108.6	88.5
Potassium oxide	145.7	98.2
Potassium sulphate	124.4	90.1

	Per cent of minimum guarantee found.	Per cent of maximum guarantee found.
Nitrogen and ammonia	108.6	73.6
Available phosphoric acid	111.9	88.6
Potassium, oxide and sulphate	135.1	94.2

It will be seen, therefore, that these sixty-four brands analyzed contain upon an average 91.1 per cent of the average of the guaranteed maximum and minimum amount of nitrogen compounds, 100.3 per cent of the average of their guaranteed maximum and minimum amounts of available phosphoric acid; and 114.7 per cent of the average of their guaranteed maximum and minimum amounts of potash compounds. In other words, while they are fully up to the average guarantee of available phosphoric acid they fall short in nitrogen and overrun their guarantees in potash.

Since it is obviously impracticable for every farmer in the State to become familiar with the work of the Station through personal observation, the following statement, which was published in our local papers, has been very widely distributed along with our bulletins, and having been copied into many of our agricultural papers, has secured still more extended circulation, and it is hoped by this means the work of the Station in its several branches has become more generally known to those for whom it is being primarily done.

Work at the New York State Agricultural Experiment Station.

Few, we think, even of our own citizens, are familiar with the work of investigation in the various departments of agricultural science which is going on at our Experiment Station, and we think our readers will be interested in a brief account of the work which we find in progress there and which will well repay one for a day or two spent at the Station.

The work now in charge of the first assistant is as follows:

First. Experiments with swine.—So soon as enough skim milk, etc., is available, it is expected to conduct the pig-feeding in connection with the dairy cattle experiments, and comparison of the different breeds of swine will be made.

For the present the experiments are confined principally to feeding of various coarse foods that have been used and recommended for swine, e. g., corn ensilage, sorghum, prickly comfrey, beets, clover and clover ensilage, etc.

Second. Experiments with poultry.— Feeding experiments with rations more and less nitrogenous have been made with young and mature laying stock, and these experiments extend always throughout the whole laying season, some of both large and small breeds being used.

Feeding experiments are being made, and have been, with capons and cockerels.

Experiments have been made with "home-made" and inexpensive incubators and brooders, and it is expected to continue them.

Preparations are now nearly completed for breeding experiments with tested individuals of several breeds.

Considerable chemical work has been done, and experiments are now (although temporarily interrupted) in progress to answer the question definitely whether inorganic material, as stone, oyster shells, etc., can supply lime for the egg shell.

Experiments to ascertain the cost of production and value of product, in rearing chicks of different market breeds from the shell, under different foods and methods of hatching and brooding, are expected to be undertaken.

Third. Soil experiments.— The laboratory work on soils has been for the present discontinued, but only from pressure of more immediately necessary work.

In the field, application of several cheap chemicals has been made, viz.: sulphate of soda, sulphate of lime, sulphate of magnesia, sulphate of iron, carbonate of lime, common salt. The effect on the crop and soil is studied. These have only been applied one season, but it is intended to repeat the application several years on the same strips of soil under different crops.

Fourth. The investigation, selection and acclimatizing of sorghums—. Of the 200 or 300 samples of seed, representing 150 or more varieties that have been grown during the last three seasons, less than a dozen have been selected for future use as of value in this State; among these, however, are some very promising varieties. This necessitates, besides work in the field, much chemical work, analyses of juices, etc.

Fifth. It is also proposed to enter upon another line of work with our pasture and meadow grasses, the selection, preservation and propagation in absolute purity by sod culture and seed of the most vigorous and hardy strains and individuals of the most valuable varieties. It is hoped to establish the better types as standard by co-operation with some other stations, and to supplant the degenerate varieties so largely used.

Maps, charts, plans and drawings for purposes of illustration of Station works, have also been made.

In the chemical department the following work is in hand:

First. Analysis of milk of registered cows undergoing experiment. This work involves at present the complete analyses each week, of from ten to fourteen samples of milk, and the extent of the work will ncrease until the whole herd is in milk.

Second. Analysis of skim milk, buttermilk and butter in connection with the foregoing, requiring, at present, from fifteen to twenty-one analyses each week.

Third. An extended investigation into various methods of creaming, requiring, at present, seven analyses each week, but soon the work will be increased three-fold.

Fourth. Analyses of all the feeding stuffs connected with various experiments being carried on at the Station.

Fifth. Analysis of fertilizers in accordance with the recent law establishing a fertilizer-control at the Station.

Sixth. An investigation into the influence of acidity of cream upon the quantity and quality of butter produced.

Seventh. Experiments relating to a more accurate method for the determination of fat in feeding stuffs.

Eighth. Experiments relating to a simple method for the determination of nitrogen in nitrates.

Ninth. Analysis of various things sent to the laboratory from different parts of the State.

The work being carried on in the horticultural department is a continuation of that of last season, with the addition of such other lines as have been thought best. The leading features are:

First. Tests of the novelties in vegetables as to their desirability and commercial value.

Second. Tests of vegetable seeds, especially cauliflower and cabbage, to ascertain the value of American grown seed as compared with imported seed.

Third. The acclimatization of vegetables not native to this climate, notably the sweet potato, with which very successful results have been obtained.

Fourth. The forcing, under glass, of such vegetables as seem best adapted for that purpose.

Fifth. The present collection of varieties of small fruits is one of the largest in the country, and is destined to be of great value in the future, as well as at the present time. The tests consist in the study of the varieties as to their commercial value and adaptablility to the climate of this State.

Sixth. Also, so far as facilities offer, work in cross-fertilization is in progress tending to the improvement of varieties, and the special study of pollen influence. This line of work is of very great value, and a large part of the greenhouse has been set apart for the continuation of it through this coming winter, as there are, from the results of last winter's crossing, over one thousand seedlings to be tested, and the data, if as valuable as expected, should be before the public as soon as possible.

The above is in connection with the daily routine of note-taking and records made of the planting, germination, growth, habit, blossoming and fruiting season of all plants in this department, a large number of which notes are merely for reference and are only inserted in our record books, making no showing that would lead the public to know what a vast amount of constant painstaking work is necessary to keep records that become of greater value year by year.

In the pomological department the testing of the large fruits and of the varieties of grapes is being carried on as heretofore, and a study made of their habits of growth, vigor, susceptibility to disease, hardiness and adaptability to this climate. Also of the diseases affecting the different fruits, especially the grape. Experiments are being continued with fungicides and insecticides, with the object of obtaining simple and effective remedies for the holding in check or entirely ridding our orchards and vineyards both of fungi and the insect pests that are rendering such a large proportion of our fruit worthless. A more extended line of experiments is being planned for the coming year, intended to embrace a larger field, and some of them will be carried outside the Station limits through the courtesy of nurserymen and fruit growers, a number of whom have offered to place the necessary land and stock at the disposal of the Station. It is intended that a portion of this work shall be devoted to experiments with fertilizers. In connection with this, an object lesson in the chemical composition of the ash of four leading fruits—apple, pear, plum and cherry—and of two of the woods—viz., grape and apple—has been prepared, showing the amounts of the different fertilizing and mineral elements removed from the soil by the growth of 150 pounds of each of the fruits named, also by 100 pounds of the wood of the grape and apple. It is intended for use at the fairs, farmers' clubs, and meetings of fruit growers, and for use at the Station.

As a portion of the general farm work has been included in this department, a considerable amount of routine work has necessarily to be performed. Experiments have also been started with cereals and grasses, to test varieties and methods of seeding. Others are planned with fertilizers, ensilage, crops for soiling and methods to obtain the best and most economical results.

In addition to the above regular and systematic work of investigation going on at the Station, there have been published during the past year, in addition to an annual report of several hundred pages, seven bulletins, with an aggregate of 173 pages, 45,000 copies of which in all have been distributed among the farmers of the State; while the correspondence has steadily and rapidly increased from a total of less than 500 letters in 1887 to over 2,000 during the past year, many of these letters of inquiry necessitating study and investigation.

From the above statement it will be seen that the Experiment Station is actively engaged in the work for which it was most wisely established, "for the purpose of promoting every branch of agriculture by scientific investigation and experiment," and that its work is being more and more appreciated by the people.

This statement presents a general view of the necessary routine work of the Station, and outlines the principal lines of investigation upon which we are engaged. That any particular branch of work appears to be neglected, should not be understood as evidence of lack of just appreciation of its absolute or relative importance, but an indication only that far more must for a time be left undone than it is possible to accomplish with present means and facilities. Those familiar from personal experience with the work of investigation need not to be reminded that few practical conclusions of much value can be hastily secured, and the influence of such persons should be exerted upon every suitable occasion, on the one hand, to impress upon others reasonable patience in awaiting results, and upon the other, by every legitimate means to dissuade the publishing of immature conclusions. A hasty glance even will suffice to convince anyone that upon many of the leading questions relating to agricultural matters the solutions were regarded as more clearly established a quarter of a century ago than they are to-day, and indeed it is perhaps true that most of the rules of practice which appear so clearly defined, will, by further investigation, be found to require more or less modification.

While it is unquestionably true that the aggregate of agricultural science has within a quarter of a century been vastly increased, that in consequence our agricultural practice is to-day far more rational and intelligent, there has resulted also an increased demand upon science for more and more light, and often these demands are so pressing, persistent and unreasonable that hasty conclusions from limited data are given out only to be disproved in practice, while, as a consequence, science is thereby discredited and dishonored.

There are perhaps few of our experiment stations to which are not frequently addressed questions, and very practical questions too, to which an answer is expected by return mail; and yet it is safe to say that even if agricultural science continues to advance with its recent enormous strides, another twenty-five years will pass before these questions can be satisfactorily answered. At present the only reply must be, "I don't know," in short or at greater length to the same purport.

THE FUTURE OF AMERICAN AGRICULTURE.

An address upon the above subject delivered at one of the fairs appeared to attract considerable attention and very favorable comment upon the whole, and since there is no subject of more general interest to the farmer, it seems best to present in less ephemeral form the facts upon which was based a favorable conclusion as to the future of our agricultural industry, in the wish that their consideration may give renewed hope, and help to strengthen the growing conviction among many of our people that the agricultural depression which has existed during recent years, and relief from which to many others has appeared distant or hopeless, is destined at an early day to give way to a degree of prosperity unequaled in our history as a people.

For one, I do not see any evidence which justifies such alarming predictions as to the future of American agriculture. That agriculture of late years and at present has failed to bring the pecuniary returns which it might, all must admit, but that the prospects for the future of agriculture in this State and in this country are forbidding, I do not believe. In fact, at the risk of being thought optimistic, I wish to be placed on record as predicting that, to the best of my knowledge and belief, we are about entering upon an era of agricultural prosperity, the like of which, as a people, we have never known, and which prosperity is to be permanent.

I feel sure I can not present anything which is of greater practical value to you to-day than to briefly give you the reasons for the faith which is in me, and I hope that I may succeed in convincing you that what Washington declared to be "the most noble, the most healthful and the most useful occupation of man" is likely soon also to become, all things considered, the most profitable.

First, then, let us seek to learn the cause or causes of the present agricultural depression, since, obviously, if it or they can be removed the depression must cease.

Now, we find, upon investigation, that in this State of New York, at least, such depression is not due to a diminution in the fertility of our lands. This is so important a factor in the prosperity which I predict for the future that I know you will be willing to listen to the evidence in its support.

AVERAGE YIELD OF PRINCIPAL FARM CROPS IN NEW YORK STATE SINCE 1861 BY BUSHELS, POUNDS AND PER CENT.

	Corn, bushels.	Wheat, bushels.	Rye, bushels.	Oats, bushels.	Barley, bushels.	Buckwheat, bushels.	Potatoes, bushels.	Hay, pounds.	Tobacco, pounds.
1862-1870	30.20	14.96	15.17	30.32	22.33	19.77	103.1	2516	918
1871-1879	32.09	14.90	13.90	33.00	22.15	18.42	81.7	2404	919
1880-1888	29.91	14.82	11.94	28.84	22.66	13.40	77.7	2222	1346
1862-1870	100	100	100	100	100	100	100	100	100
1871-1876	109	99.8	91.6	108.8	99.2	99.2	79.2	95.6	100.1
1880-1888	99	99.3	78.7	95.1	101.0	67.8	75.3	80.3	146.6

Value of hay crop in New York in 1888, \$61,051,016=50.3 per cent of aggregate value of all crops.

Value of cereal, potato and tobacco crop in New York in 1888, \$60,282,841=49.7 per cent of aggregate value of all crops.

Acreage in hay in New York in 1888, 4,933,415=55 per cent of total acreage in all crops.

Acreage in all other crops in 1888, 4,033,903=45 per cent of total acreage in all crops.

If we take the average yield of our leading farm crops, corn, wheat, oats, potatoes and hay for the past quarter of a century and divide this period into those from 1862 to '70; 1871 to '79; and 1880 to '88, we find that the average acreage yield of these five crops, the aggregate value of which is 92 per cent of the total value of our leading farm crops, had fallen off but 1.6 per cent during the second period from the average yield during the first period; and the average yield of the third period was within 8.6 per cent of what it was during the first; and this diminished yield is perhaps due in great measure to less careful cultivation which the low prices of farm products seemed in many cases to excuse, if they did not justify.

On the other hand the average market value of these five crops was, during the second period mentioned, only 75.6 per cent of what it was in the first, and during the third period dropped to an average of only 66.9 per cent of what these crops upon the average sold for during the first period. In view of this great falling off in prices it appears to me needless to seek further for causes of the recent and present depression, and I think that no one can doubt that, with a restoration of prices to something approximating what they were, a revival in agriculture would speedily follow, and gladness would take the place of despondency.

But it seems to me, quite without warrant of fact, to be almost universally concluded that such restoration of prices can not in the future be hoped for, and upon every hand we hear it said that "overproduction" is the cause of all our woes, and that, as this is likely to continue indefinitely, there is no hope of future escape from our present condition through better prices, but only through greater economy in production.

This is a matter of extremest moment, and deserving our most careful consideration. For myself I can not accept either the explanation wholly of "overproduction" nor the conclusion that it is long to continue.

To me it seems that this overproduction is relative rather than actual, that it is determined rather by the ability to purchase than by the actual needs of the consumer. To take for illustration our manufactures, certainly there is of these products of labor an enormous supply, but does this in fact surpass or as yet even equal the reasonable desires or legitimate needs of our people? What woman would not be pleased to-day to add a new gown to her wardrobe or a new bonnet. What man of us who would not find a new suit of clothes, if not an actual necessity, at least convenient — of all these implements here on exhibition, how few would remain unsold if what appear more urgent demands for absolute necessities did not compel the farmer to careful deliberation over his expenditures.

But to return to agricultural products, let me give an illustration, and I purposely select a product partly the result of agricultural and partly of the manufacturing industry, also a product almost wholly imported and from countries with which we have but very little reciprocal commerce, so that it would naturally happen that such a product would perhaps best illustrate the increase of the country not only in total but per capita consumption, and best illustrate the fact that perhaps no people on the earth are to-day so well provided with the necessities or even luxuries of living as are we.

Now, during the decade before the present century, viz., from 1790 to 1800 the annual per capita consumption of sugar in the United States was less than ten pounds (9.65). In 1840 it had increased to only fifteen pounds. It doubled during the next twenty years, being thirty-one in 1850, and during the past thirty years it has again nearly doubled, since the present annual per capita consumption of sugar in this country is nearly or quite sixty pounds. Can any one believe that with such a record there is reason to question the general prosperity of the country?

As with sugar, so is it with many another article of consumption by our people. It is estimated that the per capita consumption of breadstuffs amounts annually to an equivalent of fully eight bushels of grain, mainly wheat and corn, "making the fullest bread ration of any nation in the world," as the statistician of the department of agriculture declares. Indeed it is proverbial that as a people we are almost prodigal in our expenditures for food supplies. But I wish to call attention to the several points which to me appear to prove that we are upon the eve of what I believe will prove the golden age of our agriculture.

First. The population of the country is very rapidly increasing; from 1860 to 1870 it increased twenty-three per cent; and from 1870 to 1880, thirty per cent; so that, if the same increase is continued, as there appears no reason to doubt, the present census will show a population of 65,200,000; but the increase of those living in cities has been more rapid. There were in 1880 nearly thirteen times as many people in the United States as in 1790, but over eighty-six times as many living in cities in 1880 as in 1790. The increase of population was from 1860 to 1870 twenty-three per cent; of those living in cities, fifty-nine per cent; the increase of population from 1870 to 1880 was thirty per cent; but of those living in cities forty per cent; from 1860 to 1880 the increase in population was sixty per cent, but of those living in cities, 123 per cent. Nearly one-fourth of all our people live in cities, and since then the number has vastly increased, and I think relatively so. We see then that agriculturally the consumers are increasing far more rapidly than the producers.

Second. The number of farms in the United States has nearly doubled (ninety-six per cent increase) from 1860 to 1880, while the average acreage in the farms has diminished during this same period thirty-three per cent; both facts of very great significance as evidence that the area of arable land was diminished relative to the increase in the number of those who desire to engage in agriculture.

Third. While the area in farms increased from 1860 to 1880 thirty-two per cent, the improved land in farms increased seventy-five per cent, showing that increase of tillable lands was mainly secured by improving lands already occupied.

Fourth. While the improvements of lands has gone on rapidly, the farms have been growing steadily smaller, the improved lands in farms having fallen off from 1860 to 1880 eleven per cent, while the unimproved land on farms diminished forty-seven per cent.

Fifth. And to this I call your particular attention in connection with this so-called overproduction. The statistician of the department of agriculture, in a recent report, after an extended investigation of the subject of agriculture exports, says: "It appears that the proportion of all agricultural products exported is about ten per cent, or, exclusive of cotton and tobacco, five per cent."

Now of our agricultural products exported there are four only which constitute nearly ninety-two per cent of the total value of exports, viz.: Corn, wheat, meats and cotton, but even including these, we consume in this country ninety per cent of the products of our agriculture.

Sixth. I have taken the statistics of production of our leading crops during the years 1866 to 1886 both inclusive, and, dividing this into three periods of seven years each, I find that during the second period the total crop production increased practically the same upon the average with the increase in acreage devoted to these crops over the average and yield of the first period. The increase in acreage averaged thirty-five per cent and that of crops thirty-three per cent more during the second than during the first period.

But during the third period the average increase in acreage was forty-five per cent while the average increase of crops was but thirty-five per cent, thus showing a falling off in average acreage production of the leading crops of the United States of nearly 7.5 per cent.

I might stop here, but as the reason for my faith is here in a nutshell, I know you will endure a brief recapitulation of the foregoing points:

First. Our population is increasing at the rate of nearly three per cent a year.

Second. Our consumers of agricultural products are increasing at a more rapid rate by far than are the producers.

Third. At present we consume ninety per cent of our agricultural products.

Fourth. The average crop producing capacity of our soils is diminishing in the United States.

Fifth. From 1866 to '86 the area devoted to our leading crops increased 127 per cent, while our population increased during this period sixty-nine per cent, and while everything points to the fact that our arable land is largely occupied, as witness the haste to possess Oklahoma, and the efforts to reclaim by irrigation the arid regions of the west, there appears to be no evidence that our population will not steadily increase.

At present ninety per cent of our products are consumed at home, or ninety-five per cent not counting tobacco and cotton. It scarcely appears as a hazardous prediction that within five years, and perhaps even sooner, the home demand may fully equal the supply of our agricultural products, and then, if they are wise, the farmers of the country will be the masters of the situation, and those words of Napoleon that "agriculture is the basis and strength of all national prosperity," will be recognized as sober truth.

Awaiting then, as I think we may, in confident hope the good time so near at hand, what, we may stop to inquire, are the duties of the hour; and I would say first, study economy in production. Suppose you ask any of the shopkeepers of Geneva whether they know what their nails, the sugar, the cloth which they will sell you cost them, would they not think you either jesting or recently escaped from Willard Asylum? But can our farmers tell these same dealers what their milk, butter, eggs, hay, oats or corn has cost them to produce? Can our dairymen tell the actual or relative value of the several members of their herd, which are a source of profit, which pay their way, which are being kept at actual loss? Does the farmer who is drawing his hay to market reflect that every ton of hay contains of fertilizing constituents, as Dr. Goessmann, of Massachusetts, says, from five dollars and ninety-three cents to nine dollars and sixty cents worth of fertilizing constituents, or, as an average for the last quarter of a century shows in New York, six dollars and thirty-seven cents worth in every ten dollars worth of hay sold? And yet our farms need this very fertilizing material which this hay contains, and which, by feeding it, might be kept upon the farms and largely increase the fertility of our lands.

Never, perhaps, in the history of the world, has there been such an intellectual awakening among those engaged in agricultural pursuits as at this time. Agricultural papers abound, agricultural colleges and experiment stations, farmers' institutes and clubs, the grange, alliance and numberless other agencies testify to this great uprising. And yet with all this multiplicity of sources of information there is reason to fear that our actual practice does not keep pace with our acquired knowledge.

But I wish to say a word as to what seems to me the wisest policy to pursue for the immediate future. We have seen that if there is any overproduction it must obviously be of those products which are exported and they are very few in number; corn, wheat, meats and cotton constituting, as I have said, ninety-two per cent of our exports. On the other hand, we import, annually, over $300,000,000 worth of agricultural products, many of which may be, I am sure, profitably produced in this country, for example, sugar and molasses, wool, hides, barley, fibers and horses, these alone aggregating $170,000,000 in value, or fifty-six per cent of our imported agricultural products.

To me it would seem wise to diminish by a little the production of those products which are in excess of our wants, and seek to produce those products for which the demand exceeds the home supply.

Let me mention only the matter of sugar and molasses, for which we annually expend about $100,000,000. I have a sample of sugar in my possession representing the result of an extended experiment with several hundred tons of cane, which I have no doubt can be produced at an expense not exceeding one cent a pound; and, within twenty-five miles of where we now are, was produced, at great profit, a sample of syrup as good or better than any sold in the State of New York.

I should like to have said something about our roads and highways but I forbear, only observing that probably no civilized and few uncivilized countries have roads so poor as ours. While in many and most things we have, as a people, made enormous strides in advance and are the wonder of the world for our achievements, no progress has been made in the matter of our common roads for half century. Their present condition is anomaly and a reproach to us as people, which should not be suffered to continue.

I regret to observe that several of our newspapers refer to the earnest recommendations of our chief executive in behalf of the improvement of our roads as "the pet scheme of the Governor." Now, in what I have to say to-day, I desire to avoid any suspicion of politics, while recognizing the fact that everything that has to do with production and consumption is a question inevitably of political economy. But, in reference to this matter of roads, it seems to me that it should be for the future "the pet scheme" of every man, whether Democrat, Republican or mugwump, and of every woman and child also, until some action shall be taken looking to their permanent improvement. Within a week I had the pleasure of riding over a stretch of macadamized road nine miles in length, which within two years has been laid in one of the New England States, and I could not but think that such a road, like a thing of beauty, was a joy forever. Consider for a moment the enormous tax which our roads involve, without considering even the millions upon millions of dollars which during the past half century have been expended upon our roads without at present any evidence of improvement in their condition; consider the wear and tear of horses, harnesses and vehicles which the condition of our roads for months in the year involves; consider the loss of time, which also is money, and the wear and tear upon one's patience, for I doubt whether grace has been given to any sufficient to sustain him for a ten-mile drive over any of our roads during several months of the year.

I should like to have spoken of the money value of the beautiful about us, in trees and lawns and flowers. Do not your judges one and all give their prizes, other things being equal, always to that which is most beautiful. What piece of property animate or inanimate is not enhanced by possessing the elements of beauty?

Never was there a time when those words of Job and Solomon—"The price of wisdom is above rubies," and "how much better is wisdom than gold"—were so true as to-day. "Knowledge is power" not only, but it is wealth.

As I would urge upon the farmer that he cultivate his fields, rather than to abandon them to weeds and brambles, so would I urge upon them, especially the young men, that they cultivate their minds and fill them with lofty thoughts, for no mind can long remain quite empty, but like an untenanted house, rats and bats and owls must soon possess it.

The importance of the grass crop may be, and we think generally is, overlooked by most people. The value of our hay crop in New York State was, in 1888, more than three-fourths of a million dollars greater than that of all the corn, wheat, rye, barley, oats, buckwheat and tobacco crops combined. Counting all these (including hay) at 100 per cent., the hay crop comprised 53.2 per cent., and all the others only 46.8 per cent.

But more striking even than this is the rate at which the hay crop has been falling off while the most important of the other crops have nearly or quite held their own.

This steady decline in the hay crop has gone on, in part, no doubt from the fact that the average farmer uses his manure on the cultivated crops, which the hay crop has thus been regularly contributing to support, while itself neglected. Not only is the value greater, but the acreage of the hay crop stands to that of all the others, as fifty-five to forty-five.

This showing does not include pasture grass, which supports almost the whole of our dairy, sheep and growing stock about half the year, and is second to no other than the hay crop itself, if indeed it is second in value to that.

It seems desirable that some special attention be given to improved method of culture, to finding out the best species for hay and grazing and, finally, for diffusing a better knowledge of some of the forage species of this great family of useful plants.

BULLETINS AND CORRESPONDENCE.

Since the publication of the last annual report there have been published seven bulletins, containing an aggregate of 189 pages, upon the following subjects:

Bulletin No. 19.—*June*, 1890.

A method for the determination of fat in milk and cream.

Bulletin No. 20.—*June*, 1890.

Pedigrees of dairy animals under investigation.

Bulletin No. 21.—*July*, 1890.

Testing of dairy breeds:
  Introductory.
  Foods.

Details of feeding.
Weights each month.
Summaries.

Bulletin No. 22.— *August*, 1890.

Pig feeding experiments without milk:
Results with corn ensilage.
Rations with and without salt.
Feeding prickly comfrey.

Bulletin No. 23.— *September*, 1890.

Comparative test of cows:
Comparison of rations.
Feeding trial of cows.
Loss in keeping manure.

Bulletin No. 24.— *October*, 1890.

Experiments with strawberries.
Description of varieties.
The most profitable varieties.
The influence of pollen.
Reports from other sections.

Bulletin No. 25.— *November*, 1890.

The New York State Fertilizer Control Station:
Fertilizer analyses.
Introductory.

Of each of these Bulletins 5,000 copies have been sent out, mainly among the farmers of the State, with the exception of Bulletin 25, of which 10,000 copies have been distributed, and it is much to be desired that a far larger edition should be hereafter published, in order that the work of the Station may become known to those in behalf of whom it is being done.

It would be entirely practicable to increase our Bulletin list to 50,000, since even with an edition of that number, only one farmer in eight would secure bulletins.

The correspondence of the Station has very rapidly increased during the past few years, from a total of less than 500 letters in 1887 to over 2,000 during the past year, and as many of these letters call for laboratory or other investigations, it will be seen that this increase in correspondence has very materially added not alone to the merely clerical but the other work of the Station, while it does not appear in either bulletins or reports, and yet it is perhaps the most immediately useful work which the Station can perform for agriculture.

There have also been distributed from the Station two addresses, the one upon "How to Make Dairying More Profitable," and the other upon "The Future of Agriculture," besides several circulars concerning the work of the Station or upon other matters of general interest to our farmers.

While, therefore, reasonable effort has been made, according to our means, to publish the results of our work, the increased demand which has of late years arisen, for information relating to each of the varied agricultural interests of the State, calls for greatly increased facilities for meeting these most reasonable demands.

It is also to be considered that the Empire State, large as it is in actual area, has within its borders a diversity of agricultural interests, greater perhaps by far than any other State in the Union, and each of these interests are bristling with practical problems which for their solution require months, or it may be years, of patient, careful research. Such is the precise work for which, at least, this Station was wisely established, "for the purpose of promoting every branch of agriculture by scientific investigation and experiment," and in the performance of this duty, by law devolving upon this Station, there is urgent need of very great additions to the present resources of the Station, both in men competent to carry forward the work of investigation and of money with which to provide them with their necessary equipment of laboratories, libraries and apparatus.

GIFTS TO THE STATION.

January 8. Albertson & Hobbs, Bridgeport, Ind., cions of the Ronk apple.

January 20. Tennessee Experiment Station, Knoxville, Tenn., tubers of New Queen, Early Ohio and Illinois potatoes.

January 23. W. Atlee, Burpee & Co., Philadelphia, Pa., a collection of vegetable seeds and twenty-four plants of Burpee's Louise strawberry.

February 10. H. A. March, Fidalgo, Wash., one package of Perfection No. 9 cauliflower seed.

February 10. College of Agriculture of California, Berkeley, samples of four varieties of wheat, and four varieties of flax seed.

February 11. Wm. M. Munson, Ithaca, N. Y., one package of tomato seed.

Febuary 12. Peter Henderson & Co., New York, N. Y., five packages of vegetable seed.

February 13. I. F. Tillinghast, LaPlume, Pa., eight packages of garden seeds.

February 13. F. S. Peer, Mount Morris, N. Y., one box of greenhouse plants.

February 24. W. L. Eastman, Ovid, N. Y., three quarts of wheat for seed.

March 3. A. B. Lovett, Geneva, N. Y., a roll of asbestos paper for use in the Geneva germinator.

March 4. Henry Lutts, Youngstown, N. Y., four varieties of plum cions.

March 12. Dean Ferris, Peekskill, N. Y., sample of sweet corn for seed.

March 13. A. M. Nichols, Granville, Ohio, one package of tomato seed.

March 14. Rhode Island Experiment Station, Kingston, two pounds each of Early Rose and Early Beauty of Hebron potatoes.

March 24. P. H. Foster, Babylon, N. Y., cions of the Exeter pear, a new syringa and one variety each of grape, apple and pear.

March 24. F. Q. White, Yorktown, N. Y., cions of a seedling peach.

March 24. Northrup, Braslan & Goodwin Co., Minneapolis, Minn., ten packets of vegetable seeds.

March 24. South Dakota Experiment Station, Brookings, five varieties of wheat and two varieties of potatoes.

March 25. Ohio Experiment Station, Columbus, two pounds each of three varieties of potatoes.

March 25. T. V. Munson, Denison, Tex., twenty-four plants of Parker Earle strawberry.

March 25. Duncan Rhind, Canandaigua, N. Y., one package of tomato seed.

March 26. A. N. Jones, LeRoy, N. Y., one package of beans for seed.

March 28. Isaac Hicks & Sons, Westbury Station, N. Y., cions of four varieties of apples.

March 28. D. G. Edmiston, Adrian, Mich., cions of the Morris red apple.

March 29. C. P. Bauer, Judsonia, Ark., twenty-five plants of Mitchell's Early strawberry and two plants of Bauer strawberry.

March 29. Massachusetts Experiment Station, Amherst, Mass., two pounds each of Beauty of Hebron and Early Rose potatoes.

March 31. Pennsylvania Experiment Station, College Station, Penn., tubers of Beauty of Hebron and Burbank potatoes.

March 31. Kentucky Experiment Station, Lexington, Ky., tubers of Beauty of Hebron, Early Rose and Burbank potatoes.

April 2. Wm. G. Voorheis, South Frankfort, Mich., cions of four varieties of apples.

April 4. Marcus Duboise, Newburgh, N. Y., plants of seedling strawberry.

April 4. Theron E. Platt, Newtown, Conn., tubers of three varieties of potatoes.

April 7. Phil Strubler, Naperville, Ill., twenty-four plants of Oliver strawberry.

April 7. Slaymaker & Son, Dover, Del., plants of three varieties of strawberries.

April 9. Central Experimental Farm, Ottawa, Canada, eleven varieties of wheat.

April 9. Uriah Mellott, Rays Hill, Penn., apple cions.

April 9. Geo. Townsend, Gordon, Ohio, apple cions and strawberry plants.

April 11. Josiah G. Youngken, Richlandtown, Penn., twenty-two cions of pears and apples.

April 11. A. A. Terry, Crescent City, Iowa, two trees of Hawkeye plum.

April 11. A. C. Clark, Tyre, N. Y., two seedling apples and one seedling pear.

April 11. J. W. Latimer, Pleasanton, Kans., twenty-five plants of Kimsley No. 49 strawberry.

April 11. Geo. W. Trowbridge, Crestone, Ohio, twenty-four plants of Marvel strawberry.

April 11. J. T. Lovett & Co., Little Silver, N. J., twelve strawberry plants, three blackberry plants, and six black raspberry plants.

April 12. M. F. Pierson, Seneca Castle, N. Y., apple and pear cions, and strawberry and raspberry plants.

April 14. Luther Burbank, Santa Rosa, Cal., sample of new bean.

April 14. B. O. Curtis, Paris, Ill., strawberry plants.

April 14. West Jersey Nursery Co , Bridgeton, N. J., raspberry and strawberry plants.

April 15. J. J. Measer, Hutchingson, Kans., cions of weeping mulberry, cut-leaf mulberry and seedling apple.

April 15. Jacob C. Bauer, Judsonia, Ark., twelve strawberry plants.

April 15. E. M. Buechly, Greenville, Ohio, eighteen strawberry and blackberry plants.

April 15. G. J. Emeny, Fulton, N. Y., one Kendrick feed and ensilage cutter.

April 16. Department of Agriculture, Washington, D. C., thirteen varieties of osier willow cuttings from Austria, and seeds of prunus subcordata from California.

April 18 M. Crawford, Cuyahoga Falls, Ohio, strawberry plants.

April 18. Nebraska Experiment Station, Lincoln, Nebraska, a collection of different varieties of potatoes.

April 21. W. H. Phillips, Staunton, Ind., twenty-five strawberry plants.

April 21. W. F. Allen, Jr., Allen, Md., twenty-four strawberry plants.

April 22. G. C. Brackett, Lawrence, Kans., raspberry plants.

April 21. H. A. Jones, Himrods, N. Y., pear, plum and peach trees, two of each.

April 21. L. M. Macomber, North Ferrisburgh, Vt., ten plum trees and two raspberry plants.

April 22. J. S. Pumphery, Celina, Ohio, apple cions (unnamed) and raspberry seedlings.

April 22. J. D. Adams, Mapleton, N. Y., cions of seedling pear; also cions of two varieties of apples.

April 23. W. W. Farnsworth, Waterville, Ohio, plants of seedling raspberry.

April 23. John Hazelton, Delaware, Ohio, strawberry plants.

April 23. S. E. Hall, Cherry Valley, Ill., twenty-five strawberry plants.

April 25. S. Scofield, Ridgeway, N. Y., two trees each of nine varieties of peach, and one of plum.

April 26. O. H. Will, Bismarck, North Dakota, a package of corn for seed.

April 26. Missouri Experiment Station, Columbia, tubers of four varieties of potatoes.

April 26. E. L. Smith, South Schodack, N. Y., cions of a seedling apple.

April 26. Dr. Henry Foster, Clifton Springs, N. Y., one-half bushel of red-cob corn.

April 26. Chief signal officer, Washington, D. C., his reports for 1886, 1887 and 1888, and extract No. 26 from report of 1886.

April 28. J. A. Salzer Seed Co., La Crosse, Wis., twenty-five eyes of the Gov. Rusk potato.

April 28. Minnesota Experiment Station, St. Anthony Park, tubers of three varieties of potatoes.

April 29. Albert & Clark, Cambridge, Md., thirteen plants of Bessie strawberry.

April 29. C. E. Chapman, Peruville, N. Y., tubers of four varieties of potatoes.

May 2. John Charlton, Rochester, N. Y., six gooseberry plants.

May 7. Vermont Experiment Station, Burlington, tubers of three varieties of potatoes.

May 9. Iowa Experiment Station, Ames, tubers of four varieties of potatoes.

May 10. A. Hammond, Geneva, N. Y., two trees of the Rood plum.

May 24. F. S. Peer, Mount Morris, N. Y., a choice collection of roses, begonias, chrysanthemums, geraniums, etc.

May 31. John Little, Granton, Ontario, Canada, strawberry plants.

June 6. Jack Hatt, Argentine, Mich., samples of three varieties of beans.

June 11. W. Bentzien, Troupsburg, N. Y., a packet of cluster buckwheat.

August 1. T. C. Maxwell & Bro., Geneva, N. Y., severa volumes of the Holstein-Friesian Register.

August 3. J. R. Hawkins, Mountainville, N. Y., twenty-five plants of the Banquet strawberry.

September 15. Adna H. Corser, Lyndonville, N. Y., a package of wheat.

September 24. James Carter & Co., London, Eng., samples of eleven of their new cross-bred wheats.

September 24. S. L. Goodale, Saco, Me., a package of vetch seed.

November 6. Edward Smith, Geneva, N. Y., one tree of Bolleana poplar.

November 15. Josiah Shull, Ilion, N. Y., one vine each of his seedling white grape, and Iona grape.

December 12. Hugo Beyer, New London, Iowa, seven strawberry plants.

December —. Truman Baker & Co., Earlville, N. Y., Devon bull and heifer.

December —. Adelbert F. Bronson, Vernon, N. Y., Devon heifer.

December —. J. A. Pomeroy, Sidney Center, N. Y., Devon heifer.

December —. B. F. Peck & Son, East Bethany, N. Y., Devon heifer.

NEWSPAPERS AND PERIODICALS PRESENTED TO THE STATION.

Agricultural Epitomist, Indianapolis, Ind.
Albany Weekly Journal, Albany, N. Y.
American Agriculturist, New York, N. Y.
American Cultivator, Boston, Mass.
American Dairyman, New York, N. Y.
American Farmer, Baltimore, Md.
American Garden, New York, N. Y.
American Grange Bulletin, Cincinnati, Ohio.
American Grocer, New York, N. Y.
American Rural Home, Rochester, N. Y.
American Veterinary Review, New York, N. Y.
Baltimore Sun, Baltimore, Md.

Canadian Horticulturist, Grimsby, Canada.
Chautauqua Farmer, Dunkirk, N. Y.
Country Gentleman, Albany, N. Y.
Creamery Journal, Waterloo, Iowa.
Engineering and Mining Journal, New York, N. Y.
Every Week, Angelica, N. Y.
Fanciers' Journal, Philadelphia, Penn.
Farm and Fireside, Philadelphia, Penn.
Farm and Home, Springfield, Mass.
Farmer and New Farm, Baltimore, Md.
Farmers' Advocate, London, Canada.
Farmers' Club Journal, Hornellsville, N. Y.
Farmer's Home, Dayton, Ohio.
Farm Implement News, Chicago, Ill.
Farm Journal, Philadelphia, Penn.
Farm Life, Rochester, N. Y.
Florists' Exchange, New York, N. Y.
Garden and Forest, New York, N. Y.
Grange Exponent and Rural and Poultry World, Syracuse, N. Y.
Hoard's Dairyman, Fort Atkinson, Wis.
Holstein-Friesian Register, Brattleboro, Vt.
Home and Farm, Louisville, Ky.
Horticultural Art Journal, Rochester, N. Y.
Husbandman, Elmira, N. Y.
Jersey Bulletin, Indianapolis, Ind.
Louisiana Planter and Sugar Manufacturer, New Orleans, La.
Maritime Agriculturist, Saint John, N. B.
Maryland Farmer, Baltimore, Md.
Massachusetts Ploughman, Boston, Mass.
Mirror and Farmer, Manchester, N. H.
Nebraska Farmer, Lincoln, Neb.
New Dairy, New York, N. Y.
New England Farmer, Boston, Mass.
Northwestern Farmer and Breeder, Saint Paul, Minn.
Once a Month, Winthrop, Me.
Orange County Farmer, Port Jervis, N. Y.
Orange Judd Farmer, Chicago, Ill.
Peninsula Farmer, Federalsburg, Md.
Poultry Monthly, Albany, N. Y.
Poultry Review, Syracuse, N. Y.

Practical Electricity, Boston, Mass.
Practical Farmer, Philadelphia, Penn.
Progressive Farmer, Pueblo, Colo.
Review and Farmer, Pueblo, Colo.
Rural New Yorker, New York, N. Y.
Shorthorn Gazette, Indianapolis, Ind.
Southern Cultivator, Atlanta, Ga.
Sugar Bowl and Farm Journal, New Orleans, La.
Swine Breeders' Journal, Indianapolis, Ind.
Texas Stockman, San Antonio, Texas.
Vick's Illustrated Monthly Magazine, Rochester, N. Y.
Washington Book Chronicle, Washington, D. C.
Weekly Press, Philadelphia, Penn.
Weekly World, New York, N. Y.
Western Farmer and Stockman, Sioux City, Iowa.
Western Plowman, Moline, Ill.
Western Resources, Lincoln, Neb.
Western Swineherd, Geneseo, Ill.

Report of the First Assistant.*

During the past year experiments in poultry feeding have been continued, some feeding experiments with pigs have been made, and tests of selected and of some new varieties of sorghum continued. Owing to the necessity of considerable miscellaneous work but little time could be given to the soil experiments. Some partial results are, however, on record.

Poultry.

Feeding experiments with such an animal as the hen, to whom almost any stray insect or worm is food, are much more difficult of absolute control than those with cattle and swine. While fowls may, for short periods, be kept in very small pens, it is not possible to keep laying hens, when closely confined for a long time, in anything like a normal condition; for a certain amount of liberty and exercise is for them indispensable to good health.

Neither is it possible to form reliable conclusions in regard to egg production from observations extending over only a short period, for this production is encouraged or interrupted by many influences, and especially by the season of the year. Handling and weighing the hens, changing to new quarters or any unusual excitement, especially with the more "nervous" breeds, interferes with the usual development of eggs. Neither is the factor of individuality by any means an unimportant one among hens.

During the feeding experiment here reported the fowls were given as much room as was possible with a close account of their food.

In connection with the study of more or less nitrogenous rations for laying hens, there were fed, during the twelve months ending November fifteenth, four pens of fowls. Two pens, one of smaller and one of larger breeds, had throughout the year a nitrogenous

* Wm. P. Wheeler.

grain ration while the two contrasted pens had during the same time a more carbonaceous ration.

The fowls of contrasted pens were similar in regard to breed, age, and immediate parentage and until five months old were under the same conditions of feed, etc., but for the year preceding this trial were under rations of the same character for each pen respectively as those fed during this last period. The year from which the results are here given included the whole of the second laying season, the fowls being all mature, averaging about seventeen months old when this experiment began.

Pens No. 5 and No. 7 each contained six hens, S. C. W. Leghorns and W. C. B. Polish, and pens No. 6 and No. 8 each contained eight hens, Plymouth Rocks, Light Brahmas and Buff Cochins. Pens 5 and 6 were fed oats, Indian corn on cob, and a mixture of linseed meal, bran and ground oats; and 7 and 8, corn meal, corn on the cob and oats, and all were fed corn ensilage, red clover and sometimes meat scraps.

The moisture in the foods varied somewhat from time to time, but the average composition was for each food as follows:

	Moisture.	Ash.	Fiber.	Crude albumi-noids.	N.-free extract.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Oats	11.70	3.08	10.33	13.80	56.32
Corn meal	16.41	1.32	2.19	11.50	65.04
Corn	15.10	1.37	1.27	10.40	67.15
Mixture until July 15	13.60	4.35	9.47	24.08	43.26
Mixture after July 15	10.40	4.48	7.98	22.40	50.30
Meat scraps	5.40	2.38	.81	58.41	.46
Calf meat	79.60	1.20	.18	17.44	.37
Corn ensilage	70.00	1.32	6.37	3.37	17.60
Red clover	62.70	2.43	11.68	4.92	16.55

The fowls had small but clean and comfortable quarters indoors, and during good weather each pen was allowed an open yard about fifty by ten feet in size. No grass grew in any of the yards, and inasmuch as they had been used, with frequent spading, for poultry during several years, very little animal food could have been found. None of these fowls were troubled with lice or roup.

While with hens in confinement and having continually the same foods, the product of eggs was much less than would probably be obtained from those having variety of food and the liberty of the fields full of insects and worms, the conditions were alike for all in the experiment, and the differences in results are doubtless due to the character of the foods, and are in accord with those obtained before.

The fowls having the more nitrogenous ration were always in better health, and their plumage, except during a short molting period, was always full and glossy, while those having the more carbonaceous ration were oftener sick and their plumage was always ragged and dull, and for some time during the first year the vices of feather pulling and egg eating were common among them.

The product of eggs, however, from the hens having the corn-meal ration was over twentg-eight per cent more in number, and in weight over twenty-four per cent greater, than from those with the more nitrogenous food. With fowls of the smaller breeds, which are considered the better layers, the number of eggs was over fifty-seven per cent higher, and the weight about forty-nine per cent greater than those fed the less nitrogenous ration. During the first laying season these same fowls averaged for the smaller breeds thirty-six per cent more eggs and about forty-two per cent greater weight of eggs with the corn-meal ration, while the larger breeds, which more easily become fat and inactive, gave considerably better returns under the more nitrogenous ration, showing over fourteen and one-half per cent in number, and the same per cent in weight in its favor; but these larger fowls also during the second year gave results slightly in favor of the corn-meal ration. The average size of the eggs from one pen of large fowls was about the same as from the other, but some difference existed between the averages from the smaller fowls. The average weights of all obtained for the year, with the average of those laid by the same fowls the first year, also given for comparison, were as follows:

	Second year.	First year.	
	Weight Ozs.	Weight. Ozs.	
Smaller breeds ...	2.09	1.85	More nitrogenous ration.
Smaller breeds ...	1.99	1.93	More carbonaceous ration.
Larger breeds....	2.21	2.12	More nitrogenous ration.
Larger breeds....	2.24	2.12	More carbonaceous ration.

The average weight of the hens was usually greater for those having the more carbonaceous ration, averaging with the larger fowls nearly a pound more — the average weights per fowl for the whole year and for different times being as follows:

	Average live weight at beginn'g of year.	Average live weight at end of year.	Average live weight during year.	Heaviest weight.	Time of heaviest weight.	Lowest weight.	Time of lowest weight.	Time during which heaviest weight was approximated.
	Lbs.	Lbs	Lbs	Lbs.		Lbs		
Pen No. 5........	3.02	3.55	3.4	3.77	Feb. 15	3.02	Nov. 15	Jan. 15 to Apr. 15
Pen No. 7........	3.64	3.80	3.7	4.33	Feb. 15	2.93	July 15	Jan. 15 to Mar. 15
Pen No. 6........	7.36	6.16	6.5	7.73	Feb 15	5 53	July 15	Jan. 15 to Mar. 15
Pen No. 8........	6.64	6.98	7.4	8.89	Mar. 15	6.38	Aug. 1	Feb. 15 to May 15

The total food and water-free food consumed were very similar in amounts, whether the fowls were under nitrogenous or carbonaceous rations. The chief differences noticeable were: *That the average in No. 7, where the fowls were heavier and laying more than in No. 5, was greater per fowl although the amount for every pound live weight was the same; and that in No. 8, where the fowls were heavier and laying about the same as in No. 6, the amount per fowl was practically the same although the amount consumed per pound live weight was less.* These average results for the whole year were:

	Total food per day per fowl.	Water-free food per day per fowl.	Total food per day per one pound live weight.	Water-free food per day per one pound live weight.	Ration.
	Ounces.	Ounces.	Ounces.	Ounces.	
Smaller breeds	3.01	2.43	.88	.71	More nitrogenous.
Smaller breeds	3.21	2.57	.88	.70	More carbonaceous.
Larger breeds................	4.01	3.30	.62	.51	More nitrogenous.
Larger breeds................	4.00	3.27	.54	.45	More carbonaceous.

The best returns from the food consumed during any period were obtained from April fifteenth to May fifteenth, when the results were as follows:

	Ounces of water-free food consumed per day per pound live weight.	Pounds of water-free food consumed for every pound of eggs produced.	Pounds of water-free food consumed for every dozen of eggs produced.
Smaller breeds (mixture, etc.) ...	.77	3.35	4.71
Larger breeds (mixture, etc.).....	.49	3.32	5.43
Smaller breeds (corn meal, etc.)...	.65	2.60	3.78
Larger breeds (corn meal, etc) ...	.39	3.08	5.16

Although the greatest production of eggs came at about the same time of year from all of the fowls, yet those having the corn-meal ration continued to lay for the longer period.

For certain portions of the year, including the best part of the laying season, the results were in favor of the corn meal with the smaller fowls, and of the more nitrogenous mixture with the larger. Following are some of the average results for these periods.

PERIODS.	Days.	Average Water-free food per day per fowl.	Water-free food consumed to produce one pound of eggs.	Water-free food consumed to produce one dozen of eggs.	Foods.	Breeds.
		Ozs.	Lbs.	Lbs.		
Pen 5, Feb. 15 to June 14...	119	2.39	4.88	6.84	Mixture, corn, oats, etc...	Smaller.
Pen 7, Feb. 15 to June 14...	119	2.61	3.60	5.36	Corn meal, corn, oats, etc.	Smaller.
Pen 6, Feb. 15 to June 14...	119	3.11	4.29	7.11	Mixture, corn, oats, etc...	Larger.
Pen 8, Feb. 15 to June 14...	119	3.04	5.32	9.09	Corn meal, corn, oats, etc.	Larger.
Pen 5, Jan. 15 to July 15...	181	2.27	6.43	9.04	Mixture, corn, oats, etc...	Smaller.
Pen 7, Jan. 15 to July 15...	181	2.55	4.16	6.21	Corn meal, corn, oats, etc.	Smaller.
Pen 6, Jan. 15 to July 15...	181	3.09	5.67	9.38	Mixture, corn, oats, etc...	Larger.
Pen 8, Jan. 15 to July 15...	181	3.11	6.17	10.48	Corn meal, corn, oats, etc.	Larger.

When feeding linseed or cotton-seed meal, we have never succeeded in getting hens to eat readily, for more than a short time, a much more nitrogenous ration than that here fed to pens 5 and 6 except by partially starving or by adding meat to the ration; and we have been unable to keep hens alive and confined together when fed a much larger proportion of corn meal than that given in these trials. At times it was necessary to add meat scraps to the rations, so that the hens might not become too diseased to endure the feeding for the long period. This made the difference between the rations, during too short periods, less than that which usually prevailed.

The results for the year, in periods of one month, calculated to the average for one fowl, are condensed in the following tabulated form. The ratio of albuminoids to carbohydrates given is the proportion of crude albuminoids to the sum of fats and N.-free extract. The average ratio for the year of albuminoids to the sum of carbohydrates with the weight of fats multiplied by $2\frac{1}{2}$ was for Pen 5–1 : 4.39, for Pen 6–1 : 4.23, for Pen 7–1 : 5.60, and for Pen 8–1 : 5.63.

RATIONS — AVERAGE FOR ONE FOWL.

PERIODS.	Mixture, per day.	Corn, per day.	Oats, per day.	Meat scraps, per day.	Corn ensilage, per day.	Red clover, per day.	Crude albuminoids, per day.	Carbohydrates, per day.	Fats, per day.	Ash, per day.	Ratio of crude albuminoids to total carbohydrates.
PEN NO. 5 — LEGHORNS AND POLISH — GRAIN RATION MORE NITROGENOUS.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz	Oz.	Oz.	Oz.	
November 15 to December 16	.83	1.42	.94	......	.07	......	.480	1.864	.154	.084	1:4.2
December 16 to January 15	.58	.84	.99	.27	.17	......	.527	1.403	.206	.076	1:3.1
January 15 to February 15	.64	.88	.74	29	.83	*.26	.566	1.344	.207	.077	1:4.5
February 15 to March 15	.80	.83	.94	......	.33	......	.420	1.460	.130	.080	1:3.8
March 15 to April 15	.86	.83	1.03	......	.33	......	.452	1.609	.140	.086	1:3.9
April 15 to May 15	.81	.79	1.17	.22	.33	......	.573	1.599	.208	.092	1:3.2
May 15 to June 14	.32	.98	.92	......	.33	...	.317	1.371	.111	.061	1:4 7
June 14 to July 15	.45	.83	.75	......	......	.33	.314	1.189	.103	.063	1:4.1
July 15 to August 15	.64	1.10	.94	......	......	.40	.406	1.666	.132	.083	1:4.4
August 15 to September 15	.32	.87	1.01	......	......	.40	.321	1.379	.110	.068	1:4.6
September 15 to October 15	.57	.91	1.12	......	......	.40	.397	1.595	.128	.083	1:4.6
October 15 to November 15	.44	1.39	1.67	......	......	.50	.499	2.177	.172	.103	1:4.7
Average per day for year	.61	.98	1.02	......	......	......	.439	1.554	.150	.080	1:3.88
PEN NO. 6 — BRAHMAS, PLYMOUTH ROCKS AND COCHIN — GRAIN RATION MORE NITROGENOUS.											
November 15 to December 16	1.20	1.45	1.13	......	.12	......	.600	2.149	.186	.108	1:3.9
December 16 to January 15	1.15	1 23	1.43	23	.29	......	.746	2.180	.265	.121	1:3.3
January 15 to February 15	1.33	1.15	1 31	.28	.38	*.20	.820	2.155	.280	.126	1:3.0
February 15 to March 15	1.41	1.25	1.26	......	.37	......	.655	2.214	.197	.122	1:3.7
March 15 to April 15	1.09	.91	1.07	......	.38	......	.519	1.753	.155	.099	1:3.7
April 15 to May 15	1.00	1.04	1.22	.22	.37	......	.652	1.884	.233	.107	1:3.3
May 15 to June 14	.80	1.28	1.27	......	.37	......	.514	1.985	.167	.097	1:4.2
June 14 to July 15	.70	1.08	.88	......	......	.37	.421	1.585	.134	.082	1:4.1
July 15 to August 15	.74	1.37	.92	......	......	.37	.453	1.871	.146	.089	1:4.5
August 15 to September 15	1.14	1.39	1.21	......	......	.37	.585	2.249	.178	.116	1:4.1
September 15 to October 15	1.44	1.26	1.52	......	......	.37	.682	2.486	.200	.139	1:3.9
October 15 to November 15	1.14	1.43	1.87	......	......	.37	.680	2.646	.212	.138	1:4.2
Average per day for year	1.10	1 24	1.27	......	......	......	.611	2.096	.196	.112	1:3.75

RATIONS — AVERAGE FOR ONE FOWL — (*Continued*).

PERIODS.	Corn meal per day.	Corn, per day.	Oats, per day.	Meat scraps, per day.	Corn ensilage, per day.	Red clover, per day.	Crude albuminoids, per day.	Carbohydrates, per day.	Fats, per day.	Ash, per day.	Ratio of crude albuminoids to total carbohydrates.
PEN No. 7 — LEGHORNS AND POLISH — GRAIN RATION MORE CARBONACEOUS.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	
November 15 to December 16	1.23	.75	.90	......	.07	......	.337	1.812	.122	.056	1:5.7
December 16 to January 15	1.36	.57	.95	.27	.17	......	.501	1.832	.211	.064	1:4.1
January 15 to February 15	1.13	.64	.91	.31	.33	*.26	.542	1.737	.218	.066	1:3.6
February 15 to March 15	1.53	.55	1.24	......	.34	......	.416	2.122	.133	.071	1:5.4
March 15 to April 15	1.37	.65	.90	......	.40	......	.354	1.904	.128	.060	1:5.7
April 15 to May 15	1.00	.58	.99	.21	.40	......	.432	1.668	.180	.062	1:4.3
May 15 to June 14	.90	.63	.92	......	.40	......	.301	1.597	.111	.055	1:5.7
June 14 to July 15	.62	.93	.77	......	......	.40	.294	1.528	.110	.054	1:5.6
July 15 to August 15	.70	.97	.86	......	......	.40	.320	1.657	.116	.059	1:5.5
August 15 to September 15	1.02	.62	1.11	......	......	.40	.354	1.771	.125	.066	1:5.4
September 15 to October 15	1.24	.75	1.10	......	......	.40	.392	1.995	.138	.071	1:5.4
October 15 to November 15	1.14	.74	1.11	......	......	.40	.381	1.930	.135	.069	1:5.4
Average per day for year	1.10	.70	.98	......	......	......	.385	1.796	.144	.063	1:5.04
PEN No. 8 — BRAHMAS, PLYMOUTH ROCKS AND COCHIN — GRAIN RATION MORE CARBONACEOUS.											
November 15 to December 16	1.65	1.21	.95	......	.12	......	.442	2.441	.162	.070	1:5.9
December 16 to January 15	2.19	1.17	1.26	.23	.26	......	.691	2.966	.271	.094	1:4 7
January 15 to February 15	2.01	.99	1.12	.28	.38	*.19	.691	2.671	.266	.088	1:4.3
February 15 to March 15	1.79	1.01	1.18	......	.37	......	.486	2.572	.172	.079	1:5:7
March 15 to April 15	1.35	.81	1.10	......	.37	......	.404	2.107	.143	.068	1:5.6
April 15 to May 15	1.22	.47	1.09	.41	.38	......	.581	1.855	.250	.071	1:3.6
May 15 to June 14	1.24	.85	1.00	......	.38	......	.381	1.890	.137	.064	1:5.3
June 14 to July 15	1.03	.90	.86	......	......	.38	.348	1.821	.126	.071	1:5.6
July 15 to August 15	1.17	.83	.96	......	......	.37	.371	1.910	.132	.066	1:5.5
August 15 to September 15	1.71	.83	1.13	......	......	.38	.459	2.268	.140	.071	1:5.3
September 15 to October 15	2.04	.69	1.27	......	......	.38	.501	2.568	.171	.085	1:5.5
October 15 to November 15	1.45	.85	1.29	......	......	.38	.452	2.303	.159	.080	1:5.5
Average per day for year	1.57	.88	1.10	......	......	......	.484	2.281	.177	.076	1:5.08

* Calf meat.

RESULTS — AVERAGE FOR ONE FOWL.

PERIODS.	Number days.	Total food per day.	Total water-free food per day.	Total food per day per one pound live weight.	Total water-free food per day per one pound live weight.	Gain in weight per day.	Per cent gain in weight.	Weight of eggs.	Number of eggs.	Pounds of water-free food to produce one pound eggs.	Pounds of water-free food to produce one dozen eggs.
PEN NO. 5 — LEGHORNS AND POLISH — GRAIN RATION MORE NITROGENOUS.		Oz.	Oz	Oz.	Oz.	Oz.		Oz.		Lbs.	Lbs.
November 15 to December 16	31	3.27	2.76	1.02	.86	+.20	+.20	.92	.50	....	....
December 16 to January 15	30	2.85	2.37	.80	.66	+.15	+.27	5.21	2.83	13.64	18.83
January 15 to February 15	31	3.04	2.25	.82	.61	+.04	+.06	3.26	1.67	21.37	31.29
February 15 to March 15	28	2.90	2.28	.79	.62	—.04	—.07	7.33	3.83	8.77	12.49
March 15 to April 15	31	3.10	2.45	.84	.66	+.02	+.04	12.08	6.33	6.29	9.00
April 15 to May 15	30	3.32	2.76	.92	.77	—.12	—.20	24.71	13.17	3.35	4.71
May 15 to June 14	30	2.55	2.06	.75	.61	—.12	—.21	14.17	7.83	4.36	5.91
June 14 to July 15	31	2.36	1.86	.72	.56	+.05	+.09	2.50	1.33	23.05	32.49
July 15 to August 15	31	3.08	2.52	.93	.76	—.10	—.19	6.15	3.40	12.69	17.20
August 15 to September 15	31	2.61	2.11	.84	.68	—.06	—.11	5.15	2.80	12.72	19.04
September 15 to October 15	30	3.00	2.45	.94	.77	+.11	+.22	0	0	....	....
October 15 to November 15	31	4.00	3.28	1.18	.96	+.14	+.26	0	0	....	....
Total for year	365	.....	......	....	....	......	......	91.48	43.69	....	....
Average per day for year	....	3.01	2.43	.88	.71	......	......	......	......	....	....
PEN NO. 6 — BRAHMAS, PLYMOUTH ROCKS AND COCHIN — GRAIN RATION MORE NITROGENOUS.											
November 15 to December 16	31	3.90	3.27	.57	.48	—.55	—.46	0	.0	....	....
December 16 to January 15	30	4.31	3.56	.62	.52	+.50	+.48	.70	.25	....	....
January 15 to February 15	31	4.65	3.64	.62	.49	+.25	+.23	6.22	2.75	18.13	30.75
February 15 to March 15	28	4.29	3.45	.57	.46	—.21	—.17	13.50	6.25	7.16	11.58
March 15 to April 15	31	3.45	2.73	.49	.39	—.39	—.33	22.97	10.63	3.68	5.97
April 15 to May 15	30	3.85	3.19	.59	.49	—.10	—.09	28.88	12.25	3.32	5.43
May 15 to June 14	30	3.72	3.10	.61	.51	—.29	—.28	20.78	9.88	4.43	7.05
June 14 to July 15	31	3.03	2.49	.53	.44	—.14	—.15	6.44	3.00	11.98	19.29
July 15 to August 15	31	3.40	2.81	.61	.50	+.06	+.09	1.66	.75	....	....
August 15 to September 15	31	4.11	3.44	.71	.60	+.21	+.23	0	0	....	....
September 15 to October 15	30	4.59	3.88	.73	.62	+.22	+.23	4.06	1.75	....	....
October 15 to November 15	31	4.81	4.08	.76	.65	—.17	—.16	3.03	1.38	....	....
Total for year	365	......	......	....	....	......	......	108.24	48.89	....	....
Average per day for year	....	4.01	3.30	.62	.51	......	......	.....	......	....	....

Results — Average for One Fowl.—(*Continued*).

Periods.	Number days.	Total food per day.	Total water-free food per day.	Total food per day per one pound live weight.	Total water-free food per day per one pound live weight.	Gain in weight per day.	Per cent gain in weight.	Weight of eggs.	Number of eggs.	Pounds of water-free food to produce one pound eggs.	Pounds of water-free food to produce one dozen eggs.
Pen No. 7 — Leghorns and Polish — Grain Ration More Carbonaceous.		Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Lbs.	Lbs.
November 15 to December 16	31	2.95	2.45	.80	.66	+.09	+.15	3.33	1.67	....	....
December 16 to January 15	30	3.32	2.74	.83	.69	+.21	+.34	4.50	2.17	18.30	29.45
January 15 to February 15	31	3.58	2.68	.83	.62	+.06	+.09	17.46	8.33	4.76	7.47
February 15 to March 15	28	3.66	2.88	.87	.69	—.13	—.18	20.40	9.29	3.95	6.51
March 15 to April 15	31	3.32	2.56	.83	.64	—.18	—.27	21.65	10.80	3.67	5.50
April 15 to May 15	30	3.18	2.39	.86	.65	—.11	—.18	27.60	14 20	2.60	3.78
May 15 to June 14	30	2.85	2.31	.84	.68	—.18	—.32	16.70	9.20	4.15	5.65
June 14 to July 15	31	2.72	2.19	.88	.71	—.15	—.29	7.25	4.00	9.36	12.72
July 15 to August 15	31	2.93	2 38	.95	.77	+.15	+.32	6.05	3.20	12.18	17.52
August 15 to September 15	31	3.15	2.59	.96	.79	+.08	+.15	8.20	4.20	9.79	14.34
September 15 to October 15	30	3.49	2.88	.97	.80	+.23	+.42	2.80	1.40	....	....
October 15 to November 15	31	3.39	2.79	.89	.73	—.00	—.00	.35	.20	....	....
Total for year	365	......	......	....	....	......	......	136.29	68.66	....	....
Average per day for year	....	3.21	2.57	.88	.70	......	......	......	......	....	....
Pen No. 8 — Brahmas, Plymouth Rocks and Cochin — Grain Ration More Carbonaceous.											
November 15 to December 16	31	3.93	3.26	.58	.48	+.13	+.12	2.53	1.00	....	....
December 16 to January 15	30	5.11	4.21	.68	.56	+.62	+.56	3.28	1.38	....	....
January 15 to February 15	31	4.97	3.87	.58	.46	+.43	+.31	7.19	3.13	16.67	28.71
February 15 to March 15	28	4.35	3.45	.49	.39	—.09	—.06	7.25	3.00	13.33	24.17
March 15 to April 15	31	3.63	2.85	.43	.34	—.29	—.21	9.56	3.88	9.23	17.06
April 15 to May 15	30	3.57	3.04	.46	.39	—.37	—.28	29.66	13.25	3.08	5.16
May 15 to June 14	30	3.47	2.87	.48	.40	—.27	—.23	21.66	9.75	3.98	6.63
June 14 to July 15	31	3.17	2.60	.47	.39	—.31	—.28	15.81	7.25	5.10	8.34
July 15 to August 15	31	3.33	2.75	.52	.43	+.04	+.04	3.97	2.00	21.48	31.98
August 15 to September 15	31	4.05	3.38	.62	.52	+.14	+.14	6.81	3.38	15.41	23.28
September 15 to October 15	30	4.38	3.69	.64	.54	+.12	+.11	4.44	2.12	....	....
October 15 to November 15	31	3.97	3.32	.58	.48	+.05	+.05	0	0	....	....
Total for year	365	......	......	....	....	......	......	112.16	50.14	....	....
Average per day for year	....	4.00	3.27	.54	.45	......	......	......	......	....	....

The product of eggs secured during the second laying season, even with the disadvantage of the same food for two consecutive years, was but little less than that of the first season. There are usually about three months between the first and second laying seasons. If there should be four, the cost of maintenance during that time for hens entirely dependent on the feed box would be, at the ordinary prices of grain, an average of about nineteen cents for the smaller breeds and about twenty-four cents for the larger; so unless pullets can be produced at less cost there would appear little advantage in replacing hens the first year as is so often recommended, except where great difference in the market values of one and two year old fowls exists. With breeding stock of course this question has not been considered.

The results of several feeding experiments indicate that for laying fowls of smaller breeds, Indian corn, or corn meal, can be fed in quite large proportion with a considerable margin in its favor over certain more nitrogenous foods, but that while smaller fowls, even where confined, suffer little serious disadvantage under the ration, larger breeds will not endure for long a very large proportion of corn meal in their feed, and unless at liberty do better with a somewhat more nitrogenous ration.

For exhibition stock a highly nitrogenous ration is to be recommended, except, perhaps, for a short period when extra weight is desired.

From the fact of better "condition" attending the nitrogenous ration and the tendency to have the production of eggs limited to a shorter period, an advantage will doubtless be found in the more nitrogenous and oftener varied ration for breeding stock.

There is no doubt that during the laying period the fowls of both larger and smaller breeds having the corn meal were fatter, for at almost all times during this feeding trial the handling and weights of the birds indicated it.

At the close of the two years' feeding there was not so great difference in the average weights, all the fowls having ceased laying for some time. The fowls were then put in smaller pens and fed the same rations they had been getting, but were allowed all they could eat. After six weeks of this feeding, there not having been opportunity before, many of the hens (nineteen in all) were killed and dissected.

The results obtained show that although there was enough difference between the rations to affect noticeably the appearance and general health of the fowls during the year and to affect the egg yield, there was not enough difference to prevent the hens under the more nitrogenous ration becoming on the average decidedly the fatter when fed to excess.

Only two Leghorn hens were killed, but the results of dissection are here given, together with averages from Polish, Plymouth Rocks and Light Brahmas.

	Leghorn.		Average of two Polish.	Average of three Polish.	Average of three Plymouth Rocks.		Average of three Light Brahmas.	
	More nitrogenous ration.	Less nitrogenous ration.	More nitrogenous ration.	Less nitrogenous ration.	More nitrogenous ration.	Less nitrogenous ration.	More nitrogenous ration.	Less nitrogenous ration.
	Ounces.	Ounces.	Ounces.	Ounces.	Ounces.	Ounces.	Ounces.	Ounces.
Total live weight	46.5	52.0	69.2	59.9	118.1	125.2	128.9	117.5
Loss of blood in killing	1.5	2.0	2.2	1.6	3.1	3.2	2.8	3.2
Weight of feathers	4.4	4.0	4.7	4.4	6.3	6.1	5.8	7.1
Total dressed weight	37.0	39.0	53.7	47.1	94.2	101.4	106.4	94.0
Weight of gizzard, empty	1.4	1.4	1.9	1.5	2.7	2.7	3.0	2.8
Weight of heart	.2	.2	.2	.2	.4	.4	.4	.5
Weight of liver	.6	1.1	1.1	1.4	2.0	1.7	1.5	2.0
Total weight of intestines, crop, etc	4.0	7.6	7.6	6.5	14.5	14.4	13.9	13.2
Weight of fat	4.2	3.6	9.1	4.9	23.9	29.0	32.1	19.1
Weight of skin	3.1	3.4	5.6	4.3	8.4	8.2	10.2	9.3
Weight of lean meat	21.8	23.8	26.3	25.3	44.5	46.7	44.9	45.9
Weight of head and shanks	2.5	3.0	4.6	4.8	6.2	6.9	7.1	7.6
Weight of bones	3.1	3.5	4.6	4.5	6.1	6.6	6.9	7.2
Per cent of live weight as dressed weight	79.6	75.0	77.6	78.6	79.8	81.0	82.5	80.0
Head and shanks, per cent of dressed weight	6.8	7.7	8.6	10.2	6.6	6.8	6.7	8.1
Lean meat, per cent of dressed weight	58.9	61.0	49.0	53.7	47.2	46.0	42.2	48.8
Fat, per cent of dressed weight	11.4	9.2	16.9	10.4	25.4	28.6	30.2	20.3
Skin, per cent of dressed weight	8.4	8.6	10.5	9.1	8.9	8.1	9.6	9.9
Bones, per cent of dressed weight	8.4	9.0	8.6	9.6	6.5	6.5	6.5	7.7

	AVERAGE OF THREE FOWLS, SMALLER BREEDS.	AVERAGE OF FOUR FOWLS, SMALLER BREEDS.	AVERAGE OF SIX FOWLS, LARGER BREEDS.	AVERAGE OF SIX FOWLS, LARGER BREEDS.
	More nitrogenous ration.	Less nitrogenous ration.	More nitrogenous ration.	Less nitrogenous ration.
Per cent of live weight as dressed weight............	78.3	77.7	81.1	80.5
Head and shanks, per cent of dressed weight............	8.0	9.6	6.6	7.4
Lean meat, per cent of dressed weight............	52.3	55.5	44.8	47.4
Fat, per cent of dressed weight....................	15.1	10.1	27.8	24.5
Skin, per cent of dressed weight....................	9.8	9.0	9.3	9.0
Bones, per cent of dressed weight....................	8.5	9.4	6.5	7.1
Ratio of fat to lean meat......	1:3.5	1:5.5	1:1.6	1:1.9
Liver, heart, gizzard, etc., per cent of dressed weight.	6.3	6.4	5.0	4.6

Some Plymouth Rocks averaged slightly fatter with the less nitrogenous ration, but other fowls dissected averaged considerably fatter with the more nitrogenous food, so that the general average showed the fowls having the more nitrogenous food to have become fatter. There is no doubt that most of the fat was accumulated during this period of close confinement and heavy feeding without much exercise.

It is evident that hens will become too fat, even under a much more nitrogenous ration than is usually fed, if given all they will eat and allowed little chance for exercise.

The weights of bones given are exclusive of those from the head and shanks and feet, which were not dissected. It is improbable that the bones had reached their full size during the first five months of life, especially with larger breeds, and it is not probable that they should have much changed during the fattening period. It is therefore interesting to note that with those fowls which had had the less nitrogenous feed, which also contained a much smaller amount of ash constituents, continually for two years, the bones were on the avearge for every lot, heavier.

The corn meal* ration, although so deficient in nitrogen as to injuriously affect the plumage of the birds and their general "condition," did not apparently interfere with the growth and development of the skeleton and muscular frame.

* When corn and corn meal have been fed *exclusively* or in much larger proportions than in this trial, the result has never failed to be a very unhealthy condition, feather eating, and often death.

FEEDING TABLE FOWLS.

Sixteen fowls, eight capons and eight cockerels were fed for several months to obtain data in regard to meat production. Four pens were used, one containing four Buff Cochin capons and another four Buff Cochin cockerels of the same age; one containing four Light Brahma capons and the other four Light Brahma cockerels of the same age.

Among one of two small lots of Light Brahma cockerels purchased, roup appeared a short time after their arrival, and, although those first showing disease were removed, it appeared among the others shortly after the experiment was begun.

The fowls although apparently "recovered," after treatment with carbolic acid, sulphite of soda, iodine, quinine, etc., ceased for a long time to make any growth, although still immature and with a fair appetite, and none of them regained vigor enough to show any returns for the food, and the only growth was made during the first six weeks before the disease was very prominent.

Although the Buff Cochins were in the best of condition and not affected until put in the same building with the others, they suffered more from the disease, which with them appeared among the capons first. While some of the Light Brahma capons recovered eventually, enough to reach the weight of ten and eleven pounds, they were never able to make a profitable growth, and the cockerels that survived only attained a lesser weight. This winter was apparently a very favorable season for roup and the allied diseases, but they have never appeared among fowls here except when brought with purchased stock; and it is believed that the exemption is largely due to the fact that the pens are always kept dry and dusty and the roosting places protected above, below, and on three sides by a tight partition separate from the walls of the building.

The results obtained from these feeding pens for three periods, during only one of which any reasonable gains were made, although the food consumed per fowl during the others was greater, are given in the following table.

The conditions of this feeding trial were so unfavorable that a discussion of the foods or the details of feeding would be unnecessary:

AVERAGE FOR ONE FOWL PER DAY.

PERIOD.	Number days.	Ground oats.	Indian corn.	Meat scraps.	Corn meal.	Oats.	Corn ensilage.	Total food.	Water-free food.	Total food consumed per one pound live weight.	Water-free food consumed per one pound live weight.	Pounds water-free food to one pound gain live weight.
		Ounces.	Ounces.	Ounces.	Ounces.	Ounces.	Ounces.	Ounces	Ounces.	Ounces.	Ounces.	Pounds.
BUFF COCHIN CAPONS.												
December 9 to January 20	42	1.02	1.04	.56	.70	1.38	.25	4.95	4.11	1.05	.87	8.53
January 20 to February 17	28	.87	.59	.18	.84	1.77	.25	4.50	3.33	.85	.63	Loss.
February 17 to March 31	42	....	....	....	2.25	3.06	.33	5.64	4.61	1.15	.94	Loss.
BUFF COCHIN COCKERELS.												
December 9 to January 20	42	1.19	1.61	.56	.82	1.75	.30	6.23	5.17	1.17	.97	6.39
January 20 to February 17	28	.69	.96	.64	1.14	1.86	.33	5.62	4.56	.86	.70	....
February 17 to March 31	42	....	....	....	2.11	3.57	.33	6.03	4.93	.91	.75	....
LIGHT BRAHMA CAPONS.												
December 9 to January 20	42	1.04	1.29	.79	1.00	1.45	.25	5.82	4.87	.82	.69	6.29
January 20 to February 17	28	1.21	1.06	.36	1.36	1.85	.25	6.09	4.93	.73	.60	23.01
February 17 to March 31	42	....	....	....	2.51	4.84	.33	7.71	6.38	.86	.71	....
LIGHT BRAHMA COCKERELS.												
December 9 to January 20	42	1.00	1.48	.62	.84	1.43	.25	5.62	4.62	.84	.69	5.79
January 20 to February 17	28	.94	1.12	.58	.99	2.33	.31	6.27	5.25	.76	.63	8.17
February 17 to March 31	42	....	....	....	2.09	4.51	.33	6.93	5.80	.79	.66	....

Some experiments in regard to the oyster-shell question were undertaken, but the fowls did not lay enough eggs to make the results conclusive, and the analytical work on these experiments was therefore not completed. Considerable work in this line is still in progress, but enough data are not yet secured to warrant any general conclusions. It is expected, however, that this question can soon be satisfactorily answered.

HOME-MADE BROODERS AND INCUBATORS.

Some chicks have been hatched and reared with "home-made" incubators and brooders of some of the simplest types, costing but a few dollars, which, although for some years used successfully by many poultrymen, are unfamiliar to many who have become interested in poultry raising and desirous of information regarding them.

For those who wish to undertake the rearing of chicks for broilers, etc., artificially, it is recommended that the handling of very few be attempted until the experience which is absolutely essential to success, is acquired; and for this purpose the home-made appliances are well adapted, and have an advantage of representing less capital when those who tire from the constant attention so indispensable, abandon the business.

The incubators tried were those in which the heat is supplied by a tank of hot water, with the egg drawer held in place a few inches beneath by a wooden frame, and the whole surrounded by a packing of sawdust. No lamp was used, and sufficient heat was maintained by the occasional addition of a pail of boiling water; about two common pailfuls of boiling water a day being enough to keep the proper temperature in an incubator that would hold 200 eggs, when kept in a room having the average temperature of about 65° Fahr. A poor hatch was obtained the first time, but subsequent trials were satisfactory. The objections of insurance companies could not apply to this incubator, for no part can be hotter than boiling water.

One out-door brooder tried, although moderately successful, is not to be recommended, as it requires too frequent attention and is irregular, giving either too little heat or having the floor too warm. This was arranged for heating with a lamp, a shallow pan of water or a sheet of iron two or three inches below the floor of the brooder, the heated air reaching the brooder chamber through a short tube inserted in the floor. The cover was supported at the proper height by pegs, and the whole was surrounded by a box or "cold frame," covered in stormy weather.

Another cheap home-made brooder, on which there is now no patent or royalty, the owner having given it to the public (the original Harper brooder), has proved very satisfactory. The two tried here were only slight modifications of the original, having a second air chamber above, and the under side of the upper hot-air chamber of tin instead of wood. This brooder is for use in a building or under shelter of some sort. The temperature was easily controlled, and no trouble occurred with chicks that could be attributed to any fault of the brooder. Chicks were kept with the brooder until well feathered, and were at all times vigorous and lively.

While the chicks were fed very moderately and did not early attain heavy weights, the growth, although slow, was healthy and satisfactory for chicks confined in small yards. One lot of W. P. Rock chicks from the first hatch averaged 1.7 pounds at twelve weeks old. Some from later hatches averaged for different lots at ten weeks old: W. P. Rocks, 1.1 pounds; "Crosses" (four lots), 1.2 pounds, 1.1 pounds, 1.1 pounds, 1.2 pounds; Indian Games (two lots), 1.3 pounds, 1.2 pounds. Among the different lots of "Crosses," which were S. Wyandotte and Buff Cochin by B. B. R. Game, were included quite a number Light Brahma chicks. Some Pekin ducks reared in this brooder averaged about three pounds ten weeks old and not quite four pounds at twelve weeks. The results of incubator and brooder work are intended for a Bulletin when enough data to be instructive are obtained.

The temperatures of many hens observed in connection with the incubator experiments are hardly consistent with the theory of "incubating fever" so often advanced. The temperature of hens not sitting varied in summer months from 103° F. to 109°, many being over 106°, and of sitting hens from 102.4° F. to 106.5°, the highest observed among those just beginning to sit, being 108.6°.

KEEPING EGGS IN DRY PACKING.

A few of the methods of packing eggs dry for keeping have been tried. With these the eggs were all wiped when fresh with a rag saturated with fat or oil in which had been mixed some antiseptic, and packed tightly in salt, bran, etc. Eggs packed during April and May in salt, and which had been wiped with cotton-seed oil to which had been added boracic acid, kept from four to five months with a loss of nearly one-third, the quality of those saved not being good. Eggs packed after the same preliminary handling, in bran, were all spoiled after four months. Eggs packed in salt during March and April, after wiping with vaseline to which salicylic acid had been added, kept four and five months without loss; the quality after four months was much superior to that of ordinary limed eggs. These packed eggs were all kept in a barn cellar, the ordinary temperature of which varied from 60° to 70° Fahrenheit, and each box was turned once every two days. Little difference was observed in the keeping of the fertile or the infertile eggs, and no difference was noticeable in the keeping qualities of eggs from different fowls or from those under different rations.

CAPONIZING.

During our experience in caponizing many "slips" have appeared among those birds which were oldest when the operation was performed. The most favorable age seems to be within a few weeks after the time when the sex can readily be distinguished, and with those caponized at that time very few slips have been observed. Some have been operated upon by means of the second incision from the left side, but so far little advantage has appeared in this method. None have been lost here this year from the operation, and if care is taken in the fasting of the fowls and in selecting a bright day, there is no need of the fatality that is so often reported.

BREEDING EXPERIMENT.

A breeding experiment has been undertaken which must continue several years before the desired information can be secured. Twenty-four fowls are used at the start, six pullets of each of four breeds, S. C. W. Leghorn, B. Minorica, W. P. Rock and Buff Cochin, an individual record is kept for each fowl. It is expected to breed from individuals of the best and poorest record and experiments in regard to fertitity and vitality of eggs will probably also be made in connection. A house has been erected this year in which to conduct this experiment.

SWINE.

Much of the work with pigs during the past year has been in the line of feeding experiments with some of the various course foods that are so often recommended. Clover and corn ensilage have been fed for quite long periods, and prickly comfrey, oat and pea forage, sorghum and mangolds for somewhat shorter periods. The grain foods used as part of the rations including the coarse foods, and in the rations contrasted with them, were corn, corn meal, wheat bran, wheat middlings, and a nitrogenous grain mixture.

The pigs used in these experiments were Cheshires and Duroc Jerseys, which breeds were the first that were bred here and the only ones available at this time. Thirty-six pigs were used, twenty Durocs and sixteen Cheshires.

From December to July most of the feeding was with corn ensilage, and portions of a bulletin issued in August giving the results are here repeated :

The pigs for the experiment with ensilage were divided into four lots of four pigs, two sows and two barrows each, and are for convenience designated as Pens 1, 2, 3 and 4 respectively. Pens 1 and 2, Duroc Jerseys, were as nearly alike as possible in regard to age, condition, and average weight, as were also Pens 3 and 4, which were Cheshires. At the beginning of experiment the average weight per pig for Pen 1 was 54 pounds, for Pen 2, 56 pounds, for Pen 3, 88.8 pounds, for Pen 4, 89.5 pounds. The ensilage was of superior quality, finely cut, and made from corn ripe enough to cut for husking. The average amount of moisture was about 73.0 per cent, and the average of three analyses was :

	Per cent.
Moisture	73.0
Ash	1.07
Crude albuminoids	2.19
Invert sugar	.69
Sucrose	.14
Starch	15.20
Fat	1.53
Fibre	6.18
Total nitrogen	.35
Amide nitrogen	.12

In preliminary feeding of some of the pigs, it was found that they would not eat enough from the ensilage alone to make any gain unless fed such a very large amount that it was simply rooted over for the pieces of corn on the cob, which were at all times first eaten.

Where simply maintenance of mature animals has been desired ensilage has served very well. The boars for most of the time, and the breeding sows much of the time during the winter and spring months, have been fed largely upon ensilage.

It was not possible, during this trial, to separate and determine the amount not swallowed ; so, although the figures show the exact amount *fed*, they are not absolute as regards the amount eaten, but are, however, comparable. The "nutritive ratios" for the rations, including ensilage, are subject to the same error. As very little milk was available at this time, no skim milk or buttermilk was fed during the experiment. Water was not mixed with the food, but was kept always before the animals in a separate trough, and fresh water weighed to them as often as required, generally three times a day. All of the pigs were given nearly enough of bran and middlings for sustenance, and some were fed as much ensilage in addition as they would eat or chew over, while others at the same time were fed, in contrast, corn on the cob. This corn in the ear gave from 82.5 to 83.2 per cent shelled corn, containing an average of about 15 per cent moisture. It was at the beginning attempted to have the water-free matter of the ensilage the same in amount as the water-free matter of the corn in the contrasted ration, but it was not possible to continue this without giving very much less corn than would be readily eaten with the other food.

The whole time of the experiment was divided into periods of five weeks each ; and it was so arranged that animals of the same age and not very different weights were on contrasted rations during the same periods. The general arrangement of feeding was as follows :

PERIOD.	Pen No. 1.		Pen No. 2.		Pen No. 3.		Pen No. 4.	
	Pounds average weight during period.	Ration.	Pounds average weight during period.	Ration.	Pounds average weight during period.	Ration.	Pounds average weight during period.	Ration.
Dec. 19 to Jan. 24	62.6	No ensilage	60.7	Ensilage about 75 per cent of total food.	100.1	No ensilage	96.1	Ensilage about 67 per cent of total food.
Jan. 24 to Feb. 28	82.9	No ensilage	73.7	Ensilage about 46 per cent of total food.	123.6	No ensilage	115.4	Ensilage about 41 per cent of total food.
Feb. 28 to April 4	107.2	Ensilage about 46 per cent of total food.	99.6	No ensilage	150.1	Ensilage about 44 per cent of total food.	147.6	No ensilage.
April 4 to May 9	126.5	Ensilage about 70 per cent of total food.	128.0	No ensilage	174.6	Ensilage about 65 per cent of total food.	186.0	No ensilage.

	Pen No. 1.	Pen No. 2.	Pen No. 3.	Pen No. 4.
Average weight at beginning, pounds	54	56	88.8	89.5
Average weight at end, pounds	133	146.5	184.8	204.5

The per cent of moisture in the foods changed a little during the five months, but was determined often and the dry food calculated at the time. The moisture in the wheat middlings varied from 16.6 per cent to 12.5 per cent, and in the bran from 14.7 per cent to 13.7 per cent. The amounts of the different foods consumed by the several animals varied somewhat from week to week, but within reasonable limits held the same relation.

The results obtained are calculated to the average for every 100 pounds of pig live weight, and are given in the following tabulated form.

The results from pen No. 2 for the last period, from April fourth to May ninth, are from only two pigs, the other two having become ill at the commencement of the period and removed.*

In calculating the cost of the rations, wheat middlings have been valued at twenty dollars per ton and wheat bran and corn at sixteen dollars per ton, at which prices these foods have been delivered here at the barn.† Ensilage has been rated at a very low figure—one dollar per ton—different individuals having estimated the cost in the silo at from seventy cents to one dollar and fifty cents per ton. The manurial value, however, has been calculated at one dollar and forty-eight cents per ton. In other feeding trials here, the ensilage has been put at three dollars per ton in comparison with roots at that valuation.

In computing the net cost of food, the manurial value of middlings has been considered ten dollars and seventy-five cents per ton; of wheat bran, fourteen dollars; of corn, seven dollars and ninety cents,

* The pigs (two Duroc Jersey barrows, the heaviest in the pen) were probably suffering from indigestion, rheumatism, etc. This pen has been fed, besides bran and middlings, for the first period, ensilage; for the second, ensilage and corn; and for the third, corn, during which period they consumed per pig nearly one-half more water-free food per day than during the second (the preceding period,) and made the most rapid gain of any during the whole experiment. The two pigs which remained well continued to make nearly as good gain during the next or last period.

As soon as the pigs became lame, spirits of turpentine was rubbed across the back and on the legs, and the food was taken away for a few days. Two pints of castor oil were given each, in doses of one-half pint at a time, and then for each a tablespoonful of bicarbonate of soda added daily to a light feed of bran and water. They were then fed bran and skim milk and grass. For several days they were unable to get on their feet, and it was several weeks before they were able to move around without great effort; but they finally recovered enough to be turned in pasture.

† This was in 1889 and early part of 1890.

AVERAGE PER DAY FOR EACH 100 POUNDS — PIG.

	Corn ensilage.	Corn.	Wheat middlings.	Wheat bran.	Total food.	Water-free ensilage.	Water-free corn.	Water-free middlings.	Water-free bran.	Total water-free food.	Nutritive ratio	Period.
	Lbs	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		
Average for Pens 1 and 2 with ensilage,	4.27	....	.85	.75	5.87	1.33	....	.71	.60	2.64	1:5.5*	Dec. 19 to Jan. 24 and Apr. 4 to May 9.
Average for Pens 1 and 2 without ensilage	....	1.86	.81	.84	3.51	....	1.58	.68	.71	2.97	1:6.4	Dec. 19 to Feb. 28 and Feb. 28 to May 9.
Average for Pens 1 and 2 ensilage and corn	2.26	.99	.82	.86	4.93	.57	.85	.73	.74	2.89	1:6.1*	Jan. 24 to Feb. 28 and Feb. 28 to Apr. 4.
Average for Pens 3 and 4 with ensilage,	3.53	....	.87	.90	5.30	1.10	....	.72	.77	2.53	1:5.1*	Dec. 19 to Jan. 24 and Apr. 4 to May 9.
Average for Pens 3 and 4 without ensilage	....	1.39	.79	.88	3.06	....	1.18	.66	.75	2.59	1:5.9	Dec. 19 to Feb. 28 and Feb. 28 to May 9.
Average for Pens 3 and 4 ensilage and corn	1.79	.70	.78	.95	4.22	.46	.60	.64	.82	2.52	1:5.6*	Jan. 24 to Feb. 28 and Feb. 28 to Apr. 4.
Average for all with ensilage	3.90	....	.86	.83	5.59	1.22	....	.71	.69	2.62	1:5.3*	Dec. 19 to Jan. 24 and Apr. 4 to May 9.
Average for all without ensilage	....	1.62	.80	.86	3.28	....	1.38	.67	.73	2.78	1:6.2	Dec. 19 to Feb. 28 and Feb. 28 to May 9.
Average for all ensilage and corn	2.03	.85	.80	.91	4.59	.52	.73	.68	.78	2.71	1:5.8*	Jan. 24 to Feb. 28 and Feb 28 to Apr. 4.

* Approximate.

AVERAGE PER DAY FOR EACH 100 POUNDS — PIG.

	Total food.	Water-free food.	Live weight gained.	Water-free food to one pound gain in weight.	Water.	Water in food.	Total cost of food.	Gross cost per pound gain live weight.	Total manurial value of food.	Net cost per pound after deducting two-thirds manurial value.	Period.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Cts.	Cts.	Cts.	Cts.	
Average for Pens 1 and 2 with ensilage.	5.87	2.64	.36	7.33	7.22	3.23	1.66	4.61	1.28	2.25	Dec. 19 to Jan. 24 and April 4 to May 9.
Average for Pens 1 and 2 without ensilage	3.51	2.97	.83	3.58	6.84	.54	2.77	3.34	1.77	1.92	Dec. 19 to Feb. 28 and Feb. 28 to May 9.
Average for Pens 1 and 2 corn and ensilage	4.93	2.89	.66	4.38	6.56	2.04	2.41	3.65	1.59	2.05	Jan. 24 to Feb. 28 and Feb, 28 to April 4.
Average for Pens 3 and 4 with ensilage.	5.30	2.59	.37	7.00	8.58	2.71	1.77	4.78	1.35	2.35	Dec. 19 to Jan. 24 and April 4 to May 9.
Average for Pens 3 and 4 without ensilage	3.06	2.59	.64	4.05	6.79	.47	2.60	4.66	1.61	2.39	Dec. 19 to Feb. 28 and Feb. 28 to May 9.
Average for Pens 3 and 4 corn and ensilage	4.22	2.52	.58	4.34	6.55	1.70	2.19	3.78	1.49	2.03	Jan, 24 to Feb. 28 and Feb. 28 to April 4.
Average for all with ensilage	5.59	2.62	.37	7.08	7.90	2.97	1.72	4.65	1.31	2.30	Dec. 19 to Jan. 24 and April 4 to May 9.
Average for all without ensilage	3.28	2.78	.74	3.76	6.81	.50	2.79	3.77	1.68	2.26	Dec. 19 to Feb. 28 and Feb. 28 to May 9.
Average for all corn and ensilage	4.59	2.71	.62	4.37	6.56	1.88	2.31	3.73	1.55	2.06	Jan. 24 to Feb. 28 and Feb. 28 to April 4.

and of ensilage, one dollar and forty eight cents, and allowance is made for a loss of one-third of the fertilizing constitutents in the growth of the animal. In estimating the net cost of producing pork at the Massachusetts Experimental Station, Dr. Goessman says: "Our allowance of a loss of thirty per cent of the essential fertilizing constituents contained in the food consumed, in consequence of the development and growth of the animal, is purposely a liberal one. The adoption of this basis for our estimate tends to strengthen our conclusion that the raising of pigs for the home market can be made a profitable branch of farm industry, even with comparatively limited resources of skim milk."*

Inasmuch as the amount of manurial refuse recovered depends largely upon the facilities for saving the liquid manure, and the amount of cheap bedding material available, our principal comparisons are made with the gross cost per pound of pork, the net cost, however, being also calculated. The cost of labor in feeding has not been included. The pork is valued at four and one-half cents per pound live weight. †

The results show that with ensilage rated so low as one dollar per ton, the gross cost for production of pork was considerably more than its market value, when the proportion of ensilage was about 70 per cent of the ration. When the ensilage averaged 69.8 per cent of the total food, its cost was 11.6 per cent and the manurial value 20.6 per cent; and when it formed 44.2 per cent of the ration its cost was 4.3 per cent and manurial value 9 per cent of the total food. With the cost of the ensilage rated higher, as is usual, the net costs under the different rations would bear the same relations as the gross costs.

Twice, for a month each time, during the experiment, the solid manure from the four pens was saved and weighed. There was not found much difference in the amount from the several pens, the average from all being .75 pounds dry manure per day for every 100 pounds of pig, or 3 23 pounds fresh manure, the average of many determinations of moisture being 76.9 per cent (the lowest 69.6 and the highest 84.6 per cent.)

The dried manures contained about 79 per cent of organic matter, those from ensilage-fed pens having 2.35 per cent of nitrogen and from the others 2.47 per cent, equal to .54 and .57 per

* Seventh Annual Report of State Agricultural Experiment Station, Amherst, Mass.

† Some of the poorest pigs have been sold for three cents and some of the best for six cents. Most of the pigs sold to local butchers have brought four and one-half cents per pound live weight. (This was in the latter part of 1889 and part of 1890.)

cent in the fresh samples, which besides the loss in drying would make the nitrogen value one dollar and eighty-three cents and one dollar and ninety-four cents per ton respectively. An average sample of fresh manure free from straw and bedding contained .70 per cent nitrogen, making the nitrogen value of a ton two dollars and thirty-eight cents.

RATIONS WITH AND WITHOUT SALT.

The pigs in two pens (Nos. 5 and 6, each containing one Cheshire and one Duroc Jersey) were fed from March twentieth to July tenth similar rations, which were changed for each pen at the same time. No. 6 received a small amount of salt daily and No. 5 received none.

For the first six weeks they were fed an entirely grain ration, during the next four weeks a ration of which corn ensilage formed about 50 per cent, and, after a week with both ensilage and comfrey, during the last five weeks a ration of which prickly comfrey formed over 50 per cent. The rations were almost identical for the two pens, except that, when comfrey was fed, the pen receiving salt consumed considerably more of the green food. The comfrey was fed freshly cut and contained an average of 86.7 per cent water.

These pigs were fed bran and middlings like those in the first experiment, with addition of corn, ensilage, or comfrey.

During the last five weeks corn meal was fed part of the time instead of corn, but as the amount was the same and the composition very similar, as were also the results, the weights for the whole period are averaged together. The average results obtained from these two pens are given in the following table. The data given are not the averages of discordant portions; for the weekly averages in this, as in the previous experiment, approximated closely to the general results.

In calculating the cost of food, prickly comfrey is rated at one dollar per ton, the same as ensilage; the manurial value is estimated at one dollar and forty-six cents per ton.

So far as general appearance and actions would indicate, the animals both with and without salt in their rations were in equally good condition throughout the experiment.

AVERAGE PER DAY FOR EACH 100 POUNDS — PIG.

	Corn ensilage.	Prickly comfrey.	Corn or corn meal.	Wheat middlings.	Wheat bran.	Total food.	Water-free ensilage.	Water-free comfrey.	Water-free corn.	Water-free middlings.	Water-free bran.	Total water-free food.	Period.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
Pen No. 5	....	....	2.72	1.17	.63	4.52	...	....	2.30	.98	.53	3.81	March 20 to May 1.
Pen No. 5	2.85	....	1.11	1.21	.48	5.65	.86	....	.95	1.01	.40	3.22	May 1 to May 29.
Pen No. 5	....	1.86	.80	.55	.42	3.63	....	.24	.70	.48	.36	1.78	June 5 to July 10.
Pen No. 6	....	....	2.84	1.23	.66	4.73	....	....	2.41	1.03	.56	4.00	March 20 to May 1.
Pen No. 6	2.88	....	1.12	1.22	.48	5.70	.86	....	.96	1.02	.41	3.25	May 1 to May 29.
Pen No. 6	....	2.24	.78	.53	.41	3.96	....	.29	.68	.46	.35	1.78	June 5 to July 10.

AVERAGE PER DAY FOR EACH 100 POUNDS — PIG.

	Total food.	Water-free food.	Nutritive ratio.	Live weight gained.	Water-free food to one pound gain in live weight.	Water.	Water in food.	Salt.	Total cost of food.	Gross cost per pound gain in live weight.	Total manurial value of food.	Net cost per pound after deducting two-thirds manurial value.	Ratio of dry food to water drunk.	Period.
	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Ozs.	Cts.	Cts.	Cts.	Cts.		
Pen No. 5	4.52	3.81	1:6.9	**1.14**	**3.34**	6.66	.71	......	3.85	**3.38**	2.16	2.12	1:1.7	March 20 to May 1.
Pen No. 5	5.65	3.22	1:6.3	**.46**	**7.00**	5.29	2.43	......	2.60	**5.65**	1.63	3.28	1:1.6	May 1 to May 29.
Pen No. 5	3.63	1.78	1:5.9*	**.17**	**10.47**	5.12	1.85	......	1.62	**9.53**	1.04	4.88	1:2.9	June 5 to July 10.
Pen No. 6	4.73	4.00	1:6.9	**1.27**	**3.15**	7.43	.73	.20	3.90	**3.07**	2.26	1.88	1:1.8	March 20 to May 1.
Pen No. 6	5.70	3.25	1:6.3	**.55**	**5.91**	5.17	2.45	.14	2.64	**4.80**	1.65	2.80	1:1.6	May 1 to May 29.
Pen No. 6	3.96	1.78	1:6.0*	**.26**	**6.85**	3.42	2.18	.10	1.59	**6.12**	1.05	3.43	1:1.9	June 5 to July 10.

* The nutritive ratio, exclusive of the prickly comfrey, which supplied 13.5 per cent of the water-free food for No. 5 and 16.3 per cent for No. 6.

The following points are noticeable among the results:

When the ensilage formed an average of 69.7 per cent of the total food (from 72.7 to 66.6 per cent) the gross cost for production of pork was considerably more than its market value, and 23.3 per cent higher than where corn was substituted.

When corn took the place of part of the ensilage, the ensilage forming an average of 42.2 per cent of the total food (from 42.4 to 45.8 per cent) the gross cost of pork, with ensilage rated no higher than one dollar per ton, was about the same as where no ensilage was fed.

With the ensilage ration the water-free food fed for the production of one pound gain in weight was an average of 7.33 pounds, varying at different times, with the several pens, from 7 to 7.83 pounds, Without ensilage the water-free food required for one pound gain was on the average 3.76 pounds, varying at different times from 3.23 to 4.51 pounds.

Although the moisture in the ensilage ration was six times as much as in the grain ration, the animals drank with it 7.9 pounds of water a day as average for 100 pounds pig, and 6.8 pounds without ensilage.

With pens five and six, those having salt showed the better gains under every ration, although only under the grain ration did they make a profitable growth.

While prickly confrey was fed, the pigs without salt required 52.8 per cent more water-free food for a pound gain, the cost being 55.7 per cent greater than with salt, neither pen making a profitable growth, however.

For a short time in July and August, two pens of younger pigs (Cheshires), each containing two sows and a barrow, all of the same litter, and of about the same weights, Lot A averaging 64.3 pounds, and Lot B 64.6 pounds each, were fed all the prickly comfrey they would eat, and a little corn meal. The comfrey formed over 90 per cent of the total food consumed in both pens, and less than 58 per cent of the water-free food, the moisture being 88 per cent in the fresh plant.

Neither lot would eat enough to make any gain, or even hold their weight. It would hardly seem that it was lack of capacity alone that prevented the consumption of more, for, although while getting clover containing less water, the consumption of total food was similar, yet when pigs were fed mangolds which contained as large a portion of water (89 per cent), the total food consumed for every hundred pounds, live weight, was more than twice as much. When feeding sorghum, also the consumption of total food was more than twice as great as with prickly comfrey.

There was a steady loss in weight with each lot for the period during which prickly comfrey was fed, the average results per day being as follows:

AVERAGE PER DAY FOR EVERY 100 POUNDS LIVE WEIGHT.

		Prickly comfrey fed.	Prickly comfrey consumed.	Corn meal.	Total food consumed.	Water.	Water-free comfrey consumed.	Water-free corn meal.	Total water-free food.	Gain in weight.	Per cent of total food as grain.	Per cent of water-free food as grain.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
Lot A..	June 27 to July 18..	5.81	5.17	.52	5.69	7.82	.62	.45	1.07	-.20	9.1	42.1
Lot B..	June 27 to July 18..	5.78	5.05	.52	5.57	7.63	.61	.45	1.06	-.35	9.3	42.4

These same lots of pigs were fed, one with oat and pea forage and corn meal, and the other with fresh red clover and corn meal. The average composition of each food was:*

	Oat and pea forage.	Red clover.
Per cent water	48.30	62.70
Per cent ash	3.00	2.43
Per cent crude albuminoids	8.89	4.92
Per cent crude fibre	12.36	11.68
Per cent N.-free extract	25.12	16.55
Per cent fats	2.33	1.72

The clover was second growth, and, although containing little water, was cut in rotation and averaged just in bloom. The oat and pea forage was the same as fed to the cattle, only considerably drier. The clover formed 89.6 per cent of the total food and the oat and pea forage 89.3 per cent, and of the water-free food the proportion of coarse fodder was 78.4 and 81.9 per cent, respectively. The following average results from feeding were obtained:

* The analyses of those foods, which were the same as fed to the dairy stock, were made by Mr. Whalen.

Average Per Day for Each 100 Pounds Live Weight.

		Total clover fed.	Total clover consumed.	Total oat and pea forage fed.	Total oat and pea forage consumed.	Total corn meal.	Total food consumed.	Water.	Water-free clover consumed.	Water-free oat and pea forage consumed.	Water-free corn meal.	Total water-free food.	Gain in weight.	Water-free food consumed for one lb. gain in weight.	Per cent of total food as grain.	Per cent of water-free food as grain.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		
Lot A..	July 18 to August 8.....	6.93	6.05	......	......	.70	6.75	7.80	2.25	......	.62	2.87	+.09	31.89	10.4	21.6
Lot B..	July 18 to August 8,....	......	......	6.75	5.69	.68	6.37	7.88	......	2.72	.60	3.32	+.45	7.37	10.7	18.1

With the oat and pea forage rated at the value of three dollars per ton, the increase in weight would be profitable at the prices of pork for the fall and winter of 1889 and 1890, but at the prices now holding* would only be profitable with the forage at about two dollars per ton. The pigs having clover made so small a gain that there would be a loss from the corn meal fed, even if the clover was considered as representing no value.

The same pen (Lot A) was continued on clover for the next twenty-eight days, and had salt added to the ration at the rate of one-quarter of an ounce per day for every hundred pounds live weight, and the gain in weight was much better, although not profitable unless the clover should be estimated as worth but little more than the manure. Lot B, which was fed at the same time a closely similar ration without the salt, made a very slow and unprofitable gain.

Two pens of Duroc Jerseys, each containing three sows and two barrows, were fed a similar ration at about this same time. These pigs were smaller, the average weight for Lot C being 33.1 pounds, and for Lot D 33 pounds. The lots, composed of selected individuals of two litters, were as near alike as possible. For Lot C the clover was 86.7 per cent of the total food, and for Lot D, 86.5 per cent. Lot C received 0.28 ounces salt per day for every hundred pounds live weight, and Lot D none. As with the other lots, those having salt made the better gain, the contrast being somewhat greater. The meager increase without salt was at a loss, and the gain made by those pigs having salt, without considering the manure, was unprofitable even with the clover rated at less than one dollar a ton.

The results for all the periods during which any clover was fed were as follows:

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* November, 1890.

Average Per Day for Each 100 Pounds Live Weight.

		Red clover fed.	Red clover consumed.	Corn meal.	Total food consumed.	Water.	Salt.	Water-free clover consumed.	Water-free corn meal.	Total water-free food.	Gain in weight.	Water-free food consumed for one pound gain.	Per cent of total food as grain food.	Per cent of water-free feed as grain food.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Ozs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		
Lot A....	July 18 to August 8	6.93	6.05	.70	6.75	7.80	......	2.25	.62	2.87	+.09	31.89	10.4	21.6
Lot B....	August 8 to September 5..............	7.52	5.80	.82	6.62	8.19	......	2.15	.73	2.88	+.07	41.14	12.4	25.3
Lot A....	August 8 to September 5..............	7.82	5.97	.86	6 83	9.21	.25	2.22	.76	2.98	+.22	13.55	12.6	25.5
Lot C....	August 25 to September 29...........	9.71	7.38	1.13	8.51	6.06	.28	2.74	.99	3.73	+.34	10.97	13.3	26.5
Lot D ...	August 25 to September 29...........	10.17	7.55	1.18	8.73	5.25	......	2.80	1.04	3.84	+.08	48.00	13.5	27.1
Lot A....	September 5 to October 10	3.11	1.94	2.84	4.78	8.62	......	.72	2.51	3.23	+.78	4.14	59.4	77.7
Lot B....	September 5 to October 10	3.02	2.23	2.70	4.93	13 72	.19	.83	2.44	3.27	+.80	4.09	54 8	74.3

In the preceding table are the results from Lots A and B when fed for thirty-five days another ration of clover and corn meal, in which clover constituted about 40 to 45 per cent of the total food and from 22 to 25 per cent of the water-free food. With both these pens the gain was a profitable one, even with clover rated at over four dollars per ton, and with still a slight advantage in favor of those pigs which had a small amount of salt.

With these two lots, however, when fed grain alone, the best gain was made by the lot without salt. They were fed for thirty-five days "Rex wheat waste," a by-product for sale in the local market, the composition of which was:

	Per cent.
Moisture	12.10
Ash	3.01
Crude albuminoids	11.26
Crude fiber	2.25
N.-free extract	66.85
Fats	4.53

The rate of gain would not be profitable except where the manure could be saved without any loss. The following results were obtained:

AVERAGE PER DAY FOR EACH 100 POUNDS LIVE WEIGHT.

		"Rex wheat" waste, total food.	Salt.	Water.	Water-free R. W. waste.	Gain in weight.	Water-free food consumed for one pound gain
		Lbs.	Ozs.	Lbs.	Lbs.	Lbs.	Lbs.
Lot A ...	October 17 to November 21	2.67	0.9	7.99	2.34	+.37	6.32
Lot B ...	October 17 to November 21	2.61	0	9.36	2.30	+.46	5.00

When the rations for Lots C and D, which had been largely clover, were changed to those of which sorghum constituted 89 per cent the consumption of total food was at once greatly increased, although the amount of water-free food was practically the same. With clover, the total food per day was 8.51 pounds and 8.73 pounds, and with sorghum 13.29 and 13.75 pounds, respectively. Lot C again received salt at the rate of 0.24 ounces per day for every hundred pounds live weight. The results for each pen were:

AVERAGE PER DAY FOR EACH 100 POUNDS LIVE WEIGHT.

		Sorghum fed.	Sorghum consumed.	Mixed grain.	Total food consumed.	Water.	Salt.	Water-free sorghum consumed.	Water-free mixed grain.	Total water-free food.	Gain in weight.	Water-free food consumed for one pound gain.	Per cent of total food as grain.	Per cent of water-free food as grain.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Ozs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		
Lot C....	September 29 to October 20...........	23.01	11.93	1.36	13.29	4.10	.24	2.52	1.20	3.72	+1.12	3.32	10.2	32.3
Lot D....	September 29 to October 20...........	26 34	12.20	1.55	13.75	3.03	....	2.80	1.37	4.17	+ .70	5.96	11.3	32.9

Much the better gain was made by the lot having salt, and it was a profitable one with sorghum rated at two dollars per ton. The gain made by the other lot, although far more rapid than with clover, was an unprofitable one at the present prices, even with sorghum rated at one dollar per ton.

The mixed grain fed with the sorghum and also with the mangolds, was composed by weight of:—wheat bran, five parts; linseed meal, five parts; ground oats, four parts; corn meal, one part. Chemical analysis gave:

Per cent moisture	11.9
Per cent ash	4.6
Per cent crude albuminoids	20.5
Per cent crude fibre	8.7
Per cent N.-free extract	49.6
Per cent fats	4.7

When these same lots were fed mangolds, the consumption of total food was about the same as with sorghum, the mangolds constituting 89 per cent of the total food and about 50 per cent of the water-free food. The pigs having salt at the rate of about 0.2 ounces per day per hundred pounds gave the poorest results, and the increase in weight was barely profitable with mangolds rated so low as one dollar per ton. Lot D, without salt, made a profitable gain with mangolds estimated at three dollars per ton. The average results were as follows: *

* In later feeding for several weeks during cold weather, when the pigs were older, linseed meal being fed with the mangolds, and a little less salt per 100 pounds live weight, there was not so much difference between the results from the two lots. The difference existing was in favor of the lot having salt. The gain made was profitable with mangolds at two dollars per ton, not considering the manure. Sugar beets, which contain a much higher per cent of sugar, would doubtless give better results.

AVERAGE PER DAY FOR EACH 100 POUNDS LIVE WEIGHT.

		Total mangolds.	Total mixed grain.	Total food.	Water.	Salt.	Water-free mangolds.	Water-free mixed grain.	Total water-free food.	Gain in weight.	Water-free food for one pound gain in weight.	Per cent of total food as grain.	Per cent of water-free food as grain.
		Lbs.	Lbs.	Lbs.	Lbs.	Ozs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		
Lot C....	October 27 to November 24	11.15	1.40	12.55	1.66	.19	1.22	1.23	2.45	+ .51	4.80	11.2	50.2
Lot D....	October 27 to November 24	12.29	1.54	13.83	2.01	....	1.35	1.36	2.71	+1.09	2.49	11.1	50.2

The mangolds were eaten without waste, and no other coarse food was. The water-free food required per pound gain in weight was less than is usually required from any food, excepting milk. The amount of water drunk by the pigs having mangolds was, as might be expected, very small.

The composition of the sorghum forage, and of the mangolds, was for each as follows:

	Sorghum.	Mangolds.
Water	77.00	88.98
Ash	1.13	.96
Crude albuminoids	2.98	1.49
Crude fiber	5.27	.79
N.-free extract	12.49	7.64
Fats	1.13	.14

While the animals of each lot were kept and fed together, the coarse foods were always offered them in excess, so that every animal had all that was desired. The grain food was fed dry, and as it required then more time for eating, there was not so great opportunity for the stronger animals to get more than their share.

The record of increase in weight was kept individually, the animals being designated by numbered ear-tags, and weighed once a week, and the individual loss or gain was always in accord with the general or average results. While the increase of live weight may not always be absolute gain of meat, it is approximate and comparable. There can not be much error in comparison of gain resulting from the fact of greater weight of some coarse foods being consumed, than of grain, for, with the more concentrated food, more water was drunk, so that there was much less difference in the total water and food taken. Whatever error would exist in this respect, could not have held throughout any period. A decrease of total consumption was also often coincident with increase in weight. While the proportion of water-free food consumed varied much, the actual difference in amount for the different periods, was small. The following table shows the amounts of total food, water, and of water-free food for the different rations:

AVERAGE PER DAY FOR 100 POUNDS LIVE WEIGHT.

	Total food consumed.	Water.	Total weight of food and water.	Total water-free food.	Salt.
Lot A, comfrey 90%, and corn meal	5.69	7.82	13.51	1.07	Without.
Lot B, comfrey 90%, and corn meal	5.57	7.63	13.20	1.06	Without.
Lot A, clover 89%, and corn meal	6.75	7.80	14.55	2.87	Without.
Lot B, oats and peas 89%, and corn meal	6.37	7.88	14.25	3.32	Without.
Lot A, clover 87%, and corn meal	6.83	9.21	16.04	2.98	With.
Lot B, clover 87%, and corn meal	6.62	8.19	14.81	2.88	Without.
Lot C, clover 87%, and corn meal	8.51	6.06	14.57	3.73	With.
Lot D, clover 87%, and corn meal	8.73	5.25	13.98	3.84	Without.
Lot A, clover 40%, and corn meal	4.78	8.62	13.40	3.23	Without.
Lot B, clover 45%, and corn meal	4.93	13.72	18.65	3.27	With.
Lot A, all grain	2.67	7.99	10.66	2.34	With.
Lot B, all grain	2.61	9.36	11.97	2.30	Without.
Lot C, sorghum 89%, and mixture	13.29	4.10	17.39	3.72	With.
Lot D, sorghum 89%, and mixture	13.75	3.03	16.78	4.17	Without.
Lot C, mangolds 89%, and mixture	12.55	1.66	14.21	2.45	With.
Lot D, mangolds 89%, and mixture	13.83	2.01	15.84	2.71	Without.

The analyses of two samples of manure, one rather coarse, from pigs fed ensilage, and the other containing less straw, etc., from pigs having grain only, were made. The results calculated to the fresh sample with 77 per cent of moisture, which was the average found, were:

	With ensilage ration.	With grain ration.
Per cent nitrogen (N)	.54	.57
Per cent potash (K_2O)	.73	.37
Per cent phosphoric acid (P_2O_5)	.66	.83

At the 1890 prices of fertilizing materials, the value would be about three dollars and twenty-two cents and three dollars and twenty cents per ton respectively. At this valuation, the solid manure for every hundred pounds of pig, live weight, would be worth, on the average, about one dollar and eighty-seven cents per year.

SORGHUM.

Twenty-nine varieties of sorghum seed and two varieties of millet were planted this year. Ten of the sorghums were from seed selected in 1889 from the best varieties and canes. Most of the other seeds were received from the Agri-Horticultural Society of Burmah, some from the Botanic Garden, Singapore, some from the Botanic Garden, Strait's Settlements and three from Poona.

None of the new varieties gave sufficient promise to warrant another trial; the new variety of millet grass from Burmah, growing about four feet tall, may be of value for forage and will be tried again.

Another millet from Japan (No. 71 of 1889 report) was grown this season on two one-twentieth-acre plats, the seed being planted May thirtieth and the crop cut September thirtieth. The total yield of green fodder was at the rate of 6.2 tons per acre, and 3.6 tons the yield for air dry. It was impossible to estimate the amount of seed produced on account of the ravages of English sparrows, which also destroy the immature sorghum seeds and the wheat, but the portion secured was at the rate of a little over 600 pounds dry seed per acre. The entire plant, as cut, was readily eaten by cattle and swine, but no analysis has yet been made of the forage.

The composition of the seed of this millet indicates that it may be a valuable food, especially for poultry, the size of the seeds being especially favorable for this use. An average sample, unusually dry, showed:

	Per cent.
Water	6.08
Ash	3.55
Albuminoids	14.56
Crude fibre	4.70
N.-free extract	66.77
Fats	4.34

The more important observations made on the growth of the sorghums are condensed in the following table. As a rule, these varieties mature much earlier than the dates here given, for the soil here seems unfavorable to early maturity; varieties which have been grown successfully in more favorable localities of Central New York failing repeatedly to mature at this Station.

Row number.	NAME OF VARIETY, ETC.	Seed planted.	Replanted.	Maturity.		Average height.	Average diameter.	Average weight.
				Panicle first appearing.	Seed ripe.	Feet.	Inches.	Ozs.
1	"No. 1," from Botanic Garden, Singapore (new)	May 8	....	August 7	October 1	5.9	.7	8.7
2	"No. 2," from Botanic Garden, Singapore (new)	May 8	....	August 7	October 1	7.1	.6	9.9
3	White African (1889 seed)	May 8	May 31	August 19	October 18	7.3	.7	17.8
4	"No. 3," from Botanic Garden, Singapore (new, very late maturing)	May 8	May 31	....	....	......	....	.....
5	"Sorghum, Bicolor, red variety," from Botanic Garden, Strait's Settlements (new)	May 8	....	August 19	October —	7.0	.7	9.5
6	Black Sorghum, variety bicolor (1889 seed)	May 8	....	August 13	October 10	7 5	.7	17.3
7	Undendebule (old seed)	Transplanted	....	August 14	October 8	7.2	.7	19.1
8	"Jyangentombi" (?) (1889 seed)	May 8	May 31	August 20	October —	8.2	.7	14.5
9	Boomvana, or Early Amber (1889 seed)	May 8	....	August 3	September 30	6.0	.6	13.7
10	Koombana (1889 seed)	May 8	May 31	August 7	September 30	6.7	.6	14.4
11	Pootung Sorghum (1889 seed)	May 8	May 31	August 18	October 20	8.4	.9	29.0
12	"Sorghum, Bicolor, white variety," from Botanic Garden, Strait's Settlements (new)	May 8	May 31	....	....	......	....	.....
13	"Sorghum, Bicolor, black variety," from Botanic Garden, Strait's Settlements (new)	May 8	....	August 26	October —	7.1	.7	12.9
14	"No. 2," "Lie," from Agri.-Horticultural Soc. of Burmah, (a millet grass, new)	May 8	....	August 7	September 29	4.0	.3	.....
15	Vimbischuapa (1889 seed)	May 8	May 31	....	....	......	....	.....
16	"No. 3," Hnansa net, from Agri.-Horticultural Soc. of Burmah (new)	May 8	May 31	Late	....	7.5	.7	.....
17	"No. 4," Yoso'k Hnansa, from Agri.-Horticultural Soc. of Burmah (new)	May 8	May 31	September 29	....	6.4	.7	13.4
18	"No. 5," Hnansa Me, from Agri.-Horticultural Soc. of Burmah (new)	May 8	May 31	Late	....	8.2	.7	.....
19	"No. 6," Hnansa Byer, from Agri.-Horticultural Soc. of Burmah (new)	May 8	May 31	Late	....	8.6	.7	.....

Row number.	NAME OF VARIETY, ETC.	Seed planted.	Replanted.	Maturity.		Average height.	Average diameter.	Average weight.
				Panicle first appearing.	Seed ripe.	Feet.	Inches.	Ozs.
20	Ubehlana (1889 seed)	Transplanted	....	September 5	October —	6.1	1.2	40.8
21	"No. 7," Sorghum, Red variety, from Agri.-Horticultural Soc. of Burmah (new)	May 8	May 31	Late	....	9.2	.7	.....
22	"No. 8," Sorghum, Black variety, from Agri.-Horticultural Soc. of Burmah (new)	May 8	May 31	Late	....	8.6	.7	.....
23	"No. 9," "Sorghum, variety," from Agri.-Horticultural Soc. of Burmah (new)	May 8	May 31	Late	....	8.9	.7	.....
24	No. 10, Sorghum, white variety, from Agri.-Horticultural Soc. of Burmah (new)	May 8	May 31	Late	....	6.4	.7	.....
25	"The true Jowar of India," from Agri.-Horticultural Soc. of Burmah (new)	May 8	May 31	August 18	October —	7.0	.6	8.9
26	S. Saccharatum, or Chinese Sugar Cane, from Poona (new)	May 8	....	September 12	....	7.9	.6	25.0
27	"Amber Cane from Minn." (?) from Poona (new)	May 8	....	September 12	....	7.9	.7	15.8
28	"Sorghum Kaffrarium, or Imphee," from Poona (new)	May 8	....	September 6	....	7.9	.7	.....
66	"Sorgho blanc de Changalard," Algiers (1889 seed)	May 8	May 31	September 7	....	7.8	.8	24.2
72	Early Seed, S. H. Kenney (1889 seed)	May 8	....	August 5	September 30	6.9	.7	17.9
	Sport from No. 20	Transplanted	....	August 6	October 8	7.5	1.0	33.3

One variety, "No. 20" in the list, thought to have become extinct, has been revived from a single questionable seed. Although of late maturity, this variety has many valuable characteristics; a heavy cane weighing about two and one-half pounds, having nearly twice the diameter of other varieties of the same height; a large per cent of juice rich in sugar, and a small light panicle. It is hoped that by selection it may become earlier, or that some of its good points may be obtained in hybrids.

For growing in this State only Nos. 6, 8, 9, 10, 11 and 72 are recommended, and in especially favorable localities also Nos. 3 and 7 of the preceding table.

Owing to pressure of other work at the time the sorghums were ripe, it was not possible to make complete analyses of many juices, and the cane sugar was determined only by the polariscope. The results of the examination of the juices are found in the following tabulated form:

Row number.		Date of analysis.	Weight of cane.	Per cent of juice obtained.	Specific gravity of juice.	Per cent of cane sugar by polarization.	Maturity of seed.
			Oz.				
1	"No. 1," from Botanic Garden, Singapore (av. of two canes)	October 10	7.6	35.3	1.040	....	Ripe.
1	"No. 1," from Botanic Garden, Singapore (av. of two canes)	October 17	9.9	40.9	1.054	....	Ripe.
2	"No. 2," from Botanic Garden, Singapore (av. of two canes)	October 10	7.3	34.7	1.055	6.41	Ripe.
2	"No. 2," from Botanic Garden, Singapore (av. of two canes)	October 11	11.8	40.4	1.051	5.07	Ripe.
2	"No. 2," from Botanic Garden, Singapore (av. of two canes)	October 17	10.9	38.3	1.050	....	Ripe.
3	White African	October 16	16.0	51.6	1.070	11.30	Ripe.
3	White African	October 17	13.8	54.5	1.061	8.50	In dough.
3	White African	October 18	15.5	51.6	1.060	8.93	In dough.
3	White African	October 23	27.0	61.0	1.064	9.91	Ripe.
3	White African	October 23	16.9	60.9	1.055	7.23	Ripe.
5	"Sorg., Bicolor, red var.," from Bot. Gar., Straits Settlements (av. of two canes)	October 15	9.5	45.4	1.065	10.24	Ripe.
5	"Sorg., Bicolor, red var.," from Bot. Gar., Straits Settlements	October 17	13.8	54.5	1.061	8.50	In dough.
6	Black Sorghum, var. Bicolor (av. of two canes)	October 10	17.9	53.2	1.063	10.41	Ripe.
6	Black Sorghum, var. Bicolor	October 11	20.3	54.4	1.070	12.01	Ripe.
6	Black Sorghum, var. Bicolor	October 16	16.3	56.3	1.060	7.75	Ripe.
6	Black Sorghum, var. Bicolor	October 18	17.5	60.0	1.066	10.71	Ripe.
6	Black Sorghum, var. Bicolor	October 22	14.3	60.1	1.063	9.61	Ripe.
7	Undendebule	October 17	18.3	52.4	1.069	11.01	In dough.
7	Undendebule	October 17	24.8	51.0	1.072	12.74	In dough.
7	Undendebule	October 22	14.3	54.3	1.067	9.71	Ripe.
7	Undendebule	October 25	17.4	59.0	1.064	10.21	Ripe.
7	Undendebule	Nov'ber 8	14.5	56.9	1.070	11.57	Ripe.
8	Jyangentombi (?)	October 16	12.3	43.9	1.070	11.04	Ripe.
8	Jyangentombi (?)	October 18	19.4	52.3	1.078	13.25	Ripe.
8	Jyangentombi (?)	October 24	15.8	47.6	1.069	10.68	Ripe.
8	Jyangentombi (?)	October 24	18.8	52.4	1.070	10.98	In dough.
9	Boomvana (Early Amber)	October 11	14.5	59.5	1.073	12.24	Ripe.
9	Boomvana (Early Amber)	October 15	11.5	51.1	1.076	14.33	Ripe.
9	Boomvana (Early Amber)	October 16	14.8	54.9	1.076	13.30	Ripe.
9	Boomvana (Early Amber)	October 16	13.8	56.4	1.075	12.98	Ripe.
9	Boomvana (Early Amber)	October 20	13.5	64.8	1 071	12.74	Ripe.
9	Boomvana (Early Amber)	October 20	13.8	63 3	1.077	13.61	Ripe.
9	Boomvana (Early Amber)	October 23	13.8	60.0	1.077	13.84	Ripe.
10	Koombana	October 11	9.8	41.7	1.059	8.36	Ripe.
10	Koombana	October 15	13.0	44.2	1.075	14.33	Ripe.
10	Koombana	October 17	15.8	48.4	1.070	11.41	Ripe.
10	Koombana	October 17	21.3	54.1	1.069	11.66	Ripe.
10	Koombana	October 20	12.8	57.9	1.076	(?)	Ripe.

10	Koombana	October 20	13.5	51.9	1.076	13.16	Ripe.
11	Pootung Sorghum	October 18	24.6	56.9	1.072	11.14	In milk.
11	Pootung Sorghum	October 20	31.3	67.2	1.068	11.10	Ripe.
11	Pootung Sorghum	October 23	33.0	64.4	1.071	10.41	Ripe.
11	Pootung Sorghum	October 25	27.0	63.7	1.073	11.80	In dough.
13	"Sorgh. Bicolor Blk. var." from Bot. Gar., Straits Settlements	October 11	14.5	56.6	1.055	6.32	Ripe.
13	"Sorgh. Bicolor Blk. var." from Bot. Gar., Straits Settlements	October 18	11.3	53.3	1.072	12.16	Ripe.
13	"Sorgh. Bicolor Blk. var." from Bot. Gar., Straits Settlements (av. two canes)	October 24	12.9	60.7	1.070	10.35	In dough.
17	"Yoso'k Hnansa" from Agri.-Hort. Soc., Burmah (av. two canes)	October 25	13.4	62.2	1.056	7.17	In bloom.
20	Ubehlana	October 18	40.0	60.1	1.063	9.23	After bloom.
20	Ubehlana	October 22	45.5	64.6	1.067	10.07	Ripe.
20	Ubehlana	October 25	41.5	65.7	1.063	9.07	In milk.
20	Ubehlana	October 27	36.9	65.8	1.073	11.74	Ripe.
20	Ubehlana	October 27	39.9	63.3	1.072	11.41	Ripe.
20	Ubehlana	October 24	41.0	59.2	1.074	12.04	In dough.
25	"True Jowar of India" Agri-Hort. Soc. Burmah (av. two canes)	October 15	7.9	30.6	1.075	(?) 12.77	Ripe.
25	"True Jowar of India" Agri-Hort. Soc. Burmah.	October 20	10.8	39.2	1.072	11.60	Ripe.
26	"S. Saccharatum or Chinese Sug. Cane" from Poona	October 22	25.0	61.0	1.067	9.31	In bloom.
27	"Amber Cane from Minn." (?) from Poona	October 20	15.8	52.4	1.065	10.35	In bloom.
66	"Sorgho blanc de Changalard"	October 20	18.8	52.6	1.071	11.18	After bloom.
66	"Sorgho blanc de Changalard"	October 27	28.0	57.9	1.067	9.44	After bloom.
66	"Sorgho blanc de Changalard"	Nov'ber 8	25.9	58.5	1.068	10.44	Ripe.
72	"Early Variety" from S. H. Kenney	October 11	19.3	52.0	1.070	12.04	Ripe.
72	"Early Variety" from S. H. Kenney	October 16	16.5	54.2	1.074	12.36	Ripe.
72	"Early Variety" from S. H. Kenney	October 16	19.5	57.0	1.076	13.50	Ripe.
72	"Early Variety" from S. H. Kenney	October 18	18.3	58.5	1.072	12.10	Ripe.
72	"Early Variety" from S. H. Kenney	October 18	16.0	54.4	1.073	13.00	Ripe.
....	Sport from No. 20	Octeber 16	33.3	49.7	1.055	7.03	Ripe.

These results are in accord with those obtained in previous years, although the seasons have differed somewhat, and an encouraging fact is that no mature cane of any of the better varieties has been found that did not contain a good percentage of cane sugar.

In studies of sugar cane and sorghum soils the observation has been made that a good proportion of lime in the soils or in the fertilizers applied usually accompanies a good sugar crop. With the view of obtaining information on this point, one-half of each row of sorghum was top-dressed, as soon as planted, with crude precipitated carbonate of lime at the rate of 4,000 pounds per acre, and from the arrangement of the rows this made two limed strips running across the field with intervening and adjacent strips without lime. In regard to yield of cane and time of maturity, there was no noticeable difference between the strips, and the yield of seed it was not possible to determine. Analyses of juices from forty canes (twelve varieties) of like maturity, twenty from the limed and twenty from the unlimed strips, showed an average of ten per cent more sugar in the canes from the limed strips; the average of cane sugar in the one lot being 11.31 per cent, and in the other 10.28 per cent. So far as a single experiment goes, this result is in accord with the idea that an application of some form of lime is of value to the sorghum crop on soils that contain little lime or in which the magnesia exceeds the lime. Every sample of soil from the Station farm that has been analyzed has contained less lime than magnesia, the average in all the top soils being .65 per cent of lime (Ca. O) and 1.21 per cent of magnesia (Mg. O).

FIELD EXPERIMENTS.

On field G of the Station farm, an even and level field (see map in seventh annual report), the soil of which might be characterized as a clay loam with some gravel,* twenty-one adjacent parallel strips were staked off, each of an area of one-twentieth acre.

Oats were sown on this portion of the field, at the rate of seventy-seven pounds to the acre, and on alternate strips crude chemicals were sown, having thus an untreated strip on two

* This soil contains only a trace of sulphuric acid and a small amount of lime.

sides of every strip to which chemicals were applied. The applications were as follows: *

	Pounds per acre.
Sodium sulphate at the rate of	1,000
Magnesium sulphate at the rate of	1,000
Calcium sulphate at the rate of	1,000
Ferrous sulphate at the rate of	100
Sodium chloride at the rate of	500
Calcium carbonate at the rate of	1,000
Sodium sulphate at the rate of	400
Magnesium sulphate at the rate of	400
Ferrous sulphate at the rate of	50
Sodium chloride at the rate of	240

After the wet weather in the spring, the whole field was badly affected by rust, and no exemption, even partial, could be noticed in favor of any of the strips. After a few weeks of drier weather, the oats outgrew the effects of rust enough to make an average crop. Although there were some differences in yield, they were not great enough to justify any conclusions from one season's trial. The differences in weight per struck bushel of grain, from various strips, were even less, and no difference could be attributed to the influence of the chemicals. The average weight was but little more than thirty-two pounds to the bushel. The results are not given in detail, but if they prove of value in connection with future data from field work, will be published.

* This work was carried on with the co-operation of Mr. Emery, who wished to observe any effect on the weight of the grain per bushel.

Report of the Chemist.*

The present chemist entered upon his duties July 12, 1890. The short time remaining between the beginning of his service and the close of the year, has precluded the possibility of completing any line of investigation. The present report is, therefore, mainly a statement of investigations in progress, and of lines of work newly organized.

Following is a statement, in outline, of the subjects considered in this report:

I. Summary of analytical work.
II. Analyses of cattle foods used in investigation of breeds of dairy cattle.
III. Analyses of milk of cows used in investigation of breeds of dairy cattle.
IV. Description and data pertaining to butter-work connected with investigation of breeds of dairy cattle.
V. Analyses of fertilizers.
VI. Experiments with methods of creaming.
VII. Investigations entered upon and lines of work planned.

I. Summary of Analytical Work.

From the tables below it can readily be seen how many and what kinds of substances have been analyzed. The period covered by these analyses includes the thirteen months, extending from November 1, 1889, the date of the last report, to December 1, 1890.

In order to show the very rapid increase in amount of work within the past few months, caused by the development of the work connected with the investigation of various breeds of cattle, the analyses are presented in two periods, the first period covering eight and one-half months, extending from November 1, 1889, to July 15, 1890; the second period covering four and one-half months, extending from July 15, 1890, to December 1, 1890:

* L. L. Van Slyke, Ph. D.

Samples of	Period I—Eight and one-half months.	Period II—Four and one-half months.	Total—Thirteen months.
Milk	245	249	494
Skim milk	5	173	178
Buttermilk	....	65	65
Butter	3	85	88
Cattle foods	26	20	46
Fertilizers (unofficial)	7	21	28
Fertilizers (control)	....	77	77
Miscellaneous analyses	22	54	76
Microscopical examinations of milk	12	65	77
Total	320	809	1,129

As already stated, the enormous increase of work during the past few months has been due to the rapid development of the investigation of various breeds of cattle. Inasmuch as this work will continue to increase for some time yet to come, the necessity of increasing permanently the number of assistant chemists is evident. Work of the most valuable character must remain undone until the present workers are relieved of a part of the routine work.

In the foregoing table the fertilizers described as "unofficial," refer to such fertilizers as were sent for analysis to the Station by farmers, while the "control" fertilizers are those collected by agents of the Station in accordance with the law making fertilizer control a part of the work of this Station.

A large amount of valuable chemical work done in this laboratory is not included in the above table, but will be found in the report of Mr. Wheeler, who has himself performed all the analytical work required for his investigations.

II. Analyses of Cattle Foods Used in the Investigation of Breeds of Dairy Cattle.

A general description of the foods, the composition of which is given below, will be found in the director's report.

The chemical work connected with these foods has been mainly in charge of the assistant chemist, Mr. Whalen.

COMPOSITION OF CATTLE FOODS USED IN THE INVESTIGATION WITH BREEDS OF CATTLE (DRY SUBSTANCES).

Laboratory number.		Water.	Ash.	Albuminoids.	Crude fiber.	Nitrogen-free extract.	Fat.	Invert sugar.	Sucrose.	Starch.	Albuminoid nitrogen.	Amide nitrogen.
3245	Mixed hay	11.06	6.65	12.13	33.31	44.68	3.63	4.96	1.28	24.40	1.07	0.87
3223	Mixed grasses	79.76	6 71	13.50	27.65	47.39	4.75	2 40	3.12	21.58	1.23	0.92
3079	Clover and timothy hay	16.94	6.30	13.95	30.22	44.94	4.59	5.20	2.16	14.15	1.76	0.50
3084	Timothy hay	15.61	5.14	6.80	37.05	47.17	3.84	4.00	3.00	19.16	1.68	0.33
3221	Kentucky Blue grass hay	13.53	7.61	9.56	33.50	44.65	4.68	2.78	1.28	17.08	1.26	0.27
3135	Barley hay	15.29	7.17	11.19	36.90	41.13	3.61	2.00	0.80	19.87	1.50	0.29
3094	Barley, oat and pea hay	16.48	7.18	15 07	35.27	38.86	3.62	2.00	1.62	17.30	1.54	0.87
3069	Oat and pea hay	17.59	6.78	12.44	40.75	37.12	2.91	1.92	0.68	18.25	1.45	0.44
2920	Oat hay	13.90	6.87	7.00	36.83	46.15	3.14	0.94	0.64	27.84	1.04	0.08
3246	Red clover	73.85	6.51	13.19	31.32	44.36	4.62	3.80	1.52	10.79	1.74	0.37
3271	Oat and vetch forage	67.01	5.25	10.31	30.50	50.03	3.91	4.16	3.32	19.92	1.56	0.09
3310	Oat and pea forage	74.53	5.80	17.19	23.90	48.60	4.51	4 72	2.72	18.60	1.82	0.93
2878	Maize forage	72.18	4.60	8.56	21.89	61.10	3.95	6.80	1.88	36.02	1.15	0.22
2868	Alfalfa forage	78.53	8.43	21.47	28.77	36.25	5.08	2.48	2.44	14.96	2.30	1.14
3540	Sorghum forage	77.11	4.90	12.94	22.94	54.32	4.90	18.96	14.32	21.17	1 38	0.69
2882	Maize ensilage	83.50	5.94	9.57	32.48	46.80	5.21	1.86	0.68	21.08	1.01	0.52
2927	Maize ensilage	77.85	5.24	8.49	25.87	56.25	4.15	1.99	0.82	30.78	1.03	0 32
3107	Maize ensilage	69.22	3.12	8.18	19.68	63.37	5.65	......	1.36	38.04	0.79	0 52
3190	Maize ensilage	73.26	4.41	11.22	21.24	58.65	4.48	0.60	0.92	36.06	0.83	0.97
3230	Maize ensilage	80.45	5.14	11.69	23.96	55.01	4.20	0.44	0.08	32.68	0.68	1.19
2921	Beet roots	85.92	9.66	8 52	8.73	72.52	0.57	6.30	40.92	4.37	0.74	0.69
3139	Mixed roots	87.53	7.38	9.54	7.06	74.50	1.52	10.72	39.28	5.36	0.84	0.69
2733	Linseed meal	8.18	6.06	36.54	9.44	40.75	7.21	......	1.80	22.80	5.41	0 44
3198	Linseed meal	6.59	6.07	37.81	6.21	45.59	4.32	0.60	2.60	14.44	5.51	0.54
2902	Ground oats	12.76	2.93	13.69	12.82	65.29	5.27	1.20	0.32	55.56	1.91	0.28
3196	Wheat bran	11.99	7.09	21.50	10.35	55.91	5.15	1.12	4.52	38.00	2.73	0.71
3197	Cottonseed meal	9.26	7 47	52.94	8.52	18.90	12.17	0.88	7.08	8.07	6.82	1.65
3195	Corn meal	16.43	1.58	13.75	2.62	77.82	4.23	1.12	0.88	68.02	1.68	0.52
2917	Wheat middlings	14.66	1.00	15.12	1.40	81.19	1.29	0.88	2.12	76.84	2.32	0.20
	Sweet milk	87.10	5.42	27.90	......	37.21	29.47	......	......	......	......	......
	Skim milk	90.10	8.08	35.35		49.50	7.07	......	......	......	......	......
	Mixed grains No. 5	10.32	3.51	18.73	6.37	56.61	4.46	0.70	2.30	56.65	2.76	0.25
	Mixed grains No. 6	10.61	5.22	23.28	9.78	56.38	5.34	0.61	1.31	36.18	3.02	0.31
	Mixed grains No. 7	14.57	3.98	22 46	6.05	62.42	5.09	1.03	2.65	49.42	2.84	0.67
	Mixed grains No. 7	10.00	3.97	20.75	6.43	62.70	6.15	1.40	1 48	54.32	2.90	0.42
	Mixed grains No. 8	11.37	4.46	23.75	7.49	59.30	5.00	0.63	1.94	42.60	3.05	0.30
	Mixed grains No. 9	12.20	5.30	18.58	11.03	59.82	5.27	1.16	2 86	42.73	2.31	0.65
	Mixed grains No. 10	12.35	5.21	21.29	7.30	62.26	3.94	0.99	3.73	46.87	2.87	0.55

III. Analyses of Milk of Cows used in Investigation of Breeds of Dairy Cattle.

As regards the chemical work connected with the investigation of the different breeds of dairy cattle, little could be done, except in analysis of cattle foods, until the cows came to milk. The first one of the herd dropped calf in February, and in November ten were in milk. When the present chemist came to the Station in July, only two members of the herd were in milk; and the investigation could hardly be said to have commenced. Steps were soon taken to organize the chemical work so far as it related to the investigation and to carry it on in as systematic a manner as possible.

The analytical work represented in the following tables has been almost entirely in charge of the assistant chemist, Mr. Whalen. Mr. R. D. Newton, laboratory assistant, has also been efficient in helping to carry out some details of the analytical work, in the matter of analysis of both cattle foods and milks. Inasmuch as it was found to be impossible with the present laboratory force to analyze the milk of each cow every day or even every week during the whole period of lactation, the following plan was decided upon as the one most likely to give satisfactory results: Analysis is made of the morning and evening milk separately, one day in each week, for the two first months of lactation, after which the milk is analyzed on one day every alternate week.

One full period of lactation has been decided upon as the unit of time to be used in comparing the breeds in regard to milk production. Any other basis of comparison would clearly be inaccurate and unjust. Since no one cow has yet completed a single period of lactation, it is impossible in this report to present comparisons or draw conclusions. Any conclusions based on data so incomplete as those presented at this time would be unreliable and would in all probability be changed by the complete results. The object of inserting the analyses in this report is to place them upon record for future reference, and also to enable those interested in the work to know what and how much work is being done.

The influence of time from calving, the influence of food on composition and quantity of milk, and other interesting questions will be carefully studied and the conclusions presented, when sufficient data are accumulated.

For the purpose of making comparisons readily, the number of weeks of lactation of each milk analyzed is placed in a column at the left.

RECORD OF MILK ANALYSES — HOLSTEIN-FRIESIAN — TOLSMA ARTIS.

Number of week of lactation.	DATE.	Percentage Composition of Milk.							Composition of Day's Milk Expressed in Pounds.						
		Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
1	May 29, A. M.	87.89	12.11	8.30	3.81	3.99	3.54	0.77	14.0	12.30	1.70	0.53	0.56	0.50	0.11
	29, P. M.	88.51	11.49	8.29	3.20	3.73	......	......	16.8	14.87	1.93	0.54	0.63	......	....
	Mean daily average	88.20	11.80	8.24	3.56	3.86	3.54	0.77	15.4	13.58	1.82	0.54	0.59	0.50	0.11
3	June 9, A. M.	89.76	10.24	7.75	2 49	2.98	4.19	0.58	22.5	20.20	2.30	0.56	0.67	0.94	0.13
	9, P. M.	89.67	10.33	7.68	2.65	3.10	3.84	0.74	21.5	19.28	2.22	0 57	0.67	0.82	0.15
4	16, A. M.	89.93	10 07	7.67	2.40	2.91	4.02	0.74	22.3	20.05	2.25	0.54	0.65	0.90	0.16
	16, P. M.	90.14	9.86	7.48	2.38	3.10	3.92	0.46	21.0	18.93	2.07	0.50	0.65	0.82	0.10
5	23, A. M.	89.92	10.08	7.66	2.42	3.10	3.89	0.67	19.9	17.89	2.01	0.48	0.62	0.77	0.13
	23, P. M.	90.12	9.88	7.65	2.23	2.98	3.98	0.69	18.3	16.49	1.81	0.41	0.54	0.73	0.13
6	30, A. M.	89.67	10.33	7.74	2.59	2.98	4.04	0.72	18.8	16.86	1.94	0.49	0.56	0.76	0.12
	30, P. M.	89.10	10.90	7 85	3.05	3.54	3.56	0.75	18.8	16.75	2.05	0.57	0.65	0.67	0.14
	Daily average, A. M.	89.82	10.18	7.70	2.48	2.99	4.03	0.68	20.9	18.77	2.13	0.51	0.62	0.86	0.13
	P. M.	89.76	10.24	7.66	2.58	3.18	3.82	0.66	19.9	17.86	2.04	0.51	0.63	0.76	0.13
	Mean daily average	89.79	10.21	7.68	2.53	3.09	3.92	0.67	20.4	18.35	2.09	0.51	0.63	0.82	0.13
7	July 7, A. M.	89.40	10.60	7.64	2.96	2.85	4.09	0.70	18.5	16.54	1.96	0.55	0.53	0.76	0.13
	7, P. M.	89.16	10.84	7.74	3.10	2.78	4.52	0.44	17.6	15.69	1.91	0.54	0.49	0.79	0 08
8	14, A. M.	89.28	10.72	7.82	2.90	2.78	4.35	0.69	16.3	14.55	1.75	0.47	0.45	0 71	0.11
	14, P. M.	89.06	10.94	8.25	2.69	2.99	4.58	0.68	16.3	14.52	1.78	0.47	0.49	0.75	0.11
9	21, A. M.	89.09	10.91	8.01	2.90	2.98	4.34	0.69	17.5	15.59	1.91	0.51	0.52	0.76	0.11
	21, P. M.	89.35	10.65	7.95	2.70	2.72	4.54	0.69	17.0	15.19	1.81	0.46	0.46	0.77	0.12
10	28, A. M.	88.95	11.05	7.83	3.22	......	......	0.62	15.2	13.52	1.68	0.49	......	......	0.09
	28, P. M.	89.29	10.71	7.61	3.10	2.47	4.56	0.58	16.2	14.46	1.74	0.50	0.40	0.74	0.09

RECORD OF MILK ANALYSES — HOLSTEIN-FRIESIAN — TOLSMA ARTIS — (*Concluded*).

Number of week of lactation.	DATE.	Percentage Composition of Milk. Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Composition of Day's Milk Expressed in Pounds. Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
	Daily average, A. M	89.18	10.82	7.83	2.99	2 87	4.26	0.67	16.9	15.07	1.83	0.50	0.50	0.74	0.11
	P. M.	89.21	10.79	7.89	2.90	2.74	4.55	0.60	16.8	14.99	1.81	0.48	0.46	0.76	0.10
	Mean daily average	89.19	10.81	7.86	2.95	2.81	4.41	0.64	16.9	15.08	1.82	0.49	0.48	0.75	0.10
11	August 4, A. M.	89.69	10.31	7.62	2.69	2.53	4.44	0.65	17.1	15.34	1.76	0 46	0.43	0.76	0.11
	4, P. M.	89.72	10.28	7.23	3.05	2.60	3.64	0.99	17.4	15.61	1.79	0.53	0.45	0.63	0.17
12	August 11, A. M.	88.82	11 18	7.55	3.63	2.72	4.19	0.64	16.1	14.30	1.79	0.58	0.44	0.67	0 10
	11, P M.	89.58	10.42	7.59	2.83	2.53	4.37	0.69	12.8	11.46	1.33	0.36	0.32	0.56	0.09
13	18, A. M.	88.02	11.98	8.15	3.83	......	......	0.79	10.4	9.15	1.25	0.40	......	......	0.08
	18, P. M.	88.00	12.00	8 15	3.85	2.34	5.20	0.61	10.0	8.80	1.20	0.38	0.23	0.52	0.06
14	25, A. M.	89.33	10.67	7.75	2.92	2.60	4.44	0.71	12.2	10.90	1.30	0.36	0.32	0.54	0.09
	25, P. M.	88.86	11.14	8.14	3.00	2.53	4.95	0 66	11.8	10.49	1.31	0.35	0.30	0.58	0.08
	Daily average, A. M.	88.96	11.04	7.77	3.27	2.62	4.45	0.70	13.9	12.42	1.52	0.45	0.39	0.66	0.09
	P. M.	89.04	10.96	7.78	3.18	2.50	4.54	4.74	13.0	11.59	1.41	0.40	0.32	0.57	0.10
	Mean daily average	89.00	11.00	7.77	3.23	2.56	4.49	0.72	13.5	12.03	1.47	0.42	0.36	0.61	0.09
16	September 8, A. M.	89.06	10.94	7.56	3.38	2.66	4.18	0.72	12 8	11.40	1.40	0.43	0.34	0.53	0.09
	8, P. M.	88.40	11.60	8.28	3 32	2.72	4.92	0.64	11.5	10.17	1.33	0.38	0.31	0.57	0.07
17	15, A. M.	88.33	11.67	8.81	2.86	3.42	4.90	0.49	11.6	10.25	1.35	0.33	0.40	0.57	0.06
	15, P. M.	88.48	11.52	8.39	3.13	2.72	5.00	0.67	13.2	11.68	1.52	0.41	0.36	0.66	0.09
18	22, A. M.	89.12	10.88	7.82	3.06	2.85	4.22	0 75	12.2	10.87	1.33	0.37	0.34	0.51	0.09
	22, P. M.	88.70	11.30	......	......	2.78	......	0.70	11.8	10 47	1.33	0.33	......	......	0.08
	Daily average, A. M.	88 84	11.16	8.06	3.10	2.98	4.43	0.65	12.2	10.84	1.36	0.38	0.36	0.54	0.08
	P. M.	88.53	11.47	8.25	3.22	2.74	4.96	0.67	12.2	10.77	1.39	0.37	0.33	0.61	0.08
	Mean daily average	88.68	11.32	7.66	3.66	2.86	4.69	0.66	12.2	10.83	1.37	0.38	0.35	0.57	0.08

20	October 6, A. M.	88 67	11.32	8.07	3.26	2.91	4.44	0.72	10.0	8.87	1.13	0.31	0.29	0.44	0.07
	6, P. M.	88.42	11.58	8.32	3.26	2.91	4.48	0.93	9.4	8 31	1 09	0.31	0.27	0.42	0.09
22	20, A. M.	88.93	11.07	8.11	2.96	2.98	4.38	0.75	8.5	7.56	0.94	0.25	0.25	0.37	0.07
	20, P. M.	88.63	11.37	7.97	3.40	3.04	4.14	0.79	5.0	4.43	0.57	0.17	0.15	0.21	0.04
	Daily average, A. M.	88 80	11.20	8.09	3.11	2.95	4.41	0.74	9.3	8.22	1 08	0.28	0.28	0.40	0.07
	P M.	88.52	11.48	8.15	3.33	2.98	4.31	0.86	7.2	6.37	0.83	0.24	0.20	0.31	0.06
	Mean daily average	88 66	11.34	8.12	3.22	2.96	4.36	0.80	8.3	7 46	0.94	0.26	0.24	0.36	0.07
24	November 3, A. M.	86.63	13.37	8.46	4.91	3.04	4.62	0 80	4.1	3 55	0 55	0.20	0.12	0.20	0.03
	3, P. M.	85.49	14.51	8 72	5.79	......	......	0.80	3.5	3.00	0.50	0.20	.....	......	0.03
26	17, A M.	87.22	12.78	8.36	4.42	3 61	4.09	0.66	3.8	3 32	0.48	0 17	0.14	0.14	0.03
	17, P. M.	86.76	13 24	8.54	4.70	3.48	4.56	0.50	3.5	3.01	0.46	0.16	0.12	0.16	0.02
	Daily average, A. M.	86.82	13.18	8.51	4.67	3.33	4.36	0.73	4.0	3.44	0.52	0.19	0.13	0.17	0.03
	P. M.	86 12	13.88	8.63	5.25	3.48	4.56	0.65	3.5	3.02	0.48	0.18	0.12	0.16	0.02
	Mean daily average	86.47	13.53	8.57	4.96	3.41	4.47	0.69	3.75	2.23	0.50	0.19	0.13	0.16	0.03

RECORD OF MILK ANALYSES — HOLSTEIN — ESEL 2D.

Number of week of lacation.	DATE.	Percentage Composition of Milk.							Composition of Day's Milk Expressed in Pounds.						
		Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
2	July 30, A. M.	86.22	13.78	8.77	5.01	2.98	5.06	0.72	11 6	10.00	1.60	0.58	0.35	0.58	0.08
	30, P. M.	86.84	13.16	8.45	4.71	2 85	5.05	0.55	11.5	9.99	1.51	0.54	0.33	0.58	0.06
	Mean daily average	86.53	13.47	8.61	4.86	2.92	5.05	0.64	11.6	10.04	1.56	0.56	0.34	0.58	0.07
3	August 6, A. M.	87.52	12.48	8.59	3.89	2.91	4.91	0.77	13 2	11.55	1.65	0.51	0.38	0.65	0.10
	6, P. M.	87.18	12.82	9.43	3.39	2.79	5.96	0.68	12.5	10.90	1.60	0.42	0.35	0.74	0.08
4	13, A. M.	87 39	12.61	8.98	3.63	2.85	5.36	0.77	15.4	13.46	1.94	0.56	0.44	0.83	0.12
	13, P. M.	87.64	12.36	8.46	3.90	3.48	4 21	0.77	14 4	12.62	1.78	0.56	0.49	0.68	0.11
5	20, A. M.	87.99	12.01	8.63	3.38	2.72	5.10	0.81	15.5	13.64	1.86	0.52	0.42	0.79	0.12
	20, P. M	88.04	11.96	8.11	3.85	2.60	4.91	0.60	14.8	12.03	1.77	0.57	0.38	0.73	0.09
6	27, A. M.	87.80	12.20	8.81	3.39	2.85	5.33	0.63	15.4	13.52	1.88	0.52	0.44	0.82	0.10
	27, P. M.	87.87	12.13	8.37	3.76	2.85	4.74	0.78	14.8	13.00	1.79	0 56	0.42	0.70	0.12
	Daily average, A. M.	87.67	12.33	8.76	3.57	2.83	5.17	0.74	14.9	13.01	1.83	0.53	0.42	0.77	0.11
	P. M.	87.68	12.32	8.60	3.72	2.93	5.07	0.71	14.1	12.14	1.75	0.53	0.41	0.71	0.10
	Mean daily average	87.67	12.33	8.68	3.65	2.88	5.12	0.72	14.5	12.71	1.79	0.53	0.42	0.74	0.11
8	September 10, A M.	87.39	12.61	8.76	3.85	2.72	5.27	0.77	15.0	13.11	1.89	0.58	0.41	0.79	0.12
	10, P. M.	87.85	12.15	8.09	4.06	2.66	4.73	0.70	14.8	13.00	1.80	0.60	0.39	0.70	0.10
9	17, A. M.	87.15	12.85	9.06	3.79	3.16	5.09	0.81	15.2	13.25	1.95	0.58	0.48	0.77	0.12
	17, P. M.	88.56	11.44	7.92	3.52	2.79	4.40	0.73	14.4	12.75	1.65	0 51	0.40	0.63	0.10
10	24, A. M.	87.95	12.05	8.16	3.89	2.72	4.93	0.51	15.1	13.28	1.82	0.59	0.41	0.74	0.08
	24, P. M.	87.51	12.49	8.44	4.05	2.92	4.95	0.57	14.2	12.43	1.77	0.58	0.41	0.70	0.08
	Daily average, A. M	87.50	12.50	8.66	3 84	2.87	5.09	0.70	15.1	13.21	1.89	0.58	0.43	0.82	0.11
	P. M.	87.97	12.03	8.15	3.88	2.79	4.69	0.67	14.5	12.73	1.74	0.56	0.40	0.68	0.09

	Mean daily average	87.73	12.27	8.41	3.86	2.83	4.89	0.68	14.8	12.97	1.82	0.57	0.41	0.75	0.10
11	October 1, A. M.	87.98	12.02	8.34	3.68	3.04	4.57	0.73	13.5	11.88	1.62	0.50	0.41	0.62	0.09
	1, P. M.	87.81	12.19	8.28	3.91	2.72	4.77	0.79	13.5	11.85	1.65	0.53	0.37	0.64	0.11
13	13, A. M.	87.92	12.08	8.79	3.29	3.17	4.87	0.75	13.2	11.61	1.59	0.43	0.42	0.64	0.10
	13, P. M	87.84	12.16	8.78	3.38	3.04	5.05	0.69	12.8	11.24	1.56	0.43	0.41	0.65	0.07
15	27, A. M.	87.25	12.75	9.37	3.38	3 16	5.54	0.67	12.2	10.64	1.56	0.41	0.39	0.68	0.08
	27, P. M.	86.83	13.17	8.94	4.23	3.16	5.06	0.72	11.6	10.07	1.53	0.49	0.37	0.59	0.08
	Daily average, A. M	87.72	12.28	8.83	3.45	3.12	4.99	0.72	12.9	11.38	1.52	0.45	0.41	0.64	0.09
	P. M.	87.16	12.54	8.70	3.83	2.97	4.96	0.70	12.6	11.05	1.55	0.48	0.38	0.62	0.08
	Mean daily average	87.59	12.41	8.77	3.64	3.05	4.97	0.71	12.7	11.17	1 53	0.47	0.39	0.63	0.09
17	November 10, A. M.	87.55	12.45	8.77	3.68	......	......	0.72	12.6	11.03	1.57	0.46	......	......	0.09
	10, P. M.	87.55	12.45	8.86	3.59	......	......	0.72	11.4	9.98	1.42	0.41	......	......	0.08
19	24, A. M.	87.05	12.95	9.27	3.68	3.17	5.31	0.79	12.5	10.88	1.62	0.46	0.40	0.66	0.10
	24, P. M.	87.40	12.60	8.91	3.69	......	......	0.87	12.8	11.19	1.61	0.47	......	......	0.11
	Daily average, A. M.	87.30	12.70	9.02	3.68	3.17	5.31	0.75	12.55	10.95	1.59	0.46	0.40	0.66	0.10
	P. M.	87.48	12.52	8.89	3.64	......	......	0.80	12.10	10.58	1.51	0.44	......	......	0.10
	Mean daily average	87.39	12.61	8.96	3.66	3.17	5.31	0.77	12.3	10.76	1.55	0.45	0.40	0.66	0.10

RECORD OF MILK ANALYSES — AYRSHIRE — MISS FLOW 5TH.

Number of weeks of lactation	DATE.	Percentage Composition of Milk. Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Composition of Day's Milk, Expressed in Pounds. Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
1	February 10, A. M.	85.41	14.59	9.65	4 94	3.23	5 66	0.76	7.8	6.66	1.14	0.39	0.25	0.44	0.06
	10, P. M.	84.60	15.40	9.44	5.96	3.35	5.38	0.72	6 4	5.41	0.99	0.38	0.22	0.34	0.05
2	17, A. M.	84.64	15.36	9.45	5.91	3.23	5.65	0 57	8.3	7.03	1.27	0.49	0.27	0.47	0.05
	17, P. M	84.41	15.59	8.99	6.60	3.16	5.29	0.54	8.4	7.09	1.31	0.55	0.24	0.44	0.05
3	24, A. M.	85.97	14.03	9.20	4.83	2.98	5.71	0.51	9.0	7.74	1.26	0.43	0.27	0.51	0.05
	24, P. M.	85.90	14.10	8 72	5.38	2.98	5.03	0.71	8.6	7.39	1.22	0.46	0.26	0.43	0.06
	Daily average, A. M.	85.34	14.66	9.43	5.23	3.15	5.67	0.61	8.4	7.14	1.22	0.43	0.26	0.47	0.05
	P. M.	84.97	15.03	9.05	5.98	3.16	5.23	0.66	7.8	6.63	1.18	0.46	0.25	0.40	0.05
	Mean daily average	85.15	14.85	9.24	5.61	3.16	5.45	0.64	8 1	6.89	1.20	0.46	0 26	0.43	0.05
4	March 3, A M.	86.94	13.06	9.03	4.03	3.10	5.38	0.55	9.5	8.25	1.24	0.38	0 29	0.51	0.05
	3, P M.	87.71	12.29	8.57	3.72	2.98	4.90	0.69	9.1	7.98	1.12	0 34	0.27	0.45	0.06
5	10, A. M.	87 53	12.47	9.16	3.31	3.35	5.05	0.76	9.9	8.67	1.23	0.32	0.33	0.50	0.08
	10, A. M	......	......	......	3.55	3.29	......	0.81	9.8	......	......	0.35	0.32	......	0.08
6	17, A. M.	86.70	13.30	9.33	3.97	3.29	5.44	0.60	10.3	8.93	1.37	0.41	0.34	0.56	0.06
	17, P. M.	87.04	12.96	9.12	3.84	3.23	5.28	0.61	10.2	8.88	1.32	0.39	0.33	0.54	0.06
7	24, A M.	86.95	13.05	9.16	3.89	3.42	5.04	0.70	10.6	9 22	1.38	0.41	0.36	0.53	0.07
	24, P. M.	86.76	13.24	9.11	4.13	3.23	5.17	0.71	10.2	8.85	1.35	0.42	0.33	0.53	0.07
8	31, A. M.	86.54	13.46	9.32	4.14	3.29	5.24	0 79	10.6	9.17	1.43	0.44	0.35	0.56	0.08
	31, P. M.	86.91	13.09	9.14	3.95	3 35	5.20	0.59	9.8	8.51	1.29	0.39	0.33	0.51	0.05
	Daily average, A. M.	86.78	13.22	9.21	4.01	3.27	5.27	0.66	10.1	8.89	1.36	0.41	0.33	0.54	0.07
	P. M.	87.10	12.89	8.98	3 91	3.20	5.13	0.65	9.8	8.55	1.25	0.38	0.31	0.51	0.06
	Mean daily average	86.94	13.06	9.10	3.96	3.24	5.20	0.66	10.0	8.69	1.31	0.40	0.32	0.52	0.07

9	April 8, A. M.	86.51	13.49	9.35	4.14	3.04	5.58	0.73	9.8	8.48	1.32	0.41	0.30	0.55	0.07
	8, P. M.	86.70	13.30	9.06	4.24	3.16	5.18	0.72	9.6	8.32	1.27	0.41	0.30	0.50	0.07
10	14, A. M.	86.77	13.23	9.45	3.78	3.35	5.40	0.70	10.2	8.85	1.35	0.39	0.34	0.55	0.07
	14, P. M.	87.08	12.92	9.17	3.75	3.16	5.30	0.71	9.3	8.10	1 20	0.35	0.29	0.49	0.07
11	22, A. M.	86.85	13.15	9.34	3.81	3.23	5.38	0.73	9.4	8.16	1.24	0.36	0.30	0.51	0.07
	22, P. M.	87.15	12.85	9.35	3.50	3.16	5.49	0.70	9.4	8.19	1.21	0.33	0.30	0.56	0.06
12	28, A. M.	87.00	13.00	8.90	4.10	2.98	5.20	0.72	9.5	8.27	1.24	0.39	0.28	0.50	0.07
	28, P. M.	86.89	13.11	9.14	3.97	3.17	5.27	0.70	8.8	7.64	1.15	0.35	0.28	0.46	0.06
	Daily average, A. M.	86.78	13.22	9.26	3.96	3.15	5.39	0.72	9.7	8.44	1.29	0.39	0.30	0.53	0.07
	P. M.	86.95	13.04	9.18	3.86	3.16	5.31	0.71	9.3	8.06	1.21	0.36	0.29	0.50	0.06
	Mean daily average	86.87	13.13	9.22	3.91	3.16	5.35	0.71	9.5	8.25	1.25	0.38	0.30	0.51	0.06
13	May 5, A. M.	87.00	13.00	9.00	4.00	3.23	4.98	0.79	9.8	8.53	1.27	0.39	0.32	0.49	0.08
	5, P. M.	87.38	12.62	8.62	3.74	3.29	4.90	0.69	9.2	8.04	1.16	0.34	0.30	0.45	0.06
14	12, A. M.	86.23	13.77	9.72	4.05	3.61	5.45	0.66	9.3	8.02	1.28	0.38	0.34	0.51	0.06
	12, P. M.	87.02	12.98	9.43	3.55	3.35	5.51	0.57	9.0	7.83	1.16	0.32	0.30	0.50	0.05
15	19, A. M.	86.67	13.33	9.26	4.07	3.54	5.04	0.68	10.3	8.93	1.37	0.42	0.36	0.52	0.07
	19, P. M.	87.00	13.00	9.19	3.81	3.92	4.62	0.65	9.1	7.92	1.18	0.35	0.36	0.42	0.06
16	28, A. M.	86.40	13.60	9.61	3.99	4.24	4.62	0.75	10.4	8.99	1.41	0.41	0.44	0.48	0.08
	28, P. M.	86.89	13.11	9.06	4.05	4.11	4.25	0.70	9.1	7.90	1.19	0.37	0.37	0.39	0.06
	Daily average, A. M.	86.58	13.42	9.39	4.03	3 65	5.02	0.72	10.0	8.61	1.33	0.40	0.36	0.50	0.07
	P. M.	87.07	12.93	9.15	3.78	3.67	4.82	0.65	9.1	7.92	1.17	0.34	0.33	0.44	0.06
	Mean daily average	86.82	13.18	9.27	3.91	3.66	4.92	0.69	9.6	8.35	1.25	0.37	0.35	0.47	0.06
17	June 3, A. M.	86.23	13.77	9.05	4.02	4.05	5.05	0.65	10.5	9.05	1.45	0.42	0.43	0.53	0.07
	3, P. M.	86.60	13.40	9.50	3.90	3.99	4.73	0.78	9.5	8.23	1.28	0.37	0.38	0.45	0.07
18	9, A. M.	86.77	13.23	9.47	3.76	4.11	4.62	0.74	10.3	8.94	1.36	0.39	0.42	0.48	0.08
	9, P. M.	87.20	12.80	9.41	3.39	4.24	4.58	0.59	9.0	7.85	1.15	0.30	0.38	0.41	0.05
19	16, A. M.	86.54	13.46	9.40	4.06	4.11	4.60	0.69	10.3	8.91	1.39	0.42	0.42	0.47	0.07
	16, P. M.	86.94	13.06	9.12	3.94	4.11	4.36	0.65	9.5	8.26	1.24	0.37	0.39	0.41	0.06
20	23, A. M.	86.53	13.47	9.52	3.95	4.05	4.71	0.76	10.6	9.17	1.43	0.42	0.43	0.50	0.08
	23, P. M.	87.41	12.59	9.19	3.40	3.73	4.70	0.76	9.3	8.13	1.17	0.32	0.35	0.44	0.07
21	30, A. M.	86.57	13.43	9.41	4.02	4.18	4.55	0.68	9.6	8.31	1.29	0.38	0.40	0.44	0.06
	30, P. M.	86.90	13.10	9.46	3.64	4.30	4.50	0.66	9.1	7.91	1.19	0.33	0.39	0.41	0.06

RECORD OF MILK ANALYSES. — AYRSHIRE — MISS FLOW 5TH — (*Concluded*).

Number of week of lactation.	DATE.	Percentage Composition of Milk.							Composition of Day's Milk, Expressed in Pounds.						
		Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
	Daily average, A. M.	86.53	13.47	9.51	3.96	4.10	4.70	0.70	12.8	8.87	1.38	0.40	0.42	0.48	0.07
	P. M.	87.01	12.99	9.34	3.65	4.07	4.57	0.69	11.6	8.08	1.21	0.34	0.38	0.42	0.06
	Mean daily average	86.77	13.23	9.42	3.81	4.09	4.64	0.69	12.2	10.90	1.30	0.37	0.40	0.45	0.07
22	July 7, A. M.	86.85	13.15	9.13	4.02	3.92	4.51	0.70	9.5	8.25	1.25	0.38	0 37	0.43	0.07
	7, P. M	87.11	12.89	8.89	4.00	3.92	4.30	0.67	9.0	7.84	1.16	0.36	0.35	0.39	0.06
23	14, A. M.	86.87	13.13	9.23	3.90	3.61	4.84	0.78	8.9	7.73	1.17	0.35	0.32	0.43	0.07
	14, P. M.	87.21	12.79	8.72	4.07	3.54	4.50	0.68	8.0	6.98	1.02	0.33	0.28	0.36	0.05
24	21, A. M.	86.65	13.35	9.22	4.13	3.86	4.65	0.71	8.9	7.71	1.19	0.37	0.34	0.41	0.06
	21, P. M.	......	......	......	4.28	3.73	......	0.71	8.6	......	......	0.38	0.32	......	0.06
25	27, A. M.	86.57	13.43	9.10	4.33	3.61	4.82	0.67	8.5	7.35	1.14	0.37	0.31	0.41	0.06
	27, P. M	86.72	13.28	9.11	4.17	3.48	4.95	0.68	8.2	7.11	1.09	0.34	0.29	0.41	0.06
	Daily average, A. M.	86.74	13.26	9.17	4.09	3.75	4.70	0.71	9.0	7.76	1.19	0.37	0.33	0.42	0.06
	P. M.	87.02	12.98	8.85	4.13	3.67	4.58	0.68	8.0	7.31	1.09	0.35	0.31	0.39	0.06
	Mean daily average	86.88	13.12	9.01	4.11	3.71	4.64	0.70	8.5	7.36	1.14	0.36	0.32	0.41	0.06
26	August 4, A. M.	86.46	13.54	9.53	4.01	3.43	5.56	0.54	9.1	7.87	1.23	0.36	0.31	0.51	0.05
	4, P. M.	86.97	13.03	8.89	4.14	3.48	4.71	0.70	9.2	8.00	1.20	0.38	0.32	0.43	0.06
27	11, A. M.	86.60	13.40	9.23	4.17	3.48	5.02	0.73	9.2	7.97	1.23	0.38	0.32	0.46	0.07
	11, P. M.	87.17	12.83	8.96	3.87	3.48	4.79	0.69	9.1	7.93	1.17	0.35	0.32	0.44	0.06
28	18, A. M.	86.97	13.03	8.94	4.09	3.48	4.69	0.77	9.0	7.83	1.17	0.37	0.31	0.42	0.07
	18, P. M.	86.67	13.33	9.18	4.15	2.72	5.84	0.62	9.8	8.49	1.31	0.41	0.27	0.57	0.06
29	25, A. M.	86.55	13.45	9.62	3.83	3.73	5.19	0.70	8.1	7.01	1.09	0.31	0.30	0.42	0.06
	25, P. M.	86.10	13.90	9.75	4.15	3.61	5.47	0.67	7.8	6.72	1.08	0.32	0.28	0.43	0.05

	Daily average, A. M.	86.65	13.35	9.33	4.02	3.53	5.12	0.68	8.9	7.67	1.18	0.36	0.31	0.45	0.06
	P. M.	86.73	13.27	9.19	4.08	3.32	5.20	0.67	9.0	7.78	1.19	0.36	0.30	0.47	0.06
	Mean daily average	86.69	13.31	9.26	4.05	3.43	5.16	0.67	9.0	7.81	1.19	0.36	0.31	0.46	0.06
31	September 8, A. M.	85.57	14.43	9.91	4.52	3.61	......	......	7.5	6.42	1.08	0.34	0.27	......	....
	8, P. M.	86.13	13.87	9.19	4.68	......	......	0.75	7.5	6.46	1.04	0.35	......	......	0.06
32	15, A. M.	85.27	14.73	10.23	4.50	3.54	5.77	0.92	7.8	6.65	1.15	0.35	0.28	0.45	0.07
	15, P. M.	85.79	14.21	9.96	4.25	3.42	5.79	0.75	7.6	6.52	1.08	0.32	0.26	0.44	0.06
33	22, A. M.	85.70	14.30	9.67	4.63	3.73	5.24	0.70	7.5	6.42	1.07	0.35	0.28	0.39	0.05
	22, P. M.	85.59	14.41	9.76	4.65	3.54	5.67	0.55	7.1	6.08	1.02	0.33	0.25	0.40	0.04
	Daily average, A. M	85.51	14.49	10.28	4.21	3.63	5.50	0.81	7.6	6.50	1.10	0.35	0.28	0.42	0.06
	P. M.	85.84	14.16	9.63	4.53	3.48	5.73	0.68	7.4	6.35	1.05	0.33	0.25	0.42	0.05
	Mean daily average	85.67	14.33	9.96	4.37	3.56	5.62	0.75	7.5	6.43	1.08	0.34	0.27	0.42	0.05
35	October 6, A. M.	85.66	14.34	9.71	4.63	3.67	5.40	0.64	7.4	6.34	1.06	0.34	0.27	0.40	0.05
	6, P. M.	86.28	13.72	9.36	4.36	3.42	5.23	0.71	7.1	6.13	0.97	0.31	0.24	0.37	0.05
37	20, A. M	85.85	14.15	9.86	4.29	3.61	5.48	0.77	7.1	6.10	1.00	0.30	0.26	0.39	0.05
	20, P. M.	86.37	13.63	9.56	4.07	3.67	5.23	0.66	6.9	5.96	0.94	0.28	0.25	0.36	0.05
	Daily average, A. M.	85.75	14.25	9.79	4.46	3.64	5.44	0.70	7.3	6.22	1.03	0.32	0.26	0.40	0.05
	P. M.	86.33	13.67	9.45	4.22	3.55	5.23	0.68	7.0	6.05	0.96	0.30	0.24	0.37	0.05
	Mean daily average	86.04	13.96	9.62	4.34	3.59	5.33	0.69	7.2	6.14	1.00	0.31	0.25	0.38	0.05
39	November 3, A. M.	84.66	15.34	10.22	5.12	3.73	5.73	0.76	6.4	5.42	0.98	0.33	0.24	0.36	0.04
	3, P. M.	86.04	14.96	10.00	4.96	3.99	5.30	0.71	6.0	5.10	0.90	0.30	0.24	0.32	0.04
41	17, A. M.	84.57	15.43	10.44	5.03	4.30	5.45	0.69	5.2	4.40	0.80	0.26	0.22	0.28	0.04
	17, P. M.	85.43	14.57	9.89	4.68	......	......	0.93	5.5	4.70	0.80	0.26	......	......	0.05
	Daily average, A. M.	84.61	15.39	10.31	5.08	4.02	5.59	0.73	5.8	4.91	0.89	0.30	0.23	0.32	0.04
	P. M.	85.23	14.57	9.95	4.82	3.99	5.30	0.82	5.8	4.90	0.85	0.28	0.24	0.30	0.04
	Mean daily average	85.02	14.98	10.03	4.95	4.01	5.24	0.78	5.8	4.91	0.87	0.29	0.24	0.30	0.04

RECORD OF MILK ANALYSES — AYRSHIRE — QUEEN DUCHESS.

Number of week of lactation.	DATE.	PERCENTAGE COMPOSITION OF MILK.							COMPOSITION OF DAY'S MILK, EXPRESSED IN POUNDS.						
		Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Milk yield, in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
1	July 30, A M.	86.67	13.33	9.59	3.74	3.67	5.17	0.75	8.9	7.71	1.19	0.33	0.33	0.46	0.07
	30, P. M.	86.31	13.69	9.51	4.18	3.54	5.21	0.76	12.2	10.53	1.67	0.51	0.43	0.64	0.09
	Mean daily average	86.49	13.51	9.55	3.96	3.61	5.19	0.75	10.6	9.17	1.43	0.42	0.38	0.55	0.08
2	August 6, A. M.	86.56	13.44	9.31	4.10	3.48	5.16	0.70	15.2	13.16	2.04	0.62	0.53	0.78	0.11
	6, P. M.	86.34	13.66	9.24	4.42	3.48	5.06	0.70	14.4	12.43	1.97	0.63	0.50	0.73	0.10
3	13, A. M.	85.79	14.21	9.64	4.57	3.35	5.54	0.75	15.2	13.01	2.16	0.69	0.51	0.84	0.11
	13, P. M.	86.47	13.53	9.34	4.19	3.10	......	......	13 9	12.02	1.88	0.58	0.43	......	.....
4	20, A M.	86.45	13.55	9.24	4.31	2.97	5.70	0.57	11.6	10.03	1.57	0.50	0.34	0.66	0.07
	20, P. M.	86.25	13.75	8.79	4.96	2.72	5.49	0.58	11.8	10.18	1.62	0.58	0.32	0.65	0.07
5	27, A. M	86.97	13.03	9.00	4.03	2.91	5.35	0.74	12.5	10.87	1.63	0.50	0.36	0.67	0.09
	27, P. M.	86.80	13.20	9.00	4.20	3.04	5.24	0.72	12.1	10.50	1.60	0.51	0.37	0.63	0.09
	Daily average, A. M.	86.44	13.56	9.30	4.26	3.18	5.44	0.69	13.6	11.77	1.85	0.58	0.43	0.74	0.09
	P. M.	86.47	13.53	9.09	4.44	3.08	5.26	0.67	13.1	11.28	1.77	0.57	0.40	0.67	0.08
	Mean daily average	86.45	13.55	9.20	4.35	3.13	5.35	0.68	13.4	11.59	1.81	0.56	0.42	0.71	0.09
7	September 10, A. M.	87.32	12.68	8.65	4.03	2.85	5.00	0.80	11.0	9.60	1.39	0.44	0.31	0.55	0.09
	10, P. M	86.46	13.51	9.05	4.49	2.60	5.72	0.73	10.9	9.42	1.48	0.49	0.28	0.62	0.08
8	17, A. M.	85.12	14.88	9.34	5.54	3.10	5.43	0.81	10.8	9.19	1.61	0.60	0.33	0.59	0.09
	17, P. M.	87.25	12.75	8.76	3.99	2.91	5.13	0.72	10.5	9.16	1.34	0.42	0.30	0.54	0.08
9	24, A. M.	87.13	12.87	8.70	4.17	3.29	4.78	0.63	10.6	9.23	1.36	0.44	0.35	0.51	0.07
	24, P. M.	86.90	13.10	8.43	4.67	......	......	0.59	11.4	9.91	1.49	0.53	......	......	0.07
	Daily average A. M.	86.52	13.48	8.90	4.58	3.08	5.07	0.75	10.8	9.34	1.45	0.49	0.33	0.55	0.08
	P. M.	86.87	13.13	8.75	4.38	2.75	5.42	0.68	10.9	9.50	1.44	0.48	0.29	0.58	0.08
	Mean daily average	86.69	13.31	8.83	4.48	2.92	5.25	0.72	10.9	9.45	1.45	0.49	0.31	0.57	0.08

10	October 1, A. M	87.27	12.73	8.37	4.36	2.85	4.71	0.81	11.6	10.12	1.48	0.51	0.33	0.55	0.09
	1, P. M	86.64	13.36	8.58	4.78	3.48	4.39	0.71	11.8	10.22	1.58	0.56	0.41	0.52	0.08
12	13, A. M	87.59	12.41	9.05	3.36	3.10	5.22	0.73	7.1	6.22	0.88	0.24	0.22	0.37	0.05
	13, P. M	87.26	12.74	9.07	3 67	2.85	5.53	0.69	6.5	5.67	0.83	0.24	0.19	0.36	0.05
14	27, A. M	87.07	12.93	9.51	3.42	3.04	5.76	0.71	7.4	6.44	0.96	0.25	0.22	0.43	0.05
	27, P. M	87.52	12.48	8.56	3.92	3.04	4.80	0.72	6.3	5.51	0.79	0.25	0.19	0.31	0.05
	Daily average, A. M	87.31	12.69	8.98	3.71	3.00	5.23	0.75	8.7	7.59	1.11	0.33	0.26	0.45	0.06
	P. M	87.14	12.86	8.74	4.12	3.12	4.91	0.71	8.2	7.13	1.07	0.35	0.27	0.40	0.06
	Mean daily average	87.23	12.77	8.86	3.91	3.06	5.07	0.73	8.5	7.36	1.09	0.34	0.27	0.42	0.06
16	November 10, A. M	86.94	13.06	9.13	3.93	......	......	0.72	10.5	9.13	1.37	0.41	......	......	0.08
	10, P. M	87.20	12.80	8.70	4.10	......	......	0.67	11.4	9.94	1.46	0.47	......	......	0.08
18	24, A. M	86.74	13.26	9.17	4.09	3.67	4.82	0.68	12.1	10.50	1 60	0.50	0.44	0.58	0.08
	24, P. M	87.27	12.73	9.05	3.68	3.42	5.02	0.61	11.1	9.69	1.41	0.41	0.38	0.56	0.06
	Daily average, A. M	86.84	13.16	9.15	4.01	3.67	4.82	0.70	11.3	9.82	1.48	0.45	0.44	0.58	0.08
	P. M	87.24	12.76	8.87	3.89	3.42	5.02	0.64	11.25	9.81	1.44	0.44	0.38	0.56	0.07
	Mean daily average	87.04	12.96	9.01	3.95	3.55	4.92	0.67	11.3	9.81	1.46	0.44	0.41	0.57	0.07

RECORD OF MILK ANALYSES — AMERICAN HOLDERNESS — MAGGIE 6TH.

Number of week of lactation.	DATE.	Percentage Composition of Milk.							Composition of Day's Milk, Expressed in Pounds						
		Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
1	September 30, A. M.	84.58	15.42	9.20	6.22	3.17	5.25	0.78	7.4	6.26	1.14	0.46	0.23	0.39	0.06
	30, P. M.	86.54	13.46	9.09	4.37	3.42	4.89	0.78	5.8	5.02	0.78	0.25	0.20	0.28	0.04
	Mean daily average	85.56	14.44	9.14	5.30	3.30	5.07	0.78	6.6	5.64	0.96	0.36	0,22	0.34	0.05
2	October 7, A. M.	87.63	12.37	8.21	4.16	3.04	4.42	0.75	8.6	7.54	1.06	0.36	0.26	0.38	0.07
	7, P. M.	86.99	13.01	8.70	4.31	......	......	0.67	8.3	7.22	1.08	0.36	......	......	0.06
3	14, A. M.	87.49	12.51	8.85	3.66	......	......	0.77	10.1	8.84	1.26	0.37	......	......	0.08
	14, P. M.	87.85	12.15	8.84	3.31	3.85	4.33	0.66	10.1	8.87	1.23	0.33	0.39	0.44	0.07
4	21, A. M.	87.59	12.41	8.66	3.75	2.72	5.34	0.60	9.5	8.32	1.18	0.36	0.26	0.51	0.06
	21, P. M.	88.06	11.94	8.02	3.92	2.53	4.92	0.57	9.5	8.37	1.13	0.37	0.24	0.47	0.05
5	28, A. M.	88.08	11.92	8.75	3.17	2.79	5.21	0.75	8.4	7.40	1.00	0.27	0.23	0.44	0.06
	28, P. M.	88.60	11.40	8.26	3.14	2.66	4.87	0.73	9.0	7.98	1.02	0.28	0.34	0.44	0.07
	Daily average, A. M.	87.70	12.30	8 62	3.69	2.85	4.99	0.72	9.2	8.03	1.13	0.34	0.25	0.44	0.07
	P. M.	87.87	12.13	8.46	3.67	3.01	4.71	0.66	9.3	8.11	1.12	0.34	0.29	0.45	0.06
	Mean daily average	87.78	12.22	8.54	3.68	2.93	4.85	0.69	9.3	8.17	1.13	0.34	0.27	0.45	0.07
6	November 4, A. M.	88.30	11.70	8.54	3.16	......	......	0.72	10.4	9.19	1.21	0.33	......	......	0.07
	4, P. M.	88.36	11.64	8.30	3.34	2.85	4.69	0.76	10.0	8.84	1.16	0.33	0.29	0.47	0.07
7	11, A M.	88.13	11.87	8.55	3.32	2.72	5.13	0.70	9.8	7.64	1.16	0.24	0.27	0.58	0.07
	11, P. M.	87.69	12.31	8.97	3.34	2.98	5.34	0.65	10.1	8.86	1.24	0.34	0.31	0.52	0.07
8	18, A. M.	87.93	12.07	8.48	3.59	3.48	4.25	0.75	9.1	8.00	1.10	0.33	0.32	0.38	0.07
	18, P. M.	88.34	11.66	8.12	3.54	3.29	4.26	0.57	9.0	7.95	1.05	0.32	0.28	0.40	0.05

9	November 25, A. M.	87.81	12.19	8.74	3.45	3.55	4.32	0.87	9.2	8.08	1.12	0.32	0.32	0.40	0.08
	25, P. M.	88.88	11.12	7.95	3.17	3.29	3.86	0.80	9.8	8.71	1.09	0.31	0.32	0.38	0.08
	Daily average, A. M.	88.04	11.96	8.58	3.38	3.25	4.57	0.76	9.6	8.45	1.15	0.32	0.31	0.44	0.07
	P. M.	88.32	11.68	8.34	3.35	3.10	4.54	0.69	9.7	8.57	1.13	0.32	0.30	0.44	0.07
	Mean daily average	88.18	11.82	8.46	3.36	3.18	4.55	0.73	9.65	8.51	1.14	0.32	0.31	0.44	0.07

RECORD OF MILK ANALYSES — AMERICAN HOLDERNESS — NELLIE 6TH.

Number of week of lactation.	DATE.	Percentage Composition of Milk.							Composition of Day's Milk Expressed in Pounds.						
		Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
2	September 23, A. M.	86.10	13.90	8.90	5.00	4.24	3.88	0.78	8.5	7.32	1.18	0.42	0.36	0.33	0.07
	23, P. M.	85.12	14.88	9.54	5.34	3.42	5.49	0.63	7.2	6.13	1.07	0.38	0.25	0.39	0.04
3	30, A. M.	86.24	13.76	9.07	4.69	2.98	5.37	0.72	7.6	6.55	1.05	0.36	0.23	0.41	0.05
	30, P. M.	87.39	12.61	8.52	4.09	......	......	0.70	7.0	6.12	0.88	0.29	.....	......	0.05
	Daily average, A. M.	86.17	13.83	8.99	4.84	3.61	4.62	0.75	8.1	6.93	1.11	0.39	0.29	0.37	0.06
	P. M.	86.26	13.74	8.90	4.71	3.42	5.49	0.66	7.1	6.12	0.97	0.33	0.25	0.39	0.05
	Mean daily average	86.21	13.79	9.01	4.78	3.52	5.06	0.70	7.6	6.56	1.04	0.36	0.27	0.38	0.06
4	October 7, A. M.	87.79	12.21	8.19	4.02	2.79	4.72	0.68	7.8	6.85	0.95	0.31	0.23	0.37	0.05
	7, P. M.	87.69	12.31	8.44	3.87	2.72	5.06	0.66	7.4	6.48	0.91	0.29	0.20	0.37	0.05
5	14, A. M.	87.60	12.40	8.89	3.51	3.17	5.05	0.67	8.2	6.98	1.00	0.29	0.26	0.41	0.05
	14, P. M.	87.54	12.46	8.87	3.59	3.04	5.19	0.64	8.3	7.26	1.03	0.30	0.25	0.43	0.05
6	21, A. M.	88.17	11.83	8.64	3.19	2.72	5.20	0.72	9.1	8.02	1.07	0.29	0.25	0.47	0.07
	21, P. M.	88.07	11.93	8.15	3.78	2.66	4.88	0.61	8.5	7.49	1.01	0.32	0.23	0.41	0.05
7	28, A. M.	88.45	11.55	8.45	3.10	2.72	5.10	0.63	8.9	7.87	1.03	0.28	0.24	0.45	0.06
	28, P. M.	87.90	12.10	8.86	3.24	2.72	5.43	0.71	8.4	7.38	1.02	0.27	0.23	0.46	0.06
	Daily average, A. M.	88.00	12 00	8.54	3.46	2.85	5.04	0.68	8.5	7.43	1 01	0.29	0.24	0.43	0.06
	P. M.	87.80	12.20	8.58	3.62	2.79	5.14	0.66	8.2	7.15	0.99	0.32	0.22	0.41	0.05
	Mean daily average	87.90	12.10	8.56	3.54	2.82	5.09	0.67	8.3	7.30	1.00	0.31	0.23	0.42	0.06
8	November 4, A. M.	87.71	12.29	9.19	3.10	2.98	5.50	0.71	8.9	7.81	1.09	0.28	0.26	0.51	0.04
	4, P. M.	87.71	12.29	8.76	3.53	3.42	4.83	0.51	8.9	7.81	1.09	0.31	0.30	0.43	0.05
9	11, A. M.	87.81	12.19	8.92	3.27	3.23	4.99	0.70	8.9	7.82	1.08	0.29	0.29	0.44	0.06
	11, P. M.	88.35	11.65	8.32	3.33	3.04	4.67	0.61	9.4	8.30	1.10	0.31	0.29	0.44	0.06

10	18, A. M.	87.63	12.37	8.71	3.66	3.35	4.74	0.62	9.1	7.97	1.13	0.33	0.30	0.44	0.06
	18, P. M.	88.41	11.59	8.37	3.22	3.29	4.56	0.52	9.0	7.96	1.04	0.29	0.30	0.40	0.05
	Daily average, A. M.	87.72	12.28	8.94	3.34	3.19	5 07	0.68	9.0	7.89	1.11	0.30	0.29	0.46	0.06
	P M.	88.16	11.84	8.48	3.36	3.25	4.69	0.55	9.1	8.02	1.08	0.31	0.29	0.43	0.05
	Mean daily average	87.94	12.06	8.71	3.35	3.22	4.89	0.61	9.0	7.96	1.10	0.31	0.29	0.44	0.06

RECORD OF MILK ANALYSES — JERSEY — COUNTESS FLAVIA.

Number of week of lactation.	DATE.	Percentage Composition of Milk. Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Composition of Day's Milk Expressed in Pounds. Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
1	April 25, A. M.	84.94	15.06	10.24	4.82	4.05	5.35	0.84	8.1	6.88	1.22	0.39	0.33	0.43	0.07
	25, P. M.	84.99	15.01	9.46	5.55	3.73	4.98	0.75	8.4	7.14	1.26	0.47	0.31	0.42	0.06
2	28, A. M.	84.91	15.09	9.71	5.38	3.73	5.37	0.61	8.6	7.30	1.30	0.46	0.32	0.46	0.06
	28, P. M.	85.22	14.78	9.46	5.32	3.73	4.97	0.76	8.6	7.33	1.27	0.46	0.32	0.43	0.06
	Daily average, A. M.	84.92	15.07	9.98	5.10	3.89	5.36	0.72	8.35	7.09	1.26	0.42	0.32	0.44	0.06
	P. M.	85.10	14.89	9.46	5.43	3.73	4.97	0.76	8.5	7.23	1.27	0.47	0,32	0.43	0.06
	Mean daily average	85.01	14.98	9.72	5.27	3.81	5.17	0.74	8.43	7.16	1.27	0.45	0.32	0.44	0.06
3	May 5, A. M.	86.15	13.85	9.62	4.23	3.61	5.19	0.82	10.1	8.70	1.40	0.43	0.37	0.52	0.08
	5, P. M.	86.00	14.00	9.36	4.64	3.67	4.84	0.85	9.8	8.43	1.37	0.45	0.36	0.47	0.09
4	12, A. M.	86.18	13.82	9.77	4.05	3.86	5.34	0.57	9.6	8.27	1.33	0.39	0.37	0.51	0.06
	12, P. M.	85.05	14.95	9.46	5.49	3.61	4.94	0.91	10.6	9.02	1.58	0.58	0.38	0.52	0.10
5	19, A. M.	85.76	14.24	9.41	4.83	3.67	5.01	0.73	11.1	9.52	1.58	0.54	0.41	0.56	0.08
	19, P. M.	85.24	14.76	9.45	5.31	4.11	4.64	0.70	10.0	8.52	1.48	0.53	0.41	0.46	0.07
6	28, A. M.	85.49	14.51	10.00	4.51	4.30	4.88	0.82	10.8	9.23	1.57	0.49	0.46	0.53	0.09
	28, P. M.	85.32	14.68	9.24	5.44	4.24	4.29	0.71	10.4	8.89	1.53	0.57	0.44	0.45	0.07
	Daily average, A. M.	85.94	14.06	9.60	4.46	3.87	4.99	0.74	10.4	8.97	1.47	0.47	0.40	0.52	0.08
	P. M.	85.40	14.60	9.38	5.22	3.91	4.68	0.79	10.2	8.71	1.49	0.53	0.40	0.47	0.08
	Mean daily average	85.67	14.33	9.49	4.74	3.89	4.84	0.77	10.3	8.84	1.48	0.50	0.40	0.50	0.08
7	June 3, A. M.	85.72	14.28	9.09	5.19	4.05	4.27	0.77	10.6	9.09	1.51	0.55	0.43	0.45	0.08
	3, P. M.	85.07	14.93	9.73	5.20	3.99	4.91	0.83	10.8	9.19	1.61	0.56	0.43	0.53	0.09
8	9, A. M.	85.11	14.89	9.77	5.12	4.26	4.71	0.80	10.9	9.28	1.62	0.56	0.46	0.51	0.09
	9, P. M.	85.40	14.60	9.52	5.08	4.37	4.30	0.86	10.1	8.63	1.47	0.51	0.44	0.43	0.08

9	June 16, A. M.	85.68	14.32	9.42	4.90	4.18	4.35	0.89	10.7	9.17	1.53	0.52	0.45	0.46	0.09
	16, P. M.	84.43	15.57	9.63	5.94	4.24	4.70	0.69	10.2	8.61	1.59	0.61	0.43	0.48	0.07
10	23, A. M.	85.40	14.60	9.83	4.77	4.38	4.67	0.78	9.2	7.86	1.34	0.44	0 40	0.43	0.07
	23, P. M.	83.59	16.41	9.52	6.89	3.99	4.79	0.74	9.8	8.19	1.61	0.67	0.39	0.47	0.07
11	30, A. M.	85.16	14.84	9.62	5.22	3.17	5.68	0.77	9.9	8.43	1.47	0.52	0.31	0.56	0.07
	30, P. M.	85.35	14.65	9.72	4.90	4.62	4.43	0.67	9.9	8.45	1.45	0.48	0.46	0.44	0.07
	Daily average, A. M.	85.41	14.59	9.55	5.04	4.01	4.74	0.80	10.3	8.77	1.49	0.52	0.41	0.48	0.08
	P. M.	84.77	15.23	9.62	5.60	4.24	4.62	0.76	10.2	8.61	1.55	0.57	0.43	0.47	0.08
	Mean daily average	85.09	14.91	9.59	5.32	4.13	4.68	0.78	10.3	8.69	1.52	0.55	0.42	0.48	0.08
12	July 7, A. M.	85.88	14.12	9.50	4.62	3.80	4.73	0.97	9.3	7.98	1.31	0.43	0.35	0.44	0.09
	7, P. M.	84.61	15.39	9.60	5.79	3.92	5.00	0.68	9.6	8.12	1.47	0.55	0.38	0.48	0.06
13	14, A. M.	86.37	13.63	9 66	3.97	3.80	5.13	0.73	9.5	8.20	1.29	0.38	0.36	0.50	0.07
	14, P. M.	84.60	15.40	9.66	5.74	3.80	5.14	0.72	9.5	8.03	1.46	0.54	0.36	0.49	0.07
14	21, A. M.	84.82	15.18	9.83	5.35	3.99	5.08	0.76	9.8	8.31	1.49	0.52	0.39	0.50	0.07
	21, P. M.	85.10	14.90	9.34	5.56	3.73	4.88	0.73	9.2	7.83	1.37	0.51	0.34	0.45	0.07
15	28, A. M.	84.49	15.51	9.43	6.08	3.73	5.05	0.65	9.4	7.94	1.46	0.57	0.35	0 48	0.06
	28, P. M.	84.90	15.10	9.29	5.81	3.48	5.12	0.69	9.4	7.98	1.42	0.55	0.33	0.48	0.06
	Daily average, A. M.	85.39	14.61	9.61	5.00	3.83	5.00	0.78	9.5	8.11	1.39	0.47	0.36	0.49	0.07
	P. M.	84.80	15.20	9.48	5.72	3.73	5.03	0.70	9.4	7.99	1.43	0.54	0.35	0.47	0.06
	Mean daily average	85.10	14.41	9.55	5.36	3.78	5.02	0.74	9.5	8.05	1.41	0.51	0.36	0.48	0.07
16	August 4, A. M.	87.98	12.12	8.80	3.22	3.67	4.33	0.80	9.8	8.62	1.18	0.32	0.36	0.42	0.08
	4, P. M.	87.06	12.94	8.21	4.73	3.67	3.86	0.68	9.4	8.18	1.22	0.44	0.34	0.36	0.06
17	11, A. M.	84.45	15.45	10.00	5.45	3.73	5.57	0.70	8.6	7.27	1.33	0.47	0.32	0.48	0,06
	11, P. M.	85.06	14.94	9.47	5.47	3.67	5.13	0.67	9.0	7.66	1.34	0.49	0.32	0.46	0.06
18	18, A. M.	84.18	15.82	9.59	6.23	......	......	0.74	9.8	8.25	1.55	0.61	......	......	0.07
	18, P. M.	84.75	15.25	9.45	5.80	3.35	5.34	0.78	9.9	8.39	1.50	0.57	0.33	0.53	0.08
19	25, A. M.	84.62	15.38	10.09	5.29	4.05	5.36	0.68	8.5	7.19	1.31	0.45	0.34	0.46	0.06
	25, P. M.	83.31	16.69	9.98	6.71	3.73	5.55	0.70	9.5	7.91	1.59	0.64	0.35	0.53	0.07
	Daily average, A. M.	85.33	14.67	9.62	5.05	3.70	5.15	0.74	9.2	7.85	1.35	0.45	0.34	0.47	0.07
	P. M.	85.05	14.95	9.27	5.68	3.69	4.85	0.70	9.45	8.04	1.41	0.54	0.34	0.45	0.06
	Mean daily average	85.19	14.81	9.45	5.37	3.70	5.00	0.72	9.33	7.95	1.38	0.50	0.34	0.46	0.07
21	September 8, A. M.	84.07	15.93	9.68	6.25	4.05	4.83	0.80	8.5	7.14	1.35	0.53	0.34	0.41	0.07
	8, P. M.	84.33	15.67	9.35	6.12	3.86	5.14	0.55	8.2	6.91	1.28	0.50	0.32	0.42	0.04

RECORD OF MILK ANALYSES — JERSEY — COUNTESS FLAVIA — (*Concluded*).

Number of week of lactation.	DATE.	Percentage of Composition of Milk. Per cent. of water.	Per cent. of total solids.	Per cent. of solids, not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Composition of Day's Milk Expressed in Pounds. Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
22	September 15, A. M.	82.93	17.07	10.81	6.26	4.05	5.96	0.80	8.8	7.30	1.50	0.55	0.36	0.52	0.07
	15, P. M.	83.92	16.04	10.22	5.82	3.99	5.49	0.74	8.4	7.04	1.35	0.49	0.33	0.46	0.06
23	22, A. M.	83.77	16.23	9.85	6.38	4.30	4.78	0.77	8.5	7.12	1.38	0.54	0.37	0.41	0.07
	22, P. M.	84.06	15.94	10.06	5.88	3.99	5.35	0.72	7.6	6.39	1.21	0.45	0.30	0.41	0.05
	Daily average, A. M	83 59	16.41	10.11	6.30	4.13	5.19	0.79	8.6	7.19	1.41	0.54	0.36	0.45	0.07
	P. M.	84.10	15.90	9.96	5.94	3.95	5.34	0.67	8.1	6.78	1.28	0.48	0.32	0.44	0.05
	Mean daily average	83.85	16.16	10.04	6.12	4.04	5.27	0.73	8.4	6.99	1.35	0.51	0.34	0.45	0.06
25	October 6. A. M.	83.63	16.37	9.75	6.62	3.42	5.62	0.71	7.5	6.27	1.23	0.50	0.26	0.42	0.05
	6, P. M.	84.45	15.55	9.68	5.87	3.92	5.00	0.76	7.8	6.59	1.21	0.46	0.30	0.39	0.06
27	20, A. M.	84.13	15.87	10.05	5.82	3.99	4.97	1.09	8.5	7.15	1.35	0.50	0.34	0.42	0.09
	20, P. M	84.25	15.75	10.09	5.66	3.99	5.41	0.69	8.1	6.82	1.28	0.46	0.32	0.44	0.06
	Daily average, A. M.	83.88	16.12	9.90	6.22	3.71	5.30	0.90	8.0	6.71	1.29	0.50	0.30	0.42	0.07
	P. M.	84.35	15.65	9.89	5.77	3.96	5.21	0.73	8.0	6.74	1.25	0 46	0.31	0.42	0.06
	Mean daily average	84.12	15.89	9.90	6.00	3.84	5.26	0.82	8.0	6.73	1.27	0.48	0.31	0.42	0.07
29	November 3. A M.	83.15	16.85	10.39	6.46	3.99	5.57	0.83	7.2	6.00	1.20	0.47	0.29	0.38	0.06
	3, P. M.	83.77	16.23	9.88	6.35	3 54	5.57	0 77	7.2	6.03	1.17	0.46	0.25	0.40	0.06
31	17, A. M.	83.30	16.70	9.98	6.72	4.24	4.97	0.77	7 5	6.25	1.25	0.50	0.32	0.37	0.06
	17, P. M.	84.15	15.85	9.70	6.15	4.18	4.64	0.66	7.0	5.89	1.11	0.43	0.29	0.34	0.05
	Daily average, A M.	83.22	16.78	10.19	6.59	4.12	5.27	0.80	7.9	6.13	1.23	0.49	0.31	0.37	0.06
	P. M.	83.96	16.04	9.79	6.25	3.86	5.11	0.83	7.1	5.96	1.14	0.45	0.27	0.37	0.05
	Mean daily average	83.59	16.41	9.99	6.42	3.99	5.19	0.82	7.5	6.05	1.19	0.47	0.29	0.37	0.06

RECORD OF MILK ANALYSES — JERSEY — BARBARA ALLEN.

Number of week of lactation.	DATE.	Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
		Percentage Composition of Milk.							Composition of Day's Milk Expressed in Pounds.						
	1890.														
2	September 10, A. M.	86.98	13.02	8.87	4.15	3.23	4.83	0.81	9.4	8.18	1.22	0.39	0.30	0.45	0.08
	10, P. M.	86.28	13.72	9.34	4.38	2.60	5.98	0.76	10.0	8.63	1.37	0.44	0.26	0.60	0.08
3	17, A. M.	85.61	14.39	9.38	5.01	3.17	5.50	0.71	10.0	8.56	1.44	0.50	0.32	0.55	0.07
	17, P. M.	85.62	14.38	9.28	5.10	3.04	5.42	0.82	9.2	7.88	1.32	0.47	0.28	0.50	0.07
4	24, A. M.	85.74	14.26	8.65	5.61	3.42	4.63	0.60	7.2	6.17	1.03	0.40	0.25	0.33	0.04
	24, P. M.	85.63	14.37	9.15	5.22	3.42	5.23	0.50	7.4	6.34	1.06	0.39	0.25	0.39	0.04
	Daily average, A. M.	86.11	13.89	8.97	4.92	3.27	4.99	0.71	8.9	7.66	1.24	0.43	0.29	0.44	0.06
	P. M.	85.84	14.16	9.26	4.90	3.02	5.54	0.69	8.9	7.62	1.26	0.43	0.27	0.49	0.06
	Mean daily average	85.98	14.03	9.11	4.91	3.15	5.26	0.70	8.9	7.64	1.25	0.43	0.28	0.46	0.06
5	October 1, A. M.	86.07	13.93	9.26	4.67	3.04	5.55	0.48	7.4	6.37	1.03	0.35	0.22	0.41	0.05
	1, P. M.	85.38	14.62	8.84	5.78	3.23	5.07	0.51	8.2	7.00	1.20	0.47	0.27	0.42	0.04
6	7, A. M.	86.11	13.89	8.87	5.02	3.04	5.10	0.73	6.6	5.68	0.92	0.33	0.20	0.34	0.05
	7, P. M.	85.12	14.88	9.05	5.83	3.67	4.71	0.67	7.1	6.04	1.06	0.42	0.26	0.33	0.05
7	13, A. M.	86.21	13.79	9.31	4.48	3.35	5.25	0.71	8.8	7.59	1.21	0.39	0.30	0.46	0.06
	13, A. M.	85.84	14.16	9.07	5.09	3.23	5.17	0.67	9.0	7.73	1.27	0.46	0.29	0.46	0.06
8	21, A. M.	86.68	13.32	9.17	4.15	3.23	5.26	0.68	8.4	7.28	1.12	0.35	0.27	0.44	0.06
	21, P. M.	85.79	14.21	9.14	5.07	3.35	5.03	0.76	8.9	7.64	1.26	0.45	0.30	0.45	0.07
9	28, A. M.	85.16	14.84	9.89	4.95	3.42	5.80	0.68	7.2	6.13	1.07	0.36	0.25	0.41	0.05
	28, P. M.	85.25	14.75	9.23	5.52	3.29	5.29	0.65	7.5	6.39	1.11	0.41	0.25	0.40	0.05
	Daily average, A. M.	86.05	13.95	9.30	4.65	3.25	5.37	0.69	7.7	6.63	1.07	0.35	0.25	0.41	0.06
	P. M.	85.48	14.52	9.07	5.46	3.32	5.06	0.66	8.1	6.82	1.18	0.44	0.27	0.41	0.06
	Mean daily average	85.77	14.23	9.18	5.05	3.28	5.21	0.68	7.9	6.73	1.13	0.40	0.26	0.41	0.06

RECORD OF MILK ANALYSES — JERSEY — BARBARA ALLEN — (*Concluded*).

Number of week of lactation.	DATE.	Percentage Composition of Milk.							Composition of Day's Milk Expressed in Pounds.						
		Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
10	November 4, A. M.	86.03	13.97	9.19	4.78	3.54	4.92	0.73	8.2	7.05	1.15	0.39	0.29	0.41	0.06
	4, P. M.	86.01	13.99	9.13	4.86	3.67	4.74	0.72	8.2	7.05	1.15	0.40	0.30	0.39	0.06
12	18, A. M.	84.95	15.05	9.32	5.73	4.05	4.59	0.68	8.1	6.88	1.22	0.46	0.33	0.37	0.06
	18, P. M.	85.98	14.02	8.08	5.94	......	......	0.73	8.2	7.05	1.15	0.49	......	......	0.06
	Daily average, A. M.	85.49	14.51	9.26	5.26	3.79	4.76	0.71	8.2	7.01	1.19	0.43	0.31	0.39	0.06
	P. M.	85.99	14.01	8.61	5.40	3.31	4.57	0.72	8.2	7.05	1.15	0.44	0.29	0.37	0.06
	Mean daily average	85.74	14.26	8.94	5.33	3.55	4.66	0.72	8.2	7.03	1.17	0.43	0.30	0.38	0.06

Record of Milk Analyses — Jersey — Gilderbloom.

Number of week of lactation.	Date.	Percentage Composition of Milk. Per cent. of water.	Per cent. of total solids.	Per cent. of solids not fat.	Per cent. of fat.	Per cent of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Composition of Day's Milk Expressed in Pounds. Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
1	September 16, A. M.	84.46	15.54	10.13	5.41	3.49	5.86	0.78	7.9	6.67	1.23	0.43	0.28	0.46	0.06
	16, P. M.	82.85	17.15	9.79	7.36	3 73	5.32	0.74	7.4	6.13	1.27	0.54	0.28	0.39	0.05
2	23, A. M.	85.00	15.00	9.50	5.50	3.54	5.17	0.79	9.5	8.07	1.42	0.52	0.34	0.49	0.07
	23, P. M.	84.37	15.63	9.32	6.31	3.99	4.77	0.56	9.0	7.59	1.41	0.57	0.36	0.43	0.05
3	30, A. M.	84.57	15.43	9.72	5.71	.....	......	0.79	9.8	8.28	1.51	0.56	......	......	0.08
	30, P. M.	84.58	15.42	9.20	6.22	3.17	5.25	0.78	8.1	6.85	1.25	0.50	0.26	0.42	0 06
	Daily average, A. M.	84.68	15.32	9.78	5.54	3.51	5.51	0.79	9.1	7.67	1.38	0.50	0.31	0.47	0.07
	P. M.	83.93	16.07	9.44	6.63	3.63	5.11	0.69	8.2	6.86	1.31	0.54	0.30	0.41	0.05
	Mean daily average	84.31	15.69	9.61	6.08	3.57	5.31	0.74	8.6	7.26	1.34	0.52	0.31	0.44	0.06
4	October 7, A. M.	84.97	15.03	8.94	6.09	3.23	5.07	0.61	6.8	5.78	1.02	0.41	0.22	0.35	0.04
	7, P. M.	84.32	15.68	8.95	6.73	3.29	4.93	0.73	7.6	6.41	1.19	0.51	0.25	0.37	0.06
5	14, A. M.	85.23	14.77	9.77	5.00	3.35	5.59	0.83	7.9	6.73	1.17	0.40	0.26	0.45	0.06
	14, P. M.	85.30	14.70	9.25	5.45	3.67	4.87	0.71	9.2	8.85	1.35	0.50	0.33	0.46	0.06
6	21, A. M.	84.83	15.17	9.60	5.57	3.16	5.58	0.86	8.8	7.47	1.33	0.49	0 28	0.49	0.07
	21, P. M.	85.14	14.86	9.11	5.75	2.78	5.64	0.69	9.4	8.00	1.40	0.54	0.26	0.53	0.07
7	28, A. M.	85.90	14.10	9.40	4.70	3.04	5.63	0.73	8.8	7.56	1.24	0.41	0.27	0.50	0.06
	28, P. M.	85.13	14.87	9.20	5.67	3.23	5.24	0.73	9.5	8.09	1.41	0.54	0.30	0.50	0.07
	Daily average, A. M.	85.23	14.77	9.43	5.34	3.19	5.47	0.77	8.1	6.91	1.19	0.42	0.26	0.45	0.06
	P. M.	84.97	15.03	9.13	5.90	3.24	5.17	0.72	8.9	7.56	1.34	0.52	0.28	0.47	0.07
	Mean daily average	85.10	14.90	9.28	5.62	3.21	5.33	0.74	8.5	7.23	1.27	0.47	0.27	0.46	0.07
8	November 4, A. M.	85.20	14.80	9.45	5.35	3.04	5.69	0.72	8.0	6.82	1.18	0.41	0.24	0.47	0.06
	4, P. M.	86.27	13.73	9.03	4.70	......	......	0.74	7.9	6.82	1.08	0.37	......	......	0.06

RECORD OF MILK ANALYSES — JERSEY — GILDERBLOOM — (*Concluded*).

Number of week of lactation.	DATE.	Percentage Composition of Milk.							Composition of Day's Milk Expressed in Pounds.						
		Per cent. of water.	Per cent. of total solids.	Per cent of solids not fat.	Per cent. of fat.	Per cent. of caseine and albumen.	Per cent. of sugar.	Per cent. of ash.	Milk yield in pounds.	Pounds of water.	Pounds of total solids.	Pounds of fat.	Pounds of caseine and albumen.	Pounds of sugar.	Pounds of ash.
	1890.														
9	November 11, A. M.	85.84	14.16	9.44	4.72	3.73	4.94	0.77	6.9	5.92	0.98	0.33	0.26	0.34	0.05
	11, P. M.	84.15	15.85	9.21	6.64	3.17	5.29	0.75	8.5	7.15	1.35	0.56	0.27	0.46	0.06
11	25, A. M.	85.16	14.84	9.53	5.31	3.61	5.33	0.59	8.0	6.81	1.19	0.42	0.29	0.43	0.05
	25, P. M.	86.37	13.63	9.18	4.45	3.80	4.57	0.81	7.2	6.22	0.98	0.32	0.27	0.33	0.06
	Daily average, A. M.	85.40	14.60	9.47	5.13	3.46	5.32	0.69	7.6	6.49	1.11	0.39	0.26	0.40	0.05
	P. M.	85.59	14.41	9.14	5.26	3.48	4.93	0.77	7.9	6.76	1.14	0.42	0.27	0.39	0.06
	Mean daily average	85.50	14.50	9.30	5.20	3.47	5.11	0.73	7.75	6.62	1.13	0.41	0.27	0.39	0.06

IV. Description and Data Pertaining to the Butter Work Connected with the Investigation of Breeds of Dairy Cattle.

This portion of the report will be presented under the following heads:

1. Organization of the work.
2. Objects of the work.
3. Description of methods used in creaming, churning, etc.
4. Statement of data observed and recorded.
5. Explanation of tabulated data.
6. Data useful for making comparisons.
7. Details of tabulated data.

I. Organization of the Work.

All work connected with making butter from the milk of the dairy cattle under experiment had to be organized from the beginning, and to this the chemist turned his attention as soon as was practicable after entering upon his duties at the Station.

It was planned to set milk from each cow on those days on which analysis of the milk was made and to make butter from the same. Commencing August 18, 1890, the plan has been regularly carried out.

All work connected with making and keeping the records has been under the immediate charge and supervision of the chemist. The details of creaming and churning have been mainly attended to by the Station dairyman. Most of the analytical work and the extensive calculations connected with keeping the records have been attended to personally by the chemist.

Up to December first, eighty-four churnings were made.

II. Objects of the Work.

The first and main object of the work is to study the breed characteristics in production of butter. This necessarily involves an extended study of the influence of foods upon butter yield as regards both quantity and qualtity.

A study will also be made of the various conditions which affect the efficiency of creaming, churnability of cream, etc. The plan is to vary the method of treatment from time to time, treating the milk of all the cows with uniformity, as nearly as possible, and noticing the different effects of variation of treatment.

Certain methods of creaming may be found more efficient with some breeds than with others, as it already seems to appear that the cream of each breed has a narrow range of temperature in which churning gives the best results, other conditions being the same.

Whatever variations may be made in methods, the same method will be applied at the same time to the different milks. By observing uniformity of treatment and conditions in the work justice will have been done to all breeds alike, when the investigation shall have been completed.

In general, it may be said that the effort will be made to carry on the whole investigation in such a way as to throw light from every possible direction upon the question of differences of the breeds under investigation.

It may be stated here that the comparative value of the breeds as regards cheese-making will be made a subject of study as soon as the quantity of milk furnished becomes sufficient to make the study practicable.

III. Description of Methods Used in Creaming, Churning, etc.

The method first followed, but modified as indicated later, was as follows:

Creaming.— Six pounds were weighed from the morning milk and from the evening milk of each cow. The milk was set in Cooley cans, surrounded by ice water, the temperature of the water being recorded at intervals sufficient to give an accurate idea of the average temperature of the water in the vat. The morning's milk was allowed to remain in the vat twenty-four hours, when it was skimmed.

Churning.— The cream from the morning and evening milks was weighed, mixed thoroughly, and was evenly divided, one-half being weighed into each of two glass churns, previously weighed. The churns hold about one quart each, and are used in the "Cherry" test churn, described in the report of this Station for 1884. The cream was divided for two reasons: First, it was desired to churn duplicates; and, second, one churn of the size used was insufficient to hold all the cream without being too full for efficient churning.

The cream was ripened and brought to a certain temperature for churning. The size of the Cherry test churn is sufficient to enable six samples of cream, with duplicates, to be churned at once. After the first churning, variations were made in the temperature of the cream churned to ascertain what range of temperature was suited to each cream for best results, and this range being ascertained it has been approximated in subsequent churnings. This is the only condition in which uniformity has not been adhered to. The comparatively small amount of cream churned renders it more sensitive to the influence of the temperature of the room, especially if the temperature of the room is much higher or lower than that of the cream in the churn, but effort is made to control the temperature of the room and hold it at about 60° Fahr. This is not always easy to accomplish.

Each churn was removed as soon as the butter granules were about the size of wheat kernels. When the churning of the day's samples was finished, the buttermilk was drained from each butter, fine wire gauze being tied over the mouth of each churn to prevent the escape of small particles of butter. The butters were then washed with cold water until the rinsings were clear, and, finally, the churns were wiped dry on the outside and then weighed on a balance sensitive to within 100 milligrams (about 1-283 of an ounce.)

Sampling butter for analysis.— The churns were then transferred to the laboratory, the butter was carefully melted, thoroughly shaken, in order to incorporate all the moisture on the inside of the churn, the duplicates were mixed, again thoroughly agitated, and a portion poured into a smaller wide-mouthed bottle and cooled to solidity as quickly as possible under a stream of cold water, with constant shaking. In no other way can a *uniform* sample of butter be easily secured for analysis. The samples thus prepared were then analyzed.

The foregoing is the plan first adopted, but the following modifications have been found desirable: (1.) Prolongation of period of creaming. (2.) Making correction for loss in handling. (3.) Changing the amount of milk used for making butter. (4.) Changing the manner of washing the butter. (5.) Changing method of ripening cream.

(1.) *Prolongation of period of creaming.*—It was soon observed that the amount of fat lost in the skim milk was much larger than it should be, and, on special investigation, it was found that the twelve-hour creaming was, in most cases, responsible for the loss. Since then the morning milk has been allowed to set thirty-four hours, and the evening milk twenty-two or twenty-three hours, other conditions being the same. Taking the average of all the cows for the period during which milk was set twenty-four and twelve hours, and also the average for the period during which milk was set thirty-four and twenty-two hours (up to December first), it is found that the per centage of fat lost in the skim milk was diminished from 21.67 per cent. to 14.34 per cent. of the fat in the milk. The per centage of fat recovered in the cream was increased from 78.33 per cent. to 85.66 per cent. of the fat in the milk. The percentage of fat recovered in the butter for the same period was increased from 69.16 per cent. to 75.92 per cent. of the fat in the milk. Practically, then, all the extra fat recovered in the cream by prolonged setting was also recovered in the butter; that is, the churnability of the fat rising last in the creaming was the same as that rising first.

(2.) *Correction for loss in handling.*—In transferring the cream from the Cooley cans to the churns, some cream remains adhering to the inside of the can; this amount is weighed and a correction is made in the weight of the butter produced to allow for this loss. The loss is variable, depending on the thickness of the cream, mainly, and so the amount of correction must be determined in each case. This amount of loss, though small, is taken into consideration, since the total amount of cream used is small, and appreciable error might be caused by neglect of this precaution. Of course the last traces of cream could be removed from the Cooley can by rinsing with water, but this would introduce complications desirable to avoid in experimental work, and the simplest as well as the most accurate method has been found to weigh the actual loss and make a correction for it.

(3.) *Changing amount of milk used.*—It was found desirable to change the amount of milk set, since the cream from twelve pounds often makes the churn too full for best results in churning. Accordingly, five pounds are set from each milking; and, in the case of cows whose milk is rich in fat, only half this amount can be used. In one case churning was prolonged over four hours by trying to churn the cream from twelve pounds of milk in two churns.

(4.) *Change in methods of washing butter.*—An effort was made to work the butter to some extent, but no convenient plan could be devised which would not involve some loss of butter. At first, the butter was washed with cold water; later, cold brine was substituted for this, and still later washing with brine followed by cold water was employed. The effect of washing the butter in these different ways upon the amount of solids not fat has been noted, but no striking uniformity of effect has been observed.

(5.) *Change of method of ripening cream.*— About the middle of October we began to use Boyd's "starter" for ripening cream. The method of ripening by exposing to air in a moderately warm place proved too uncontrollable for our purpose, since it was desired to have the time of ripening uniform, in order that the creams might all be ready at the same time for churning. The "starter" has been used since, giving the desired results. No increase in percentage of butter fat recovered has been noticed which could be attributed to its use.

Some may suppose that the small amount of milk used for making butter is insufficient to give the most satisfactory results. The only objection of weight that can be urged is that in using small amounts of milk, the loss due to handling will be proportionately greater than where large amounts are used. This objection might hold good were it not for the fact that every possible precaution is taken to guard against losses, and where loss in handling is inevitable, the exact amount is determined and the necessary correction applied to the results. Our experience would lead us to believe that the method is even more accurate than the usual methods employed in working with large amounts of milk.

IV. STATEMENT OF DATA OBSERVED AND RECORDED.

Following is an outline of the data kept in connection with the butter work:

I. CREAMING.

1. *Milk set.*
   - a. Date.
   - b. Temperature.
   - c. Number of hours.
   - d. Pounds.
   - e. Per cent. fat.
   - f. Total fat.

2. *Skim-milk.*
    a. Pounds.
    b. Per cent. fat.
    c. Total fat.

3. *Cream.*
    a. Pounds.
    b. Per cent. fat.
    c. Total fat.

II. CHURNING.

1. *Conditions.*
    a. Cream, sour or sweet.
    b. Temperature during churning.
    c. Time of churning.

2. *Buttermilk.*
    a. Pounds.
    b. Per cent. fat.
    c. Total fat.

3. *Butter* (unsalted and unworked).
    a. Pounds.
    b. Total fat.

III. BUTTER.

1. *Composition.*
    a. Per cent. water.
    b. Per cent. fat.
    c. Per cent. solids not fat.
    d. Per cent. volatile fatty acids.
    e. Iodine equivalent.

2. *Physical properties.*
    a. Specific gravity.
    b. Melting point.
    c. Viscosity.
    d. Index of refraction.

IV. GENERAL DERIVED DATA.

1. *From* 100 *pounds of milk.*
    a. Pounds of fat in milk.
    b. Pounds of fat in skim milk.

c. Pounds of fat in cream.
d. Pounds of fat in buttermilk.
e. Pounds of fat in butter.
f. Pounds of butter containing 85 per cent butter-fat.

2. *Yield of butter.*
a. Pounds of milk required to make one pound of butter.
b. Milk yield for one day.
c. Pounds of butter from milk of one day.

3. *Fat recovered and lost.*
a. Per cent of fat recovered in cream.
b. Per cent of fat lost in skim milk.
c. Per cent of fat lost in buttermilk.
d. Per cent of fat recovered in butter.

V. MICROSCOPIC DATA.

1. *Fat globules.*
a. Relative number.
b. Relative size.

All the foregoing data have been recorded regularly except those pertaining to the physical properties of butter, to volatile fatty acids and iodine equivalent. These data will also be observed and studied as soon as the laboratory force is sufficiently increased to allow time for the work.

It is believed that such data, representing carefully conducted work, will prove exceedingly valuable in enabling conclusions regarding dairy problems to be drawn, which will be of general interest and value to dairy interests, in addition to the special objects of the investigation.

V. EXPLANATION OF TABULATED DATA.

The data connected with the butter record of each cow are arranged in four separate tables. While the general nature of each table can readily be seen at a glance, certain data may need explanation, in order that they may be clearly understood and their relations appreciated.

In order to render comparisons easy according to period of lactation, the number of weeks each cow has been in milk is placed in a column at the left. The columns are also numbered in Roman numerals across the top from left to right, in order that the same data in the corresponding tables of different cows may be more readily found and compared.

Table I embraces the most important data connected with the processes of creaming and churning. In column XIII the "Butter, unsalted and unworked," is the butter as it comes from the dairy to the laboratory for analysis, prepared as already described. The other data in Table I require no further explanation than that which has been given already under "Description of Methods, etc."

Table II contains a statement of the chemical composition of the "Butter unsalted and unworked," giving the percentages of the three chief constituents, "Fat," "Solids not fat," and "Water." The "Solids not fat" consist almost entirely of caseine as a result of the method of washing the butter and not salting it. During a part of the month of October, when the butters were washed only with brine, the "Solids not fat" contained considerable salt in addition to the caseine.

Table III follows the course of the fat in the milk through the operation of creaming and churning to the butter, stating the number of pounds of fat in 100 pounds of milk, the number of pounds of this fat recovered in the cream, lost in the skim milk and in the buttermilk, the number of pounds of fat recovered in the butter, and the number of "pounds of butter containing 85 per cent butter-fat;" also, under "Yield of butter," the number of pounds of milk and cream required to make one pound of butter, and the number of pounds of butter produced by the milk of one day.

The only point that needs attention is regarding the meaning of the data in column VII, "Pounds of butter containing 85 per cent butter-fat." The butters, as they come from the dairy, contain amounts of butter-fat and water which are very variable. By examining the data in Table II, in case of each cow, it will readily be seen to what extent different butters, treated practically in the same manner, may differ in regard to the amount of water and butter-fat contained in them. For example, taking the extreme cases, the lowest amount of water contained in any of these butters is 14.05 per cent., the highest being 48.97 per cent. These same butters contained butter-fat to the extent, respectively, of 85.21 per cent. and 50.73 per cent. To compare with one another butters differing so widely would clearly be extremely inaccurate as well as unjust. The only rational way to compare butters, where strict accuracy is required, is to reduce them all to the same content of butter-fat, for it is this that gives butter its food value, and, other things being equal, its commercial value also. This, of course, involves an accurate analysis of the butter. Since butter, on the average, contains, or should contain, 85 per cent. of butter-fat, this has been adopted as the standard to be used for comparison in this investigation, and all calculations in Tables III and IV are based on this standard butter. Thus, the butter in Table III, columns VIII, IX and XI, is in every case butter containing 85 per cent. butter-fat.

The amount of standard butter, or butter containing 85 per cent. of butter-fat, is ascertained by calculating from the amounts of butter given in Table I, column XIII, the composition of which is ascertained by analysis, the exact equivalent in butter containing 85 per cent. butter-fat.

Table IV, containing the "Percentages of Fat recovered and lost," is derived from data contained in Table III. It states, in parts per hundred, what part of the fat in the milk is recovered in the cream, and what part is lost in the skim milk; also what part of the fat in the milk is lost in the buttermilk, and what is recovered in the butter. If there were no loss of fat in the handling, and if analyses were absolutely correct, the numbers in columns IV and V, in Table IV, would just equal the corresponding number in column II; that is, the fat lost in the buttermilk added to the fat recovered in the butter would just equal the fat recovered from the milk in the cream. In actual practice, this can not be realized, owing to the two possible sources of loss mentioned. The "churnability" of fat in milk is the same thing as the "Fat recovered in Butter," in column V, Table IV.

In Table IV, column VI, the "Ratio of Fat in Milk to Butter," refers to the amount of butter produced compared with the amount of fat in the milk, and is found by dividing the amount of butter produced by the amount of fat in the milk of a definite quantity of milk, expressing the results on the scale of 100. For example, the number of pounds of fat in 100 pounds of a cow's milk is 6.02; from 100 pounds of this milk are made 6.13 pounds of butter. The ratio of fat in milk to butter is 6.13, divided by 6.02, multiplied by 100, which gives us the ratio of 102.

Since the butters are all reduced to one standard content of butter-fat, the numbers in Table IV, column VI, expressing the ratio of fat in milk to butter, are proportional to the numbers contained in column V, expressing the "churnability" or per cent of fat recovered in butter.

In general, the data of Table IV may be said to express the efficiency of each cow's milk as regards creaming and butter-making, independent of the absolute amount of fat recovered.

VI. DATA USEFUL FOR MAKING COMPARISONS.

In the tables presented below, certain data have been recorded and arranged with a special view to enabling one to make fair comparisons of the butter production of one cow with others. As in the case of the milk production, the members of the Station withhold comparisons and conclusions until one full period of lactation has been completed. But if any one wishes to make such comparisons from the data at hand, it may not be out of place to suggest the lines of comparison, in order that the data may not be interpreted to indicate what they do not and were not intended to mean.

For general purposes of comparison of the butter production of one cow with that of others, Tables I and II will not be found serviceable. Column XIII, in Table I, is particularly to be avoided in making such comparisons, since the amounts of butter recorded there contain varying amounts of butter-fat, as has already been pointed out.

The most useful data for making comparisons of record will be found in Table III, column VI, stating pounds of fat in butter from 100 pounds of milk; column VII, giving pounds of butter containing 85 per cent butter-fat, from 100 pounds of milk; column VIII, containing the number of pounds of milk required to make one pound of butter; column XI, stating the number of pounds of butter produced from the milk yield of one day.

For general comparison, where the *efficiency* of each cow in regard to creaming and butter-yield is desired, rather than the absolute amount of butter made, Table IV will be found useful.

In every case, in making comparisons between different cows, the same week of lactation should be used; this is found in the first column at the left.

VII. DETAILS OF TABULATED DATA.

BUTTER RECORD — HOLSTEIN-FRIESIAN — TOLSMA ARTIS.

TABLE I.

Creaming and Churning Data.

Number of week of lactation.	DATE		CREAMING. MILK SET. Average temperature.	Number of hours. M.	Number of hours. E.	Pounds.	Per cent. fat in milk.	Skim milk, per cent. fat.	Cream, per cent. fat.	CHURNING. CONDITIONS. Cream, sour or sweet.	Temperature during churning.	Time of churning. hrs.	Time of churning. min.	Butter-milk, per cent. fat.	Butter, unsalted and unworked, Pounds.
I.	II.		III.	IV.		V.	VI.	VII.	VIII.	IX.	X.	XI.		XII.	XIII.
	1890.														
13..........	August	18	54°	24	12	12	4.31	0.64	27.66	Sour	58°—65°		32	1.31	0.46
14..........	August	25	49°	24	12	12	2.96	1.37	19.52	Sour	56°—62°		30	2.00	0.20
16	September	8	51°	24	12	12	3.32	1.86	22.22	Sour	58°—62°		25	3.27	0.16
17..........	September	15	51°	24	12	12	2.99	2.07	15.42	Sour	58°—62°	1	3	1.75	0.15
20..........	October	6	50°	34	22	10	3.26	0.74	24.53	Sour	58°—60°		50	1.31	0.30
22..........	October	20	48°	34	22	10	3.13	1.25	15.18	Sour	59°—62°	1	5	1.15	0.24
24	November	3	47°	34	22	10	5.05	0.67	19.08	Sour	59°—63°		32	0.26	0.41
26..........	November	17	50°	34	23	10	4.56	0.51	20.65	Sour	60°—63°		32	5.20	0.44

BUTTER RECORD — HOLSTEIN FRIESIAN — TOLSMA ARTIS.

TABLE II.

Composition of Butter.

NUMBER OF WEEK OF LACTATION.	Per cent. fat.	Per cent. solids not fat.	Per cent. water.
I.	II.	III.	IV.
13	79.50	0.76	19.74
14	78.65	1.06	20.29
16	80.69	1.15	18.16
17	75.43	0.91	23.66
20	78.40	1.00	20.60
22	74.65	1.53	23.82
24	76.30	1.92	21.78
26	71.60	2.46	25.94

BUTTER RECORD — HOLSTEIN-FRIESIAN — TOLSMA ARTIS.

TABLE III.

Derived Data.

NUMBER OF WEEK OF LACTATION.	From One Hundred Pounds of Milk.						Yield of Butter.			
	Pounds of fat in milk.	Pounds of fat in in skim milk.	Pounds of fat in cream.	Pounds of fat in butter-milk.	Pounds of fat in butter.	Pounds of butter contain-ing 85 per cent. but-ter fat.	Pounds of milk required to make one pound of butter.	Pounds of cream required to make one pound of butter.	Milk yield for one day.	Pounds of butter from milk of one day.
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
13	4.31	0.55	3.76	0.13	3.05	3.59	27.86	3.79	20.38	0.73
14	2.96	1.25	1.71	0,14	1.31	1.54	64.93	5.68	24.00	0.37
16	3.32	1.73	1.59	0.19	1.08	1.27	78.74	4.82	24.25	0.31
17	2.99	1.93	1.06	0.10	0.94	1.11	90.10	6.30	24.81	0.28
20	3.26	0.66	2.60	0.10	2.35	2.76	36.23	3.84	19.38	0.53
22	3.13	1.08	2.05	0.13	1.79	2.11	47.39	6.40	13.50	0.28
24	5.05	0.51	4.54	0.05	3.13	3.68	27.17	6.46	7.63	0.27
26	4.56	0.41	4.15	0.82	3.15	3.71	26.95	5.42	7.25	0.27

BUTTER RECORD—HOLSTEIN-FRIESIAN—TOLSMA ARTIS.

TABLE IV.

Percentages of Fat Recovered and Lost.

NUMBER OF WEEK OF LACTATION.	Per cent. of fat recovered in cream.	Per cent. of fat lost in skim-milk.	Per cent. of fat lost in butter-milk.	Per cent. of fat recovered in butter.	Ratio of fat in milk to butter.
I.	II.	III.	IV.	V.	VI.
13	87.23	12.77	3.01	70.76	83
14	57.77	42.23	4.73	44.26	52
16	47.90	52.10	5.72	32.53	39
17	35.46	64.54	3.35	31.44	37
20	79.76	20.24	3.07	72.09	85
22	65.49	34.51	4.15	57.19	67
24	89.90	10.10	0.99	61.98	73
26	91.00	9.00	17.98	69.10	81

BUTTER RECORD — HOLSTEIN-FRIESIAN — ESEL 2D.

TABLE I.

Creaming and Churning Data.

Number of week of lactation.	DATE.		CREAMING. Milk set. Average temperature.	Number of hours. M.	Number of hours. E.	Pounds.	Per cent. fat in milk.	Skim-milk, per cent. fat.	Cream, per cent. fat.	CHURNING. Conditions. Cream, sour or sweet.	Temperature during churning.	Time of churning. hrs.	Time of churning. min.	Butter-milk, per cent. fat.	Butter, unsalted and unworked. Pounds.
I.	II.		III.	IV.		V.	VI.	VII.	VIII.	IX.	X.	XI.		XII.	XIII.
	1890.														
5.........	August	20	48°	24	12	12	3.61	0.65	22.04	Sour	56°—64°		51	2.96	0.41
6.........	August	27	48°	24	12	12	3.57	0.69	22.25	Sour	56°—62°		30	4.91	0.40
8.........	September	10	50°	24	12	12	3.96	0.83	22.67	Sour	58°—66°		47	1.97	0.45
9.........	September	17	49°	24	12	12	3.65	0.90	19.77	Sour	58°—65°	1	—	1.61	0.39
10.........	September	24	43°	24	12	10	3.97	1.03	17.62	Sour	60°—63°	1	35	0.93	0.38
11.........	October	1	49°	34	22	10	3.78	0.71	19.75	Sour	61°—64°		50	4.57	0.34
13.........	October	13	49°	34	22	10	3.34	0.65	19.71	Sour	60°—64°	1	25	1.02	0.31
15.........	October	27	48°	34	22	10	3.81	0.65	20.50	Sour	59°—64°	2	20	0.71	0.38
17.........	November	10	50°	34	23	10	3.64	1.43	20.00	Sour	60°	1	10	1.11	0.29
19.........	November	24	46°	34	23	10	3.69	0.98	20.81	Sour	58°—63°	1	20	1.28	0.35

BUTTER RECORD — HOLSTEIN-FRIESIAN — ESEL 2D.

TABLE II.

Composition of Butter.

NUMBER OF WEEK OF LACTATION.	Per cent. fat.	Per cent. solids not fat.	Per cent. water.
I.	II.	III.	IV.
5	70.50	1.05	28.45
6	67.13	1.59	31.28
8	77.83	1.14	21.03
9	75.94	1.24	22.82
10	76.80	0.73	22.47
11	59.14	1.79	39.07
13	76.78	1.82	21.40
15	76.52	1.70	21.78
17	74.08	1.27	24.65
19	77.45	1.42	21.13

BUTTER RECORD — HOLSTEIN-FRIESIAN — ESEL 2D.

TABLE III.

Derived Data.

NUMBER OF WEEK OF LACTATION.	FROM ONE HUNDRED POUNDS OF MILK.						YIELD OF BUTTER.			
	Pounds of fat in milk.	Pounds of fat in skim-milk.	Pounds of fat in cream.	Pounds of fat in butter-milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. butter fat.	Pounds of milk required to make one pound of butter.	Pounds of cream required to make one pound of butter.	Milk yield for one day.	Pounds of butter from milk of one day.
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
5	3.61	0.56	3.05	0.31	2.41	2.83	35.34	4.88	30.38	0.86
6	3.57	0.60	2.97	0.49	2.24	2.64	37.90	5.05	30.13	0.80
8	3.96	0.71	3.25	0.21	2.92	3.44	29.08	4.16	29.75	1.02
9	3.65	0.77	2.88	0.18	2.47	2.91	34.36	5.03	29.63	0.86
10	3.97	0.85	3.12	0.13	2.92	3.44	29.07	5.14	29.38	1.01
11	3.78	0.59	3.19	0.59	2.01	2.36	42.37	7.33	27.00	0.64
13	3.34	0.56	2.78	0.11	2.38	2.80	35.71	5.04	26.00	0.73
15	3.81	0.55	3.26	0.08	2.91	3.42	29.24	4.65	23.00	0.79
17	3.64	1.26	2.38	0.10	2.15	2.53	39.52	4.31	24.00	0.61
19	3.69	0.86	2.83	0.13	2.71	3.19	31.35	4.26	25.25	0.81

BUTTER RECORD — HOLSTEIN-FRIESIAN — ESEL 2D.

TABLE IV.

Percentages of Fat Recovered and Lost.

NUMBER OF WEEK OF LACTATION.	Per cent. of fat recovered in cream.	Per cent. of fat lost in skim milk.	Per cent. of fat lost in butter-milk.	Per cent. of fat recovered in butter.	Ratio of fat in milk to butter.
I.	II.	III.	IV.	V.	VI.
5	84.49	15.51	8.58	66.76	78
6	83.19	16.81	13.72	62.74	74
8	82.07	17.93	5.30	73.73	87
9	78.90	21.10	4 93	67.67	80
10	78.59	21.41	3.27	73.55	86
11	84.39	15.61	15.61	53.17	62
13	83.23	16.77	3.29	71.26	84
15	85.56	14.44	2.09	76.38	90
17	65.38	34.62	2.75	59.06	70
19	76.69	23.31	3.52	73.44	86

BUTTER RECORD — AYRSHIRE — MISS FLOW 5TH.

TABLE I.

Creaming and Churning Data.

Number of week of lactation.	DATE.		CREAMING. MILK SET. Average temperature.	Number of hours. M.	Number of hours. E.	Pounds.	Per cent. fat in milk.	Skim-milk, per cent. fat.	Cream, per cent. fat.	CHURNING. CONDITIONS. Cream, sour or sweet.	Temperature during churning.	Time of churning. Hrs.	Time of churning. Min.	Butter-milk, per cent. fat.	Butter unsalted and unworked. Pounds.
I.	II.		III.	IV.		V.	VI.	VII.	VIII.	IX.	X.	XI.		XII.	XIII.
	1890.														
28.........	August	18	54°	24	12	12	4.12	1.83	23.47	Sour	58°—67°		40	3.26	0.32
29.........	August	25	49°	24	12	12	3.99	2.01	22.01	Sour	56°—62°	1	—	2.82	0.27
31.........	September	8	51°	24	12	12	4.60	2.17	25.85	Sour	58°—62°		40	5.58	0.28
32.........	September	15	51°	24	12	12	4.38	2.31	23.59	Sour	58°—62°	1	22	1.88	0.32
33.........	September	22	51°	24	12	12	4.64	2.42	21.73	Sour	60°—62°	1	—	3.42	0.27
35.........	October	6	50°	34	22	10	4.50	2.00	21.56	Sour	58°—61°	1	10	0.94	0.33
37.........	October	20	48°	34	22	10	4.18	1.43	25.17	Sour	60°—62°	1	—	2.14	0.28
39.........	November	3	47°	34	22	10	5.04	2.40	21.68	Sour	61°—67°		59	1.06	0.35
41.........	November	17	50°	34	23	10	4.86	2.54	20.54	Sour	61°—63°		55	5.86	0.25

BUTTER RECORD — AYRSHIRE — MISS FLOW 5TH.

TABLE II.

Composition of Butter.

NUMBER OF WEEK OF LACTATION.	Per cent. fat.	Per cent. solids not fat.	Per cent. water.
I.	II.	III.	IV.
28	77.73	0.59	21.68
29	78.59	1.27	20.14
31	78.48	1.38	20.14
32	79.06	1.46	19.47
33	79.52	0.67	19.81
35	80.11	0.79	19.10
37	72.13	1.44	26.43
39	73.11	2.07	24.82
41	76.77	1.63	21.60

Butter Record — Ayrshire — Miss Flow 5th.

TABLE III.

Derived Data.

Number of week of lactation.	From one hundred pounds of milk.						Yield of butter.			
	Pounds of fat in milk.	Pounds of fat in skim milk.	Pounds of fat in cream.	Pounds of fat in butter-milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. butter fat.	Pounds of milk required to make one pound of butter.	Pounds of cream required to make one pound of butter.	Milk yield for one day.	Pounds of butter from milk of one day.
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
28	4.12	1.63	2.49	0.26	2.08	2.44	40.98	4.34	18.75	0.46
29	3.99	1.81	2.18	0.22	1.77	2.08	48.08	4.77	15.88	0.33
31	4.60	1.95	2.65	0.44	1.83	2.15	46.51	4.76	15.00	0.32
32	4.38	2.08	2.30	0.13	2.10	2.47	40.48	3.95	15.38	0.38
33	4.64	2.14	2.50	0.31	1.79	2.11	47.39	5.47	14.63	0.31
35	4.50	1.74	2.76	0.09	2.64	3.11	32.15	4.11	14.56	0.45
37	4.18	1.26	2.92	0.19	2.02	2.38	42.02	4.87	14.06	0.33
39	5.04	2.07	2.97	0.11	2.56	3.01	33.22	4.55	12.44	0.37
41	4.86	2.21	2.65	0.61	1.92	2.26	44.25	5.71	10.75	0.24

BUTTER RECORD — AYRSHIRE — MISS FLOW 5TH.

TABLE IV.

Percentages of Fat Recovered and Lost.

NUMBER OF WEEK OF LACTATION.	Per cent. of fat recovered in cream.	Per cent. of fat lost in skim-milk.	Per cent. of fat lost in butter-milk.	Per cent. of fat recovered in butter.	Ratio of fat in milk to butter.
I.	II.	III.	IV.	V.	VI.
28	60.34	39.66	6.27	50.47	59
29	54.63	45.37	5.51	44.36	52
31	57.60	42.40	9.57	40.00	47
32	52.51	47.49	2.96	47.92	56
33	53.87	46.13	6.68	38.57	45
35	61.33	38.67	2.00	58.67	69
37	69.86	30.14	4.54	48.32	57
39	58.92	41.07	2.18	50.79	60
41	54.53	45.47	12.53	39.51	46

BUTTER RECORD — AYRSHIRE — QUEEN DUTCHESS.

TABLE I.

Creaming and Churning Data.

Number of week of lactation.	DATE.		CREAMING.							CHURNING.					
			MILK SET.					Skim-milk, per cent. fat.	Cream, per cent. fat.	CONDITIONS.				Butter-milk, per cent. fat.	Butter unsalted and unworked. Pounds.
			Average temperature.	Number of hours. M.	E.	Pounds.	Per cent. fat in milk.			Cream, sour or sweet.	Temperature during churning.	Time of churning. Hrs.	Min.		
I.	II.		III.	IV.		V.	VI.	VII.	VIII.	IX.	X.	XI.		XII.	XIII.
	1890.														
4..........	August	20	48°	24	12	12	4.63	0.53	28.20	Sour	56°—62°	—	29	1.45	0.61
5..........	August	27	48°	24	12	12	4.12	0.66	28.33	Sour	56°—62°	—	30	1.30	0.50
7..........	September	10	50°	24	12	12	4.26	0.49	24.52	Sour	58°—63°	—	12	2.10	0.50
8.	September	17	49°	24	12	12	4.76	1.12	24.83	Sour	58°—63°	—	40	1.42	0.50
9..........	September	24	43°	24	12	10	4.42	0.73	17.50	Sour	60°—62°	—	50	0.59	0.50
10..........	October	1	49°	34	22	10	4.57	0.51	23.71	Sour	61°—63°	—	25	3.00	0.45
12..........	October	13	49°	34	22	10	3.56	0.35	20.69	Sour	60°—62°	—	36	2.76	0.35
14..........	October	27	48°	34	22	10	3.67	0.47	21.09	Sour	59°—61°	—	40	0.67	0.39
16..........	November	10	50°	34	23	10	4.02	0.33	20.66	Sour	60°—62°	—	40	2.10	0.45
18..........	November	24	46°	34	23	10	3.89	0.46	22.38	Sour	60°—62°	—	32	1.66	0.42

BUTTER RECORD — AYRSHIRE — QUEEN DUTCHESS.

TABLE II.

Composition of Butter.

NUMBER OF WEEK OF LACTATION.	Per cent. fat.	Per cent. solids not fat.	Per cent. water.
I.	II.	III.	IV.
4	78.83	0.73	20.44
5	77.86	1.13	21.01
7	77.75	1.33	20.92
8	79.57	1.38	19.05
9	73.72	1.45	24.83
10	72.01	1.14	26.85
12	75.84	1.59	22.57
14	74.91	1.50	23.59
16	73.36	1.90	24.74
18	77.56	1.35	21.09

BUTTER RECORD — AYRSHIRE — QUEEN DUCHESS.

TABLE III.

Derived Data.

NUMBER OF WEEK OF LACTATION.	FROM ONE HUNDRED POUNDS OF MILK.						YIELD OF BUTTER.			
	Pounds of fat in milk.	Pounds of fat in skim-milk.	Pounds of fat in cream.	Pounds of fat in butter-milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. butter fat.	Pounds of milk required to make one pound of butter.	Pounds of cream required to make one pound of butter.	Milk yield for one day.	Pounds of butter from milk of one day.
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
4	4.63	0.45	4.18	0.14	4.00	4.71	21.23	3.15	23.38	1.10
5	4.12	0.58	3.54	0.11	3.24	3.81	26.24	3.28	24.63	0.94
7	4.26	0.42	3.84	0.24	3.24	3.81	26.24	4.09	21.88	0.83
8	4.76	0.95	3.81	0.16	3.32	3.99	25.64	3.93	21.25	0.83
9	4.42	0.58	3.84	0.08	3.69	4.34	23.04	6.39	22.00	0.95
10	4.57	0.42	4.15	0.39	3.24	3.81	26.24	4.60	23.38	0.89
12	3.56	0.29	3.27	0.34	2.65	3.12	32.05	5.06	23.00	0.72
14	3.67	0.40	3.27	0.08	2.92	3.44	29.07	4.51	22.38	0.77
16	4.02	0.28	3.74	0.29	3.30	3.88	25.77	4.66	21.88	0.85
18	3.89	0.40	3.49	0.19	3.26	3.84	26.04	4.06	23.25	0.89

BUTTER RECORD — AYRSHIRE — QUEEN DUCHESS.

TABLE IV.

Percentages of Fat Recovered and Lost.

NUMBER OF WEEK OF LACTATION.	Per cent. of fat recovered in cream.	Per cent. of fat lost in skim milk.	Per cent. of fat lost in butter-milk.	Per cent. of fat recovered in butter.	Ratio of fat in milk to butter.
I.	II.	III.	IV.	V.	VI.
4	90.28	9.72	3.02	86.40	102
5	85.92	14.08	2.67	78.64	92
7	89.20	10.80	5.63	76.05	89
8	80.04	19.96	3.36	69.75	82
9	86.85	13.15	1.81	83.48	98
10	90.81	9.19	8.53	70.89	83
12	91.86	8.14	9.55	74.43	88
14	89.10	10.90	2.18	79.56	94
16	93.03	6.97	7.21	82.09	96
18	89.72	10.28	4.86	83.80	99

BUTTER RECORD — AMERICAN HOLDERNESS — NELLIE 6TH.

TABLE I.

Creaming and Churning Data.

Number of week of lactation.	DATE.	CREAMING.							CHURNING.					
		MILK SET.					Skim-milk, per cent. fat.	Cream, per cent. fat.	CONDITIONS.				Butter-milk, per cent fat.	Butter, unsalted and un-worked.
		Average tempera-ture.	Number of hours.		Pounds.	Per cent. fat in milk.			Cream, sour or sweet.	Tempera-ture dur-ing churning.	Time of churning.			
			M.	E.							Hrs.	Min.		Pounds.
I.	II.	III.	IV.		V.	VI.	VII.	VIII.	IX.	X.	XI.		XII.	XIII.
	1890.													
2.........	September 23	48°	24	12	10	5.17	1.23	24.12	Sour	60°—62°	—	50	0.67	0.52
3.........	September 30	42°	34	22	10	4.39	0.38	22.17	Sour	61°—64°	—	45	1.17	0.48
4.........	October 7	49°	34	22	10	3.95	0.63	26.35	Sour	58°—62°	1	25	0.33	0.39
5.........	October 14	49°	34	22	10	3.55	0.46	20.65	Sour	60°—61°	—	40	0.18	0.41
6.........	October 21	49°	34	22	10	3.48	0.70	20.00	Sour	60°—62°	—	40	0.35	0.33
7.........	October 28	47°	34	22	10	3.17	0.45	16.85	Sour	60°—62°	—	50	0.49	0.36
8.........	November 4	47°	34	22	10	3.35	0.48	17.35	Sour	59°—62°	—	33	0.27	0.37
9.........	November 11	50°	34	23	10	3.30	0.66	18.96	Sour	59°—60°	—	45	0.69	0.33
10.........	November 18	49°	34	23	10	3.44	0.40	19.02	Sour	59°—60°	1	14	0.31	0.36

BUTTER RECORD — AMERICAN HOLDERNESS — NELLIE 6TH.

TABLE II.

Composition of Butter.

NUMBER OF WEEK OF LACTATION.	Per cent. fat.	Per cent. solids not fat.	Per cent. water.
I.	II.	III.	IV.
2	72.05	1.73	26.22
3	79.35	1.35	19.30
4	82.84	0.88	16.28
5	74.08	1.40	24.52
6	75.89	1.06	23.05
7	73.49	1.41	25.10
8	78.02	1.20	20.78
9	75.34	0.98	23.68
10	72.59	0.47	26.94

Butter Record — American Holderness — Nellie 6th.

TABLE III.

Derived Data.

Number of week of lactation.	From One Hundred Pounds of Milk.						Yield of Butter.			
	Pounds of fat in milk.	Pounds of fat in skim-milk.	Pounds of fat in cream.	Pounds of fat in butter-milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. butter fat	Pounds of milk required to make one pound of butter.	Pounds of cream required to make one pound of butter.	Milk yield for one day.	Pounds of butter from milk of one day.
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
2	5.17	1.02	4.15	0.08	3.75	4.41	22.67	3.90	15.75	0.69
3	4.39	0.31	4.08	0.16	3.81	4.48	22.32	4.11	14.56	0.65
4	3.95	0.55	3.40	.03	3.23	3.80	26.31	3.39	15.13	0.57
5	3.55	0 39	3.16	0.02	3.01	3.58	27.93	4.27	16.50	0.59
6	3.48	0.60	2.88	0.04	2.50	2.94	31.01	4.91	17.63	0.52
7	3.17	0.37	2.80	0.06	2.65	3.12	32.05	5.32	17.25	0.54
8	3.35	0.40	2.95	0.04	2.89	3.40	29.41	5.00	17.75	0.60
9	3.30	0.57	2.73	0.08	2.50	2.94	34.01	4.89	18.25	0.54
10	3.44	0.34	3.10	0.04	2.61	3.08	32.47	5.30	18.13	0.56

BUTTER RECORD — AMERICAN HOLDERNESS — NELLIE 6TH.

TABLE IV.

Percentages of Fat Recovered and Lost.

NUMBER OF WEEK OF LACTATION.	Per cent. of fat recovered in cream.	Per cent. of fat lost in skim-milk.	Per cent. of fat lost in butter-milk.	Per cent. of fat recovered in butter.	Ratio of fat in milk to butter.
I.	II.	III.	IV.	V.	VI.
2	80.27	19.73	1.54	72.53	85
3	92.94	7.06	3.64	86.78	102
4	86.07	13.93	0.75	81.77	96
5	89.01	10.99	0.56	85.63	101
6	82.76	17.24	1.15	71.84	84
7	88.33	11.67	1.88	83.59	98
8	88.06	11.94	1.19	86.23	101
9	82.73	17.27	2.42	75.76	90
0	90.12	9.88	1.16	75.87	89

Butter Record — American Holderness — Maggie 6th.

TABLE I.

Creaming and Churning Data.

Number of week of lactation.	Date.	Creaming. Milk set. Average temperature.	Number of hours. M.	Number of hours. E.	Pounds.	Per cent. fat in milk.	Skim-milk, per cent. fat.	Cream, per cent. fat.	Churning. Conditions. Cream, sour or sweet.	Temperature during churning.	Time of churning. Hrs.	Time of churning. Min.	Butter-milk, per cent. fat.	Butter, unsalted and unworked. Pounds.
I.	II.	III.	IV.		V.	VI.	VII.	VIII.	IX.	X.	XI.		XII.	XIII.
	1890.													
1	September 30	42°	34	22	10	5.30	0.74	23.31	Sour	58°—60°	1	25	0.62	0.57
2	October 7	49°	34	22	10	4.23	0.42	19.21	Sour	58°—60°	1	25	0.31	0.44
3	October 14	49°	34	22	10	3.49	0.40	21.43	Sour	60°—62°	—	40	0.35	0.39
4	October 21	49°	34	22	10	3.83	0.44	23.82	Sour	60°—62°	—	40	0.37	0.40
5	October 28	47°	34	22	10	3.16	0.42	17.97	Sour	60°—62°	—	40	0.57	0.35
6	November 4	47°	34	22	10	3.34	0.36	19.00	Sour	59°—61°	—	51	0.47	0.37
7	November 11	50°	34	23	10	3.33	0.25	20.32	Sour	59°—60°	—	45	0.92	0.41
8	November 18	49°	34	23	10	3.55	0.27	21.28	Sour	60°	—	43	0.74	0.43
9	November 25	46°	34	23	10	3.31	0.65	17.57	Sour	60°—62°	—	48	0.85	0.35

BUTTER RECORD — AMERICAN HOLDERNESS — MAGGIE 6TH.

TABLE II.

Composition of Butter.

NUMBER OF WEEK OF LACTATION.	Per cent. fat.	Per cent. solids not fat.	Per cent. water.
I.	II.	III.	IV.
1	79.16	0.17	20.67
2	85.21	0.74	14.05
3	74.12	1.12	24.76
4	77.81	1.26	20.93
5	74.78	1.48	23.74
6	73.31	1.73	24.96
7	73.00	0.89	26.11
8	75.26	1.14	23.60
9	75.47	1.28	23 25

Butter Record — American Holderness — Maggie 6th.

TABLE III.

Derived Data.

Number of week of lactation.	From one hundred pounds of milk.						Yield of butter.			
	Pounds of fat in milk.	Pounds of fat in skim-milk.	Pounds of fat in cream.	Pounds of fat in butter-milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. butter fat.	Pounds of milk required to make one pound of butter.	Pounds of cream required to make one pound of butter.	Milk yield for one day.	Pounds of butter from milk of one day.
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
1	5.30	0.59	4.71	0.09	4.51	5.31	18.83	3.80	13.13	0.70
2	4.23	0.33	3.90	0.05	3.75	4.41	22.69	4.60	16.88	0.74
3	3.49	0.34	3.15	0.04	2.89	3.40	29.41	4.29	20.25	0.69
4	3.83	0.40	3.43	0.04	3.11	3.66	27.32	3.93	19.00	0.70
5	3.16	0.41	2.75	0.07	2.62	3.08	32.46	4.96	17.38	0.54
6	3.34	0.32	3.02	0.06	2.71	3.19	31.35	4.98	20.38	0.65
7	3.33	0.22	3.11	0.10	2.99	3.52	28.41	4.35	19.88	0.70
8	3.55	0.23	3.32	0.08	3.20	3.76	26.60	4.15	18.13	0.68
9	3.31	0.57	2.74	0.10	2.60	3.16	32.68	4.93	19.00	0.58

BUTTER RECORD — AMERICAN HOLDERNESS — MAGGIE 6TH.

TABLE IV.

Percentages of Fat Recovered and Lost.

NUMBER OF WEEK OF LACTATION.	Per cent. of fat recovered in cream.	Per cent. of fat lost in skim milk.	Per cent. of fat lost in butter-milk.	Per cent. of fat recovered in butter.	Ratio of fat in milk to butter.
I.	II.	III.	IV.	V.	VI.
1	88.86	11.14	1.70	85.09	100
2	92.19	7.81	1.18	88.65	104
3	90.26	9.74	1.15	82.80	97
4	89.56	10.44	1.04	81.20	95
5	87.03	12.97	2.21	82.91	97
6	90.42	9.58	1.79	81.14	95
7	93.40	6.60	3.00	89.78	105
8	93.52	6.48	2.25	90.14	106
9	82.78	17.22	3.02	78.55	96

BUTTER RECORD — JERSEY — COUNTESS FLAVIA.

TABLE I.

Creaming and Churning Data.

Number of week of lactation.	DATE.	CREAMING. MILK SET. Average temperature.	Number of hours. M.	Number of hours. E.	Pounds.	Per cent. fat in milk.	Skim-milk, per cent. fat.	Cream, per cent. fat.	CHURNING. CONDITIONS. Cream, sour or sweet.	Temperature during churning.	Time of churning. Hrs.	Time of churning. Min.	Butter-milk, per cent. fat.	Butter unsalted and unworked. Pounds.
I.	II.	III.	IV.		V.	VI.	VII.	VIII.	IX.	X.	XI.		XII.	XIII.
	1890.													
18..........	August 18	54°	24	12	12	6.02	0.79	25.98	Sour	58°—67°	1	30	0.71	0.81
19..........	August 25	49°	24	12	12	6.00	0.91	26.66	Sour	56°—62°	1	50	0.61	0.75
21..........	September 8	51°	24	12	12	6.19	1.16	28.00	Sour	58°—63°	—	50	0.73	0.75
22..........	September 15	51°	24	12	12	6.04	1.58	24.28	Sour	58°—67°	4	40	0.81	0.76
23..........	September 22	51°	24	12	6	6.13	0.79	26.40	Sour . ..	60°—65°	1	15	2.55	0.31
25..........	October 6	50°	34	22	5	6.25	0.39	23.38	Sour	60°—64°	2	45	0.32	0.34
27..........	October 20	48°	34	22	5	5.74	0.53	21.88	Sour	62°—65°	1	45	0.23	0.32
29..........	November 3	47°	34	22	5	6.41	0.64	24 34	Sour	62°—71°	1	33	0.32	0.37
31..........	November 17	51°	34	23	5	6.44	0.65	24.96	Sour	62°—63°	1	13	0.68	0.56

BUTTER RECORD — JERSEY — COUNTESS FLAVIA.

TABLE II.

Composition of Butter.

NUMBER OF WEEK OF LACTATION.	Per cent. fat.	Per cent. solids not fat.	Per cent. water.
I.	II.	III.	IV.
18	77.12	1.12	21.76
19	79.96	0.87	19.17
21	80.53	0.82	18.65
22	72.35	1.09	26.56
23	78.77	0.92	20.31
25	80.00	0.29	19.71
27	73.34	1.64	25.02
29	77.10	1.70	21.20
31	50.73	0.30	48.97

Butter Record — Jersey — Countess Flavia.

TABLE III.

Derived Data.

Number of week of lactation.	From One Hundred Pounds of Milk.						Yield of Butter.			
	Pounds of fat in milk.	Pounds of fat in skim-milk.	Pounds of fat in cream.	Pounds of fat in butter-milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. butter fat.	Pounds of milk required to make one pound of butter.	Pounds of cream required to make one pound of butter.	Milk yield for one day.	Pounds of butter from milk of one day.
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
18	6.02	0.63	5.39	0.10	5.21	6.13	16.31	3.38	19.63	1.20
19	6.00	0.73	5.27	0.08	5.00	5.88	17.00	3.36	18.00	1.06
21	6.19	0.94	5.25	0.09	5.03	5.92	16.89	3.17	16.75	0.99
22	6.04	1.27	4.77	0.11	4.58	5.39	18.55	3.64	17.13	0.92
23	6.13	0.63	5 50	0.40	4.07	4.79	20.87	4.35	16.13	0.98
25	6.25	0.30	5.95	0.06	5.74	6.76	14.79	3.78	16.25	1.10
27	5.74	0.40	5.34	0.04	4.70	5.53	18.08	4.41	16.69	0.92
29	6.41	0.48	5.93	0.06	5.70	6.70	14.92	3.64	14.50	0.97
31	6.44	0.50	5.94	0.08	5.68	6.68	14.97	3.56	14.50	0.97

BUTTER RECORD — JERSEY — COUNTESS FLAVIA.

TABLE IV.

Percentages of Fat Recovered and Lost.

NUMBER OF WEEK OF LACTATION.	Per cent. of fat recovered in cream.	Per cent. of fat lost in skim milk.	Per cent. of fat lost in butter-milk.	Per cent. of fat recovered in butter.	Ratio of fat in to milk butter.
I.	II.	III.	IV.	V.	VI.
18	89.54	10.46	1.66	86.54	102
19	87.83	12.17	1.33	83.33	98
21	84.81	15.19	1.45	81.26	96
22	78.97	21.03	1.82	75.82	89
23	89.72	10.28	6.52	66.39	78
25	95.20	4.80	0.96	91.84	108
27	93.03	6.97	0.70	81.88	96
29	92.51	7.49	0.93	88.92	105
31	92.24	7.76	1.24	88.19	104

BUTTER RECORD — JERSEY — BARBARA ALLEN.

TABLE I.

Creaming and Churning Data.

Number of week of lactation.	DATE.	Creaming. Milk set. Average temperature.	Number of hours. M.	Number of hours. E.	Pounds.	Per cent. fat in milk.	Skim-milk, per cent. fat.	Cream per cent. fat.	Churning. Conditions. Cream, sour or sweet.	Temperature during churning.	Time of churning. Hrs.	Time of churning. Min.	Butter-milk, per cent. fat.	Butter unsalted and unworked. Pounds.
I.	II.	III.	IV.		V.	VI.	VII.	VIII.	IX.	X.	XI.		XII.	XIII.
	1890.													
2..........	September 10	50°	24	12	12	4.27	0.50	23.81	Sour	58°—64°		23	0.57	0.55
3..........	September 17	49°	24	12	12	5.05	0.42	21.93	Sour	58°—67°	1	37	0.69	0.70
4..........	September 24	43°	24	12	5	5.42	1.35	10.99	Sour	60°—62°	1	20	0.45	0.33
5..........	October 1	49°	34	22	5	5.23	0.25	15.58	Sour	61°—63°		25	0.68	0.30
6..........	October 7	49°	34	22	5	5.43	0.48	25.30	Sour	62°—63°		35	0.57	0.30
7..........	October 13	49°	34	22	5	5.29	0.36	25.77	Sour	62°—63°		35	1.37	0.28
8..........	October 21	49°	34	22	5	4.61	0.33	19.55	Sour	60°—61°		45	0.24	0.27
9..........	October 27	48°	34	22	5	5.24	0.48	18.28	Sour	61°—64°	1	35	0.16	0.31
10..........	November 4	47°	34	22	5	4.82	0.26	20.81	Sour	61°—63°		33	0.20	0.28
12..........	November 18	49°	34	23		5.84	0.22	21.36	Sour	60°—61°		47	0.24	0.38

BUTTER RECORD — JERSEY — BARBARA ALLEN.

TABLE II.

Composition of Butter.

NUMBER OF WEEK OF LACTATION.	Per cent. fat.	Per cent. solids not fat.	Per cent. water.
I.	II.	III.	IV.
2	79.96	1.10	18.94
3	76.03	0.33	23.64
4	65.33	2.28	32.39
5	80.52	2.71	16.77
6	82.04	0.41	17.55
7	71.98	1.54	26.48
8	75.38	1.25	23.37
9	75.69	1.79	22.52
10	74.16	1.67	24.17
12	63.20	0.88	35.92

Butter Record — Jersey — Barbara Allen.

TABLE III.

Derived Data.

Number of week of lactation.	From One Hundred Pounds of Milk. Pounds of fat in milk.	Pounds of fat in skim-milk.	Pounds of fat in cream.	Pounds of fat in butter-milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. butter fat.	Yield of Butter. Pounds of milk required to make one pound of butter.	Pounds of cream required to make one pound of butter.	Milk yield for one day.	Pounds of butter from milk of one day.
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
2	4.27	0.42	3.85	0.07	3.67	4.32	23.15	3.74	19.38	0.84
3	5.05	0.33	4.72	0.11	4.43	5.21	19.19	4.12	19.25	1.00
4	5.42	0.78	4.64	0.16	4.32	5.08	19.68	8.31	14.63	0.74
5	5.23	0.16	5.07	0.18	4.84	5.69	17.57	5.68	15.63	0.89
6	5.43	0.38	5.05	0.08	4.92	5.79	17.27	3.45	13.75	0.80
7	5.29	0.30	4.99	0.18	4.04	4.75	21.05	4.08	17.75	0.84
8	4.61	0.28	4.33	0.04	4.08	4.80	20.83	4.63	17.25	0.83
9	5.24	0.34	4.90	0.04	4.70	5.53	18.08	4.85	14.75	0.81
10	4.82	9.20	4.62	0.04	4.16	4.90	20.40	4.53	16.50	0.81
12	5.84	0.16	5.68	0.04	4.80	5.65	17.71	4.71	16.38	0.93

BUTTER RECORD — JERSEY — BARBARA ALLEN.

TABLE IV.

Percentages of Fat Recovered and Lost.

NUMBER OF WEEK OF LACTATION.	Per cent. of fat recovered in cream.	Per cent. of fat lost in skim milk.	Per cent. of fat lost in butter-milk.	Per cent. of fat recovered in butter.	Ratio of fat in milk to butter.
I.	II.	III.	IV.	V.	VI.
2	90.16	9.84	1.64	85.95	101
3	93.46	6.54	2.17	87.72	103
4	85.61	14.39	2.95	79.70	94
5	96.94	3.06	3.44	92.54	109
6	93.00	7.00	1.47	90.61	107
7	94.33	5.67	3.40	76.37	90
8	93.93	6.07	0.89	88.50	104
9	93.51	6.49	0.76	89.69	106
10	95.85	4.15	0.83	86.31	102
12	97.26	2.74	0.69	82.19	97

BUTTER RECORD — JERSEY — GILDERBLOOM.

TABLE I.

Creaming and Churning Data.

Number of week of lactation.	DATE.	CREAMING.							CHURNING.					
		MILK SET.					Skim-milk, per cent. fat.	Cream, per cent. fat.	CONDITIONS.				Butter-milk, per cent. fat.	Butter, unsalted and unworked. Pounds.
		Average temperature.	Number of hours. M.	E.	Pounds.	Per cent. fat in milk.			Cream, sour or sweet.	Temperature during churning.	Time of churning. Hrs.	Min.		
I.	II.	III.	IV.		V.	VI.	VII.	VIII.	IX.	X.	XI.		XII.	XIII.
	1890.													
1	September 16	49°	24	12	12	6.39	0.54	27.33	Sour	58°—63°	1	5	0.95	0.84
2	September 23	48°	24	12	5	5.91	0.80	20.30	Sour	60°—61°		20	0.91	0.31
3	September 30	42°	34	22	5	6.01	0.41	21.83	Sour	61°—62°		15	0.71	0.33
4	October 7	49°	34	22	5	6.41	0.50	21.95	Sour	61°—62°		20	0.76	0.33
5	October 14	49°	34	22	5	5.23	0.22	22.39	Sour	60°—61°		30	0.27	0.31
6	October 21	49°	34	22	5	5.66	0.52	20.89	Sour	61°—62°		30	0.30	0.33
7	October 28	47°	34	22	5	5.19	0.21	19.61	Sour	60°—61°		20	0.29	0.32
8	November 4	47°	34	22	5	5.02	0.17	22.60	Sour	61°—64°		27	0.32	0.33
9	November 11	50°	34	23	5	5.68	0.12	13.44	Sour	59°—61°		20	0.53	0.40
11	November 25	46°	34	23	5	4.88	0.49	18.44	Sour	62°—63°		38	0.28	0.33

BUTTER RECORD — JERSEY — GILDERBLOOM.

TABLE II.

Composition of Butter.

NUMBER OF WEEK OF LACTATION.	Per cent. fat.	Per cent. solids not fat.	Per cent. water.
I.	II.	III.	IV.
1	78.04	0.76	21.20
2	78.39	1.37	20.24
3	81.13	0.88	17.99
4	83.02	0.60	16.38
5	76.40	1.74	21.86
6	75.09	0.52	24.39
7	74.22	1.81	23.97
8	69.57	1.30	29.13
9	60.04	0.87	39.09
11	69.18	1.14	29.68

Butter Record — Jersey — Gilderbloom.

TABLE III.

Derived Data.

Number of week of lactation.	From One Hundred Pounds of Milk.						Yield of Butter.			
	Pounds of fat in milk.	Pounds of fat in skim-milk.	Pounds of fat in cream.	Pounds of fat in butter-milk.	Pounds of fat in butter.	Pounds of butter containing 85 per cent. butter fat.	Pounds of milk required to make one pound of butter.	Pounds of cream required to make one pound of butter.	Milk yield for one day.	Pounds of butter from milk of one day.
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
1	6.39	0.43	5.96	0.14	5.47	6.44	15.53	3.39	17.25	1.11
2	5.91	0.60	5.31	0.18	4.86	5.71	17.51	4.59	18.50	1.06
3	6.01	0.30	5.71	0.14	5.36	6.30	15.87	4.16	17.88	1.13
4	6.41	0.36	6.05	0.16	5.50	6.47	15.45	4.29	14.38	0.93
5	5.23	0.18	5.05	0.04	4.74	5.57	17.95	4.06	17.13	0.95
6	5.66	0.44	5.22	0.06	4.96	5.84	17.12	4.28	18.13	1.06
7	5.19	0.16	5.03	0.06	4.76	5.60	17.86	4.57	18.25	1.02
8	5.02	0.14	4.88	0.04	4.60	5.41	18.48	3.99	15.88	0.86
9	5.68	0.10	5.58	0.08	4.80	5.65	17.70	4.21	15.38	0.87
11	4.88	0.38	4.50	0.06	4.40	5.18	19.31	4.71	15.25	0.79

BUTTER RECORD — JERSEY — GILDERBLOOM.

TABLE IV.

Percentages of Fat Recovered and Lost.

NUMBER OF WEEK OF LACTATION.	Per cent. of fat recovered in cream.	Per cent. of fat lost in skim milk.	Per cent. of fat lost in butter-milk.	Per cent. of fat recovered in butter.	Ratio of fat in milk to butter.
I.	II.	III.	IV.	V.	VI.
1	93.28	6.72	2.19	85.60	101
2	89.85	10.15	3.04	82.23	97
3	95.01	4.99	2.33	89.18	105
4	94.38	5.62	2.49	85.80	101
5	96.56	3.44	0.76	90.63	106
6	92.22	7.78	1.05	87.63	103
7	96.91	3.09	1.16	91.71	108
8	97.21	2.79	0.79	91.63	108
9	98.24	1.76	1.41	84.51	99
11	92.21	7.79	1.23	90.16	106

V. ANALYSES OF FERTILIZERS.

Unofficial analyses.— During the past year twenty-eight fertilizers have been sent to the Station by farmers for analysis. These are indicated in the summary of analyses as "unofficial," because the Station, as a fertilizer-control, assumes no responsibility for such samples, and simply sends its report to the individuals interested. Such analyses are not published, as a rule.

Organization of chemical work of fertilizer-control.— The most important analyses of fertilizers are those connected with the work of the Station as a fertilizer-control, in accordance with the fertilizer law passed in May, 1890. One of the first duties assigned to the chemist after his connection with the Station was the organization of the chemical work necessary to carry out the provisions of the law.

As the regular laboratory accommodations of the Station were already hardly sufficient for the previous work of the Station, rooms were secured at 129 Exchange street, Geneva, and fitted up for temporary use as a laboratory. Two assistant chemists, W. I. Tibballs Ph. C., and R. B. Armstrong, Ph. C., were placed in charge of the chemical work, under the immediate supervision of the Station chemist; and they have attended to all the details of the analytical work.

In November, the chemist, under the Director's supervision, prepared Bulletin No. 25, the first of a series of fertilizer bulletins.

The table of analyses following contains, of course, only a portion of the fall samples analyzed.

For further details connected with this work, and for discussion of data, see the Director's report.

RESULTS OF ANALYSES OF COMMERCIAL FERTILIZERS

Composition of fertilizers as guaranteed by manufacturers and

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Agent taking sample.	Station number.
Allentown Manufacturing Co., Allentown, Pa.	Lehigh phosphate.	Attica.	E. F. Dibble.	618
Armour & Co., Chicago, Ill.	Dried blood.	Syracuse.	F. E. Dawley.	36
Bowker Fertilizer Co., Boston and New York.	Ammoniated dissolved bone phosphate.	Livonia Station East Avon. Delhi.	 E. F. Dibble. J. W. McCann	313 318 411
Bowker Fertilizer Co., Boston and New York.	Hill and drill.	Canandaigua East Avon. Delhi.	J. L. Colvin.. E. F. Dibble . J. W. McCann	167 317 412
Bowker Fertilizer Co., Boston and New York.	Stockbridge for roots.	Syracuse.	F. E. Dawley.	10
Bowker Fertilizer Co., Boston and New York.	Stockbridge for vines.	Syracuse.	F. E. Dawley.	11
Bowker Fertilizer Co., Boston and New York.	Super-phosphate.	Syracuse.	F. E. Dawley.	1 9 26
Bowker Fertilizer Co., Boston and New York.	Sure crop.	Canandaigua Livonia Station. Geneseo.	J. L. Colvin.. E. F. Dibble.	168 314 344
Bradley Fertilizer Co., Boston, Mass.	Alkaline bone.	Seneca Castle	J. L. Colvin.	173
Bradley Fertilizer Co., Boston, Mass.	Ammoniated dissolved bones.	Canandaigua Victor. Lima. Mt. Morris.	J. L. Colvin. E. F. Dibble.	261 169 303 334
Bradley Fertilizer Co., Boston, Mass.	Dissolved bone	Blood's Depot	E. F. Dibble.	554
Bradley Fertilizer Co., Boston, Mass.	Dissolved bone with potash.	Penn Yan.	J. L. Colvin.	273
Bradley Fertilizer Co., Boston, Mass.	Eureka superphosphate.	Avon.	E. F. Dibble.	319
Bradley Fertilizer Co., Boston, Mass.	Farmer's new method.	Canandaigua	J. L. Colvin.	171

in New York State for the Fall of 1890.

as found by chemical analysis — estimated in parts per hundred.

	Nitrogen.		Phosphoric Acid.			Potash, soluble in water. Determined as potash.
	Determined as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed Found.	0.83 1.35	1.00 1.63	7 to 8 7.00	1 to 2 3.25	8 to 10 10.25	2 to 2.50 2.62
Guaranteed Found.	12.76 13.08	15.50 15.88	....	....	....	....
Guaranteed Found.	1.65 to 2.50 2.10	2 to 3 2.54	8 to 10 9.85	2 1.85	10 to 12 11.70	1 to 2 2.47
Guaranteed Found.	2 to 2.90 2.22	2.50 to 3.50 2.70	8 to 10 9.49	2 2.43	10 to 12 11.52	2 to 3 2.66
Guaranteed Found.	2.5 to 3.30 2.66	3 to 4 3.22	9 to 11 9.59	.... 1.54	.... 11.13	2 to 4 3.92
Guaranteed Found.	3.30 to 4.10 3.16	4 to 5 3.84	7 to 8 9.66	1 to 2 1.85	8 to 10 11.51	5 to 6 5.26
Guaranteed Found.	....	....	10 to 12 10.31	2 1.58	12 to 14 11.89	1 to 2 2.71
Guaranteed Found.	0.83 to 1.65 1.05	1 to 2 1.30	8 to 10 8.78	2 2.74	10 to 12 11.52	1 to 2 1.45
Guaranteed Found.	....	....	11 to 15 10.54	1 to 2 1.99	12 to 16 12.53	2.40 to 3.50 2.52
Guaranteed Found.	1.65 to 2.50 2.03	2 to 3 2.46	7 to 9 9.90	1 to 2 1.55	8 to 10 11.45	1 to 2 1.81
Guaranteed Found.	....	....	12 to 15 14.75	1 to 2 1.05	13 to 16 15.70	....
Guaranteed Found.	83 to 1.65 1.18	1 to 2 1.44	8 to 10 9.22	1 to 2 1.74	10 to 12 10.96	4 to 6 4.07
Guaranteed Found.	....	....	9 to 12 11.33	.... 0.85	.... 12.18	3.20 to 4.30 2.99
Guaranteed Found.	0.83 to 1.65 1.50	1 to 2 1.82	8 to 10 9.19	1 to 2 0.83	11 to 12 10.02	2.15 to 3.25 2.43

RESULTS OF ANALYSES OF COMMERCIAL

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Agent taking sample.	Station number.
Bradley Fertilizer Co., Boston, Mass.	Fine ground bone.	Attica.	E. F. Dibble.	620
Bradley Fertilizer Co., Boston, Mass.	Niagara phosphate.	Lima.	E. F. Dibble.	302
Bradley Fertilizer Co., Boston, Mass.	Bradley's patent superphosphate.	Milo Center. Victor. Moscow.	J. L. Colvin. E. F. Dibble.	284 260 331
Bradley Fertilizer Co., Boston, Mass.	Potato fertilizer.	Delhi.	J.W.McCann.	407
Bradley Fertilizer Co., Boston, Mass.	Bradley's sea fowl guano.	Canandaigua	J. L. Colvin.	170
Chemical Company of Canton, Baltimore, Md.	Dissolved bone phosphate.	Lyons. Weedsport.	F. E. Dawley.	45 67
Chesapeake Guano Co., Baltimore, Md.	Oriole alkaline bone.	Lima.	E. F. Dibble.	304
Cleveland Dryer Co., Cleveland, Ohio.	Ohio seed maker.	York.	E. F. Dibble.	330
Cleveland Dryer Co., Cleveland, Ohio.	Square bone.	Hamburgh.	C. J. Fenner.	674
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Ammoniated bone superphosphate.	Hart Lot.	F. E. Dawley.	53
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Dissolved bone black.	Hopewell.	J. L. Colvin.	175
Crocker Fertilizer and Chemical Co., Buffalo, N. Y.	Queen city phosphate.	Delhi.	J. W. McCann	409
Davidge Fertilizer Co., New York City.	Wheat and corn compound.	Blood's Depot	E. F. Dibble.	558
E. Frank Coe, New York City.	Alkaline bone.	Caledonia.	E. F. Dibble.	327
E. Frank Coe, New York City.	Ammoniated bone superphosphate.	Wyoming.	E. F. Dibble.	601
E. Frank Coe, New York City.	Gold brand excelsior guano.	Orient, L. I.	G. E. Aldrich.	507

Fertilizers, Etc.—(*Continued*).

	Nitrogen.		Phosphoric Acid.			Potash soluble in water. Determined as potash.
	Determined as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed Found.	2.50 to 3.25 3.49	3 to 4 4.23	.... 7.30	.... 15.68	21 to 23 22.98	....
Guaranteed Found.	1 to 2 1.37	1.20 to 2.40 1.66	7 to 9 9.10	1 to 2 1.73	8 to 10 10.83	1 to 1.60 1.30
Guaranteed Found.	2.05 to 2.90 1.93	2.50 to 3.50 2.34	8 to 10 10.17	1 to 2 1.46	10 to 12 11.63	1.50 to 2.50 2.20
Guaranteed Found.	2.05 to 2.90 2.15	2.50 to 3.50 2.61	9 to 10 9.29	1 to 2 0.73	11 to 12 10.02	3.20 to 4.30 3.45
Guaranteed Found.	2.05 to 2.85 1.89	2.5 to 3.5 2.29	8 to 10 10.41	1 to 2 1.81	10 to 12 12.22	1.5 to 2.5 2.53
Guaranteed Found.	....	....	12 to 14 11.65	2 to 4 2.17	14 to 18 13.82	....
Guaranteed Found.	....	....	10 to 11 10.14	.... 0.53	.... 10.67	3 to 4 3.65
Guaranteed Found.	1.25 to 2.05 1.10	1.5 to 2.5 1.34	10 to 12 11.62	3 to 5 2.53	15 to 17 14.15	....
Guaranteed Found.	2.50 to 3.25 2.74	3 to 4 3.33	8 to 10 9.27	.... 2.45	.... 11.72	....
Guaranteed Found.	2.90 to 3.70 2.91	3.5 to 4.5 3.53	8 to 12 9.70	1 to 2 1.14	10 to 12 10.84	1.10 to 1.60 2.19
Guaranteed Found.	....	....	15 to 18 16.72	....	....	....
Guaranteed Found.	1.65 to 2.05 1.78	2 to 2.50 2.16	8 to 12 8.54	1 to 2 1.45	9 to 12 9.99	1.08 to 2.16 2.21
Guaranteed Found.	0.83 to 1.65 1.15	1 to 2 1.39	7 to 9 7.65	1 to 3 2.52	8 to 12 10.17	1 to 2 2.14
Guaranteed Found.	1 to 1.50 1.09	1.20 to 1.80 1.32	9 to 12 10.94	2 to 3 1.34	11 to 14 12.28	1.60 to 2.15 1.94
Guaranteed Found.	1.75 to 2.00 1.92	2 to 2.50 2.33	8 to 10 10.50	.... 2.47	.... 12.97	1.10 to 1.60 1.84
Guaranteed Found.	2.50 to 3.25 3.20	3 to 4 3.88	8 to 10 8.57	1 to 2 1.25	8 to 11 9.82	6 to 8 5.59

RESULTS OF ANALYSES OF COMMERCIAL

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Agent taking sample.	Station number.
E. Frank Coe, New York City.	Red brand excelsior guano.	Orient, L. I.	G. E. Aldrich	506
E. Frank Coe, New York City.	XXV ammoniated bone super-phosphate	Benton Center.	J. L. Colvin.	252
Farmers' Fertilizer Co., Syracuse, N. Y.	Empire guano.	DeWitt.	F. E. Dawley.	41
Farmers' Fertilizer Co., Syracuse, N. Y.	Reaper brand.	DeWitt.	F. E. Dawley.	37
Farmers' Fertilizer Co., Syracuse, N. Y.	Standard ammoniated bone phosphate.	Shortsville. Penn Yan. N. Bloomfield	J. L. Colvin. E. F. Dibble.	163 274 301
Farmers' Fertilizer Co., Syracuse, N. Y.	Standard ammoniated bone phosphate, special formula.	DeWitt.	F. E. Dawley.	40
Great Eastern Fertilizer Co., New York City.	Universal plant food.	Caledonia.	E. F. Dibble.	325
Great Eastern Fertilizer Co., New York City.	Wheat special.	Caledonia.	E. F. Dibble.	326
Listers' Ag'l Chemical Works, Newark, N. J.	Ammoniated dissolved bone.	Stanley.	J. L. Colvin.	188
Listers' Ag'l Chemical Works, Newark, N. J.	Dissolved bone black.	Weedsport. E. Bloomfield	J. L. Colvin. F. E. Dawley.	48, 70 255
Listers' Ag'l Chemical Works, Newark, N. J.	Dried blood.	Weedsport.	F. E. Dawley.	47, 73
Listers' Ag'l Chemical Works, Newark, N. J.	German potash salts.	Weedsport.	F. E. Dawley.	46, 69
Listers' Ag'l Chemical Works, Newark, N. J.	Perfect fertilizer.	Geneseo.	E. F. Dibble	349
Listers' Ag'l Chemical Works, Newark, N. J.	Standard super-phosphate of lime.	E. Bloomfield Penn Yan. Geneseo.	J. L. Colvin. E. F. Dibble.	254 280 348

FERTILIZERS, ETC. — (*Continued*).

	Nitrogen.		Phosphoric Acid.			Potash soluble in water. Determined as potash.
	Determined as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed Found.	3.30 to 4.10 4.13	4 to 5 5.02	7 to 9 9.27	1 to 2 0.52	10 to 12 9.79	6 to 7 5.65
Guaranteed Found.	0.83 to 1.23 0.70	1 to 1.5 0.85	7 to 9 11.17	2 to 3 1.91	10 to 12 12.08	1.50 to 2.25 1.60
Guaranteed Found.	....	....	6 to 7.5 7.79	1 to 2 0.85	7.5 to 9 8.64	2.15 to 3.25 4.07
Guaranteed Found.	1.65 to 2.50 1.54	2 to 3 1.87	5.5 to 7 5.86	1 to 2 0.53	7.5 to 9 6.39	4.30 to 5.40 5.23
Guaranteed Found.	0.83 to 1.65 1.72	1 to 2 2.09	9 to 11 9.05	1 to 2 0.54	11 to 13 9.59	3.25 to 4.30 4.70
Guaranteed Found.	0.83 to 1.65 0.82	1 to 2 0.99	8 to 10 8.08	1 to 2 0.94	10 to 12 9.02	2.15 to 3.25 2.86
Guaranteed Found.	1 to 1.65 1.49	1.25 to 2 1.82	8 to 12 8.81	1 to 2 1.35	10 to 12 10.16	1.90 to 2.70 2.35
Guaranteed Found.	1.65 to 2.05 1.32	2 to 2.50 1.60	8 to 12 8.71	1 to 3 1.15	10 to 12 9.86	1.60 to 2.70 2.78
Guaranteed Found.	1.80 to 2.05 1.97	2.2 to 2.5 2.39	9 to 10 9.28	2 to 3 1.71	10 to 12 10.99	1.5 to 2 1.62
Guaranteed Found.	....	....	13 to 16 12.57	....	....	....
Guaranteed Found.	8.20 to 10.70 8.74	10 to 13 10.61	....	....	....	....
Guaranteed Found.	....	....	....	....	....	11.88 to 13.50 14.76
Guaranteed Found.	1 to 1.65 2.19	1.20 to 2 2.66	10.50 to 12 10.82	.... 0.60	.... 11.42	1.50 to 2.50 2.59
Guaranteed Found.	2.35 to 2.70 2.77	2.85 to 3.25 3.36	10 to 12 9.52	2 to 3 0.45	12 to 15 9.97	1.50 to 2 2.53

RESULTS OF ANALYSES OF COMMERCIAL

MANUFACTURER	Trade name or brand.	Locality where sample was taken.	Agent taking sample.	Station number.
Listers' Ag'l Chemical Works, Newark, N. J.	Success.	Penn Yan. Dundee. East Avon. Caledonia.	J. L. Colvin. E. F. Dibble.	281 285 315 324
Frederick Ludlam, New York City.	Cereal brand.	Wyoming.	E. F. Dibble.	597
Frederick Ludlam, New York City.	Sickle brand.	Wyoming.	E. F. Dibble.	598
Maryland Fertilizer and Manufacturing Co., Baltimore, Md.	Alkaline bone.	Lima, Mount Morris	E. F. Dibble.	335 305
Maryland Fertilizer and Manufacturing Co., Baltimore, Md.	Linden superphosphate.	Mount Morris.	E. F. Dibble.	336
C. Meyer, Jr., Maspeth, L. I.	Acme potato fertilizer.	Aquebogue, L. I.	G. E. Aldrich.	501
C. Meyer, Jr., Maspeth, L. I.	Superior superphosphate.	Stanley.	J. L. Colvin.	184
Michigan Carbon Works, Detroit, Mich.	Homestead super-phosphate.	Penn Yan.	J. L. Colvin.	282
Michigan Carbon Works, Detroit, Mich.	Homestead tobacco grower.	Livonia Station.	E. F. Dibble.	307
Michigan Carbon Works, Detroit, Mich.	Jarves drill phosphate.	Castile.	E. F. Dibble.	611
H. S. Miller & Co., Newark, N. J.	Ammoniated dissolved bone.	Hopewell.	J. L. Colvin.	176
H. S. Miller & Co., Newark, N. J.	Bone and potash.	Penn Yan. Geneseo.	J. L. Colvin. E. F. Dibble.	270 345
Milsom Rendering and Fertilizer Co., East Buffalo, N. Y.	Buffalo guano.	Rushville.	J. L. Colvin.	183
Milsom Rendering and Fertilizer Co., East Buffalo, N. Y.	Erie king.	Geneseo.	E. F. Dibble.	343
Milsom Rendering and Fertilizer Co., East Buffalo, N. Y.	Wheat phosphate.	Phelps.	J. L. Colvin.	154

Fertilizers, Etc.—(*Continued*).

	Nitrogen.		Phosphoric Acid.			Potash, soluble in water. Determined as potash.
	Determined as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed Found.	1.00 to 1.65 1.73	1.25 to 2.00 2.09	10.50 to 12 9.53	.... 0.55	.... 10.08	1.60 to 2 2.47
Guaranteed Found.	1.23 to 1.65 1.38	1.5 to 2 1.67	10 to 12 9.57	1 to 3 1.60	10 to 14 11.06	2.15 to 3.25 2.63
Guaranteed Found.	....	....	11 to 15 10.94	1 to 3 3.08	12 to 18 14.02	3 to 4 2.65
Guaranteed Found.	....	....	10 to 15 10.96	.... 0.50	.... 11.46	3 to 4 3.11
Guaranteed Found.	....	....	10 to 13 10.12	1 to 2 0.54	11 to 14 10.66	2 to 4 3.09
Guaranteed Found.	2.90 to 3.30 3.14	3.50 to 4 3.81	6 to 7 7.93	.... 1.21	7 to 8 9.14	8 to 10 8.28
Guaranteed Found.	1.25 to 1.65 1.92	1.5 to 2 2.33	.... 11.27	....	8 to 9 11.98	4 to 5 5.62
Guaranteed Found.	1.85 to 2.60 1.94	2.25 to 3.15 2.36	8 to 11 8.54	.... 0.37	.... 8.91	1.50 to 2 1.77
Guaranteed Found.	3 to 4 3.08	3.60 to 4.80 3.70	10 to 11 12.05	.... 0.85	.... 12.90	3.50 to 4.00 3.24
Guaranteed Found.	1.00 to 1.65 1.32	1.25 to 2 1.60	8 to 9 9.93	2 to 3 1.40	10 to 12 11.34	0.27 to 0.54 1.54
Guaranteed Found.	1.85 to 2.05 1.78	2.25 to 2.5 2.16	9 to 10 8.88	1.5 to 2.5 1.38	10 to 12 10.26	2.5 to 3 3.42
Guaranteed Found.	....	....	10 to 12 10.32	.... 0.44	.... 10.76	2.50 2.31
Guaranteed Found.	1.65 to 2.50 1.84	2 to 3 2 23	7 to 11 8.22	3 to 4 1.76	10 to 15 9.98	1 to 2 1.37
Guaranteed Found.	0.83 to 1.65 1.84	1 to 2 2.24	8.45 to 10.45 9.80	4 to 5 2.90	12.45 to 15.45 12.70	1.90 to 2.10 1.40
Guaranteed Found.	1.65 to 3.30 1.74	2 to 4 2.11	8 to 10 7.79	2 to 3 2.43	10 to 13 10.21	2 to 3 3.67

RESULTS OF ANALYSES OF COMMERCIAL

MANUFACTURER.	Trade name or brand.	Locality where sample was taken.	Agent taking sample.	Station number.
Pacific Guano Co., Boston, Mass.	Soluble Pacific guano.	Stanley. Durhamville Seneca Castle	J. L. Colvin.	172 185 288
Quinnipiac Co., New London, Conn.	Climax phosphate.	North Bloomfield.	J. L. Colvin.	265
Sheldon Bros., Weedsport, N. Y.	Sheldon's compound.	Weedsport.	F. E. Dawley.	55, 72
Standard Fertilizer Co., Boston, Mass.	Stand'rd guano	Avon.	E. F. Dibble.	316
W. D. Stewart & Co., New York City.	A No. 1.	Durhamville.	J. L. Colvin.	290
W. D. Stewart & Co., Boston, Mass.	Nobsque guano	Stanley.	J. L. Colvin.	186
Walker Fertilizer Co., Phelps Junction, N. Y.	Ammoniated phosphate.	Rushville.	J. L. Colvin.	187
Williams & Clark Fertilizer Co., New York City.	Royal bone phosphate.	York.	E. F. Dibble.	329
Zell Guano Co., Baltimore, Md.	Zell's economizer.	Cheshire. Stanley.	J. L. Colvin.	165 190

FERTILIZERS, ETC.— (*Concluded*).

	Nitrogen.		Phosphoric Acid.			Potash, soluble in water. Determined as potash.
	Determined as nitrogen.	Equivalent to ammonia.	Available.	Insoluble.	Total.	
Guaranteed Found.	2.05 to 2.85 2.36	2.50 to 3.50 2.87	8 to 10 10.16	2 to 4 1.30	11 to 14 11.46	1.50 to 2.50 2.68
Guaranteed Found.	0.83 to 1.65 1.37	1 to 2 1.67	9 to 10 10.43	1 to 2 0.95	11 to 12 11.38	2.16 to 2.70 2.95
Guaranteed Found.	0.60 to 1.20 0.72	0.75 to 1.50 0.88	5 to 7 5.18	2 to 3 0.31	7 to 9 5.49	2 to 3 3.31
Guaranteed Found.	1 to 2 1.12	1.5 to 3 1.36	8 to 12 7.86	2 to 3 3.82	10 to 15 11.68	2.16 to 3.20 2.19
Guaranteed Found.	1.25 to 2 1.32	1.50 to 2.40 1.60	7 to 9 8.25	2 to 3 1.81	9 to 11 10.06	1.50 to 2.50 1.56
Guaranteed Found.	1.15 to 1.65 1.10	1.4 to 2 1.32	9 to 12 9.36	.... 0.44	.... 10.80	2 to 3 2.86
Guaranteed Found.	1.65 to 2.50 1.78	2 to 3 2.17	7 to 9 7.73	.... 2.94	.... 10.67	1 to 2 1.91
Guaranteed Found.	0.83 to 1.65 1.52	1 to 2 1.84	7 to 9 8.32	1 to 2 1.80	8 to 10 10.12	2 to 3 2.90
Guaranteed Found.	0.83 to 1.65 1.05	1 to 2 1.23	9 to 11 10.86	2 to 3 1.28	11 to 14 12.14	1 to 2 2.10

VI. EXPERIMENTS WITH METHODS OF CREAMING.

Introduction.— The subject of creaming is one of the highest importance to dairymen. Various methods have been practiced and new ones are constantly being suggested, the purpose of which is to secure a more complete separation of the fat in the milk from the larger bulk of milk serum. The great variety of methods of creaming in actual use indicate a rather chaotic condition of mind in regard to the whole subject.

The experiments with methods of creaming, which are worthy of being called really scientific, have, for the most part, been very fragmentary. The result is that our knowledge of creaming methods is made up of fragments; a little has been done here, and a little there, and the results of different fragments often lead to contradictory conclusions.

In view of the unsatisfactory state of our knowledge regarding the true comparative value of methods of creaming, it has been proposed to carry out at this Station an extended investigation of the different methods of creaming in use. By making the experiments as exhaustive as is practicable, by planning and carrying them out under one management, by observing every precaution necessary to make the investigation practical and thoroughly scientific, it is hoped that consistent results may be reached, which shall serve to show the true value of the methods dealt with.

It is not proposed until later, probably in a bulletin, to discuss the nature of the process of creaming; but all know the very complex nature of the process and the marked influence exerted by slight variation in any one of many conditions; but these difficulties make the problem all the more worthy of the most careful treatment it can receive.

After the most efficient methods of creaming have been determined, then it is proposed to compare these with reference to efficiency in producing butter; for, as a rule, creaming is merely for the purpose of butter production.

Plan of Experiments with Creaming by Dilution.— Since the practice of diluting milk with water for creaming has recently been attracting some attention, it was decided to take up this method as the first one for investigation. Work was begun early in September, but as the other Station work would permit only one set of experiments each week, the investigation has not progressed rapidly. However, the work will, from this time on, be more rapidly pushed.

A brief description of the work done will give a definite idea of the plan of carrying out the experiments.

The experiments, according to the original plan, are divided into four series:

Series I.

In the first series the milk is set in Cooley cans under the following conditions:

1. Ten pounds of milk, undiluted, are set in Cooley vat in cold water.
2. Ten pounds of milk, undiluted, are set in open room.
3. To eight pounds of milk, two pounds of water at 35° Fahr. are added, making a mixture of ten pounds, containing twenty per cent of added water. Set in Cooley vat in water.
4. The same as the preceding, except set in open room.
5. Same as 3 except the water added is at 130° Fahr.
6. Same as preceding except set in open room.

Series II.

In the second series the conditions regarding dilution are the same as in Series I. All are set in Cooley cans in vat in cold water, 1, 3 and 5 creaming twelve hours, and 2, 4 and 6 creaming twenty-four hours.

Series III.

In the third series, the conditions regarding dilution are the same as in preceding cases. 1, 3 and 5 are set in Cooley cans in vat of cold water, while 2, 4 and 6 are set in shallow pans in open room, for thirty-six hours.

Series IV.

The conditions of dilution observed in preceding series are the same in this series. All are set in open room, 1, 3 and 5 being in Cooley cans, 2, 4 and 6 being in shallow pans, for thirty-six hours.

In carrying on the experiments the following observations are made and recorded: (1) Pounds of milk set; (2) pounds of water added to milk; (3) temperature of water added; temperature of milk (4) before dilution; (5) after dilution, and (6) temperature when set; (7) depth of milk set; temperature of (8) water in Cooley vat and (9) of air in open room; (10) temperature of cream; time (11) when set, and (12) when skimmed; (13) weight of cream; (14) weight of skim milk;

per cent of fat (15) in skim-milk as determined by analysis, and (16) in cream; total fat (17) in skim milk, and (18) in cream; percentage of fat (19) recovered in cream, and (20) lost in skim milk.

The experiments represented by each series are repeated at least three times. If the results do not all agree, work is continued until the cause of lack of agreement is found and obviated, if possible.

It is proposed to repeat the same series of experiments, using the same degree of dilution but varying the temperature of the water added until a wide range of temperatures is tried, and, perhaps, making other variations. Then the amount of dilution and the same range of temperatures are gone through as before.

The plan proposed involves an enormous amount of work, but it is desirable that the ground should be covered so thoroughly that some definite results may be reached.

Up to December first, eighty-one experiments were made, nearly covering the ground relating to dilution by adding two pounds of water at 35° Fahr., and at 130° Fahr. each to eight pounds of milk.

Inasmuch as this constitutes only a beginning of the work, the detailed data of the experiments will be reserved for publication until later, in a bulletin, when the investigation shall have covered more ground.

VII. Investigations Entered upon and Lines of Work Planned.

All the lines of work previously noticed in this report will be continued during the coming year. In addition to these investigations, others have been entered upon but are not yet carried far enough to report upon. These additional investigations have reference to methods of analysis.

It is hoped that time may be found during the coming year to carry on a series of feeding experiments in order to study the effects of certain foods upon the yield of milk and butter, as regards both quantity and composition.

So far as time permits, the Station will heartily co-operate in carrying out the work of the Association of Official Agricultural Chemists, in analyzing for the reporters of the association such substances as are especially connected with our work. To a certain extent, the work of the Station can not be more profitably employed than in aiding in the improvement of methods of analysis.

Report of Acting Horticulturist.*

In submitting my report of this season's work, I will state the general scope of the investigations planned and carried out as far as possible.

1. The continuation of tests of small fruits as to their varietal characteristics, adaptability and value to growers.

2. Trials of the varieties of vegetables of recent introduction.

3. An extensive comparison of imported versus American grown seed of cabbage and cauliflower.

4. A test of the relative yield of different varieties of tomatoes grown by several methods of culture.

5. A trial of varieties of potatoes, in connection with which a test was made as to the liability to decay of tubers taken from varieties that were subject to decay last year as against tubers of varieties that were free from decay. Also an experiment with several varieties of sweet potatoes in order to determine their value as a crop in this section and the acclimatization of them.

6. The continuation of cross-pollination of fruits for their improvement, and the study of pollen influence.

7. Insects, fungi and their remedies.

These, with many minor experiments and a vast amount of routine work, has occupied my time through the season.

The season on the whole has been one of successes, the greatest drawback being the almost total failure of the potatoes, making the work done on them in a large degree valueless. Most of the investigations planned have resulted in a partial solution of the questions considered, those having the results of but one year's work are, of course, not conclusive, but with accumulative data will be of value.

I would respectfully call attention to the fact that owing to inadequate green-house facilities the work of this department is to a large degree confined to the summer months, thereby causing

* C. E. Hunn.

a delay of considerable time in attaining the results of some of our investigations and causing the total inability to carry on lines of work valuable alike to the market gardener and the fruit grower.

STRAWBERRIES.

Much has been written in regard to strawberry culture in a commercial way, but comparatively little that would lead farmers to think how easily and cheaply they can be grown for home use.

A large number of the farmers of this State have planted strawberries for their own use, but through the press of other and to their minds more important work, they have been neglected until overrun with weeds and then have been given up as a failure. Strawberries can be grown on the farm as easily and cheaply as potatoes.

The average yield of potatoes per acre in this State is less than 100 bushels, while a small yield of strawberries is 600 quarts. As the price of good strawberries seldom goes below ten cents per quart, it can be readily seen that land planted to strawberries and given the same care as are given potatoes, will give results far ahead of anything grown ordinarily on the farm.

I do not doubt that any farmer could sell his surplus fruit from an eighth acre patch to his neighbor for more than enough to pay for his plants and time taken in cultivating them the first year, besides being able to have this delicious fruit on the table for from three to four weeks in its natural state, and also canned through the winter, when any fruit is a welcome diet. To one who contemplates setting a bed of strawberries the knowledge of the perfect flowering and pistillate varieties is necessary, for if the latter are alone planted the results will be a very meager crop or none at all. But the pistillate varieties being the most productive it is usual to plant largely of them, and by setting a perfect flowering variety every third or fourth row they become fertilized sufficiently to yield their full crop. I should advise spring planting, although a fair yield may be had from August set plants.

The ground in which they are to be planted should be well enriched and fitted as for potatoes. Rows should be marked three or three and one-half feet apart, the latter preferable. Plants should be set at least eighteen inches in the row. If the ground is not weedy, horse cultivation is all that will be necessary through the season. After the ground becomes frozen late in winter a top dressing of marsh hay or straw free from weeds, should be placed over them, not as a protection against cold but to prevent the alternate thawing and freezing by which the roots are heaved up and destroyed. After spring has opened, the material may be raked from off the plants leaving it between the rows to act as a mulch to keep down weeds, retain moisture and to protect the fruits from contact with the soil. If the beds have been well taken care of they will fruit two years in a satisfactory manner, but if allowed to become foul with weeds it is cheaper to make a new bed. It is better to use soil that has been under cultivation for at least two years previous to setting the plants, for sod contains white grubs that are very destructive to young plants. I should recommend for a kitchen garden, the following varieties: Bomba and Haverland for early; Burts Seedling and Daisy for medium; Crawford and Middlefield for late. These planted in the order named, will give each alternate row of pistillate varieties, insuring a perfect pollination.

While I consider these varieties the best of the newer kinds for the purpose named, there are several of the older varieties that will give good satisfaction, as Bidwell, Charles Downing, Crescent, Cumberland, and on heavy soil none are better than Sharpless. In so short an article as this it is impossible to meet every detail, but the Station is ready and anxious to answer any inquiry in regard to the culture of fruits in its power.

A DESCRIPTION OF VARIETIES.

Belmont, P.†—This is a very showy berry when fully ripe. Typical fruits oblong with thick neck, but bears a large number of coxcombed fruits. With good culture it will yield an average crop. The berries are firm and of very fine flavor. Season late.

Bidwell, P.—This has been a very profitable variety in some sections, but is not reliable enough for general use. Fruits of medium size, soft and not of the best quality. Season early.

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* Those marked * have been tested but one season.

† The letter P is used to designate a perfect flowering variety capable of fertilizing itself. Imp. being used for the imperfect or pistillate varieties, or those that should have a perfect flowering variety planted with them. Bisexual plants are those having perfect and imperfect blossoms on the same plant. In report of L. J. Farmer the letter H means perfect flowering, the letter P pistillate or imperfect.

Bomba, P.—A very vigorous plant, bearing a large crop of above the medium-sized fruits. Of a very dark scarlet color. The flesh of this berry is of high color and distinctly veined. Season early.

Bubach, Imp.—A rank growing late variety. Fruits average large, bright scarlet. A very promising variety, but quite soft.

Burt's Seedling, P.—This is claimed to be Captain Jack and there seems to be no difference in the appearance, habit of growth or productiveness. If there is a difference, it is not enough to matter which you have. The season is from medium to late. Berries firm, good size through season. One of the most productive varieties we have.

Captain Jack,* P.—The remarks in regard to Burt's Seedling will apply to this.

Cardinal.—This variety has nothing to recommend it, is of weak growth and winter kills badly. Season late.

Carmichael, Imp.—In a few sections this is well spoken of on account of its late fruiting qualities; has not proved of any value here.

Charles Downing, P.—One of the older varieties; still grown extensively in some sections, it is not very productive here but is of value for growing with pistillate varieties to furnish pollen. Season from early to late.

Cloud, P.—Of rank growth and great multiplier of runners. A handsome berry of large size, quite firm, and of a brisk, tart flavor. Productive, season medium; is thought highly of in the Southern States.

Coleman's No. 1,* P.—A local variety originated at Geneva; an early bearer of medium-sized fruits of light scarlet color, soft, but of good flavor. A good substitute for May King.

Cornelia, Imp.—This has done better this season than heretofore, but has only its firmness to recommend it. Fruits usually small and not of extra quality. Season late.

Crawford, Bisex.—A variety of vigorous growth, free from blight and multiplies by runners very rapidly. An abundant yielder of showy berries of more than average size; very firm and of first quality. A good late market variety.

Crescent, Imp.—A variety probably grown more extensively than any other through the north on account of its earliness, hardiness and productiveness. The fruits are of good size and showy, but run small towards the end of the season. The quality is inferior and if the market is at all critical they will not sell well.

Crimson Cluster, Bisexual.— This has proved itself of but little value, the growth is weak, berries small and few.

Daisy, * Imp.— This is considered an improvement on the Crescent being as heavy a cropper; the fruits are firmer, holding large through long picking season; not affected by wet weather. A profitable market variety.

Daniel Boone, Imp.— Not of very vigorous growth; bears a good average crop of medium-sized fruits, firm enough for shipping purposes, but of second quality.

Dawley, P.— A variety of Sharpless type. Fruits coxcombed; in no way superior to Sharpless as grown here.

Enhance.— A late berry of large size. Firm and productive; has proved one of the best late varieties we have. Quality of the best, it will respond to high culture in a profitable way.

Excelsior.— This variety does best with stool culture; the plants free from blight but of weak growth, fruits not very abundant, soft, and of second quality. Season early to late.

Farnsworth, P.— Not quite as productive this season as last. A great many plants in stool row killed out, still I consider it one of the best kitchen garden varieties we have. Too soft for shipping, but of exquisite flavor and fairly productive of good-sized berries. Season medium.

Felton,* P.— Of very rank growth; somewhat of Sharpless type; a prolific bearer. Fruits large through picking season, obtuse conic, dark glossy scarlet, firm and of the best flavor. I should say this will become a favorite. Season late.

Foster's Seedling, Imp.— A variety of vigorous growth; late and fairly productive. Large fruits, resembles Sharpless, quality of the best. Plants blight badly.

*Gandy.**— This is a late berry of rank growth. Fruits hold over average size through season. A very handsome berry, firm and of good flavor. I am of the opinion this will prove of value. Season late.

Garden, P.— Growth and yield better this year than last; of no especial value. Season long.

Gold, Imp.— Plants of vigorous growth but a poor yielder. All it has to recommend it is its flavor.

Hampden.— Of vigorous growth early in the season, but soon begins to rust. Fruits set well but many of them fail to mature;

decay rapidly after rains; not of any especial value. Season long.

Haverland, Imp.—Plants of vigorous growth, with distinct leafage, free from blight. Fruits in large clusters so heavy as to lay on the ground, and should be mulched. Berries long, of a showy scarlet and good size. Too soft for a shipping berry, but a first-class variety for home use or near market. Season early.

Henderson, P.—Where this proves productive it will be valuable on account of its fine flavor. Not productive enough here to pay for cultivation.

*Hinman.**—This is one of the newer varieties sent to this Station last year for testing. Growth of the plants through season of '89 was very vigorous, making runners rapidly, in fact matting so thick as to be unable to fruit. Stool plants held a fair crop, fruits irregular, of a showy scarlet, of firm texture and fair quality. The plants showed signs of blight early in the season, and later are badly affected. Season late.

Hoffman, P.—Of vigorous growth, makes many runners. Fruits large and showy, firm, subacid. A good shipping berry. Season early.

*Itaska.**—Of moderate vigorous growth, producing a fair crop of fruits of a dark scarlet color, medium size, subacid and firm; season late.

Ivanhoe, P.—Of vigorous growth, produces runners freely and is free from blight; the fruits which are produced in abundance are obtuse conical, bright showy scarlet, from large to very large, firm, and of the best quality. I consider it a fine garden berry. Season early.

James Vick, P.—Almost a failure in many sections; it is vigorous; blooms freely and sets a wonderful crop of fruits but lacks the vitality to mature more than a few. I have known of its doing very well on heavy clay in a partial neglected state.

Jersey Queen.—This variety blights very badly, growth not vigorous; unproductive. The fruits are of superior flavor, and in sections where it proves productive is a choice variety to grow. Season medium.

Jessie.—This variety makes a very vigorous growth in stool rows, and has a few fruits of the largest size and fine flavor, ripening quite early; balance of crop poor. This berry requires a soil peculiarly adapted to its needs to become of any value.

Jewell.— This variety has the reputation of being a prize taker at several of the eastern Horticultural Exhibitions. While it is a noble looking berry, it does not do well here, its worst fault being inability to produce runners with which to renew itself. Season early.

Johnson's Late, Imp.— A variety of distinct foliage, leaves very stiff, of a dark green color. Very late and fine flavor, but being a pistillate variety does not yield a very large crop as it blooms too late to be pollenized by other varieties.

Jumbo or Cumberland.— This has proved a promising variety under the name of Cumberland in some sections of the country, but is not above the average here. Fruits large, pale scarlet, soft and not of extra quality. Season early.

Kentucky, Bisex.— One of the oldest varieties, of rank upright growth; moderately productive; fruits held up on stiff stalks and shaded by leafage; rather soft. Season long.

*Lady Rusk.** — This variety was sent out for testing last year. Its chief claim was its shipping qualities. One season's experience with it shows it to be a very promising variety for keeping or shipping; it is a very dark berry of average size and yield. I do not think it will supplant any of the first-class varieties now in market. Season medium.

Legal Tender.— Season medium, of good growth and above the average in productiveness. Fruits of good size, showy and very sweet; it is nearly devoid of acid and requires but little sugar. Season from early to late.

Lennig White.— While this variety is not productive enough to be profitable, it is a first-class fertilizer for pistillate varieties as it continues to bloom through a long season and is supplied with quantities of pollen.

Leonard's Seedling, P.— This variety proved to be the earliest variety to give a good picking; growth of plant very vigorous, with large leafage and making many runners. Fruit conical, dark glossy scarlet. Average large, firm and of good quality. I think this will prove a profitable early variety.

Lida.— This is a very sturdy growing variety; enormously productive, of large dark red fruits. The fruits are almost without flavor and if left to become fully ripe are too soft to pick, rotting very quickly after rains. Season medium.

*Logan.** — A vigorous growing variety and should be mulched; fruits usually large, but held on short, weak fruit stalks. They are of a clear red color with a handsome gloss and yellow seeds, making it a very showy market berry. Season medium.

Longfellow.—Is not of any special value.

*Long John,** P.—A local variety from Niagara county, this State. Rather strong growth; fruits long, dark red, on short fruit stalks; small and of only average production. Season medium.

Lyons Seedling.—A late variety of good growth, fairly productive; season from medium to late. Fruits average large, deep scarlet, firm and with a pronounced Hautboy flavor.

Mammoth.—Of rank growth and makes runners very rapidly but blights rather badly. Quite productive of large fruits, soft but of good quality; season late.

Manchester, Imp.—This old variety blights very badly and its only recommendation is its firmness.

May King, P.—Of vigorous growth, makes runners freely, free from rust, fruits ripen early and continue through long season; medium large and firm, quality of the best. I consider this one of the best table berries; it will be an acquisition to any home garden.

Miami, Imp.—This is a late variety of merit; it makes a good growth and any quantity of runners and is quite productive. Berries over average size, oblong and dark showy scarlet, soft but good quality.

Middlefield (*Augurs No.* 70.)—The growth of plant is all that one could wish; foliage dark green free from rust; making runners freely; was second in productiveness this year. Fruits conical, flattened on large specimens, very showy, glossy scarlet, firm, holding large through picking; season from medium to late. I consider this the best one of the Jersey Queen type.

*Monmouth,** P.—Of but moderate growth, not very productive. Fruits irregular, flattened similarly to Sharpless, usually large, firm and a very pleasant tart; season early.

Mrs. Garfield.—Plants of this variety seem to lack in vigor and are unproductive. The few fruits it ripens are of a showy scarlet, soft and rather poor in quality; season early.

Mt. Vernon.—This variety was reported as not being productive during the season of '89, but this year it has done finely, standing third in yield from matted rows of all the varieties under test. The fruits are obtuse conical, bright scarlet, of medium size, soft but of fine quality; season late.

New Dominion, P.— Growth vigorous; season late; fairly productive. Fruits conical and a showy scarlet, hold large through picking, soft but fair quality.

Ohio.— Not of extra vigor; late, produces a few large fruits but most of crop small; firm but scalds badly; flavor very tart.

Ontario.— Resembles Sharpless; in no way superior to that variety.

Parry.— Of Jersey Queen type; flavor very fine, but unproductive and of weak growth.

Pine Apple, P.— Of vigorous growth. Free from rust. Late and unproductive. This has nothing to recommend itself with.

Piper's Seedling, P.— Growth rank, making many runners, free from blight; not very productive; fruits conical, deep red, almost black when fully ripe, firm and of fine flavor; season medium.

Primo, Bisexual.— This is usually a productive variety. This last season however it failed to keep up its reputation. Season late; fruits light scarlet, medium size and holding well through season; firm, good flavor.

Prince of Berries, Bisexual.— Of vigorous growth with but few runners; free from blight; not productive enough for a market variety but should be in every private garden, for it is the standard of excellence as regards flavor; season late.

Russell's Advance, * Imp.— An old variety, without particular merit except fine flavor.

Scarlet Gem, *— This variety originated in Michigan, where it is well thought of; here it is utterly worthless; growth of plants weak; fruits small, without any flavor; season medium.

Sharpless, P.— A well-known variety and very satisfactory either for market or private garden. Fruits unusually large, tips usually green when fruits are ripe enough to pick.

Smith's 77.— This is also a Kansas production. Plants of vigorous growth. At the time the flower buds appeared it gave promise of being a grand acquisition, but set too many fruits to perfect. In habit of growth and inability to mature crop it is identical with James Vick, but has larger fruits, flavor very tart; season late.

Souv De Bossuet, Bisexual.— This is an importation from France; growth stocky; foliage dark green; unproductive; season medium; fruits nearly round, dark scarlet and soft; slight Hautboy flavor.

Stayman's No. 1.*— This is a Kansas variety of very vigorous growth, with long stiff fruit stalks; bears an enormous crop of more than averaged sized fruits of conical shape and pleasing scarlet color; hold good size through long picking; season from early to late; firm enough to ship and of fine flavor; fruiting season's notes say "ground literally covered." I consider this the best variety among one year tested plants grown on the Station grounds; it excelled all others in stool row by one-quarter.

Stayman's No. 2.*— A good healthy growing variety; one day ahead of the No. 1 in picking, but not nearly as productive, and softer.

Summit, Imp.— Of medium growth; fruits of the largest; very symmetrical and of fine flavor; not very productive this year. Well spoken of in certain sections; season late.

Viola, *— Of rank growth, large leaves; fruits unusually large, obtuse, conical, flattened on end; of firm texture, and fine flavor; color, fine deep scarlet; seascn medium.

Warfield, Imp.— This does not do well here; the plants make a very poor growth and fail to produce even a medium crop; fruits conical, showy scarlet and soft; quality fair; season medium.

Wilson.— This good old variety has about run out in this section, and is only profitable where care is taken to select runners from plants that have not borne a crop of fruit; it never has been excelled for shipping or canning, and for a canning berry for family use should be grown.

Windsor Chief, *— Growth very vigorous; an abundant yielder of round, dark, glossy, scarlet fruit of large size; firm, and has a pleasant acid flavor; season early.

Woodruff, No. 1, P.— Of thrifty growth; very productive; fruits very much misshapen, with hard core; of no special merit.

The following varieties were received and planted during the spring of 1890, and the accompanying descriptions are of this season's growth only. The early summer was favorable to their growth, but through the latter part of June and the month of July we had a severe drought which tried the constitution of spring set plants:

Beeder Woods, P.— Growth vigorous; foliage very dark green; leaves usually narrow and pointed; makes an enormous quantity of runners well set with young plants. This variety has been sent out under the name of Racster it is claimed.

Bessie, Imp.— Of moderate growth; foliage a good green; quantities of runners thickly set with young plants. This variety has persisted in blooming and fruiting through the summer; ripe fruits picked August five.

Buchley's Seedling.— Growth low and stocky; foliage dark green; leaves small; makes runners freely.

California, P.— Of good stocky growth; foliage dark green; shows slight signs of blight; runners very long between sets; would cover a large surface if allowed to run at will.

Duboise, P.— Habit of growth and foliage similar to Sharpless; furnishes an abundance of sets on medium long runners.

Edgar Queen.— A perfect flowering variety of remarkably vigorous growth; foliage dark green; free from blight; makes a large number of runners.

Eureka, Imp.— Of moderate growth; foliage dark green; leaves somewhat wrinkled; makes runners freely.

Gipsy, Imp.— Of low stocky growth; foliage dark green; well supplied with runners.

Hulburt, P.— Growth stocky; dark green foliage; runners well set with young plants.

Kimsey's No. 49, Imp.— A variety from Kansas, of good growth; foliage light green, free from rust, runners well set with young plants.

Lincoln.— Of Shapeless type; with quantities of runners.

Marvel, P.— A stocky growing variety; foliage dark green, leaves long and pointed, free from blight; makes quantities of runners.

Mitchell's Early, P.— An Arkansas variety, spoken very highly of on account of its earliness. The plants are very vigorous, making large stool plants and matting thickly where allowed to. Foliage a good green, entirely free from blight. Altogether a very promising variety. This is claimed to be identical with Osceola.

Mrs. Cleveland, Imp.— Of good growth; foliage dark green; leaves very much wrinkled; makes runners freely.

No. 19.— Good stocky growth; foliage dark green; makes runners quite freely.

No. 1, Imp.— Of Sharpless type; well supplied with runners thickly set with plants.

New Improved Manchester, P.— A variety of vigorous growth; foliage dark green, leaves wrinkled; makes an abundance of runners.

Ohio Centennial, Imp.— This variety is of low stocky growth making in stool plants almost a perfect ball; foliage a very dark green, leaves half rounding, very distinct; runners short.

Oliver, P.— Of very vigorous growth; foliage dark green, leaves large, resemble Sharpless. Stool plants of very large size; makes runners very slowly.

Parker Earl, P.— A Texas berry, of very vigorous growth; foliage light green, leaves pointed; runners well filled with plants that are of large size before becoming rooted. This has been tested in certain sections and is well spoken of.

Pearl, P.— Of vigorous growth; foliage dark green, leaves large, show signs of blight; runners long, well filled with plants.

Phillips' Seedling, P.— Good growth, leaves of Sharpless type but smaller, dark green; makes a large number of runners thickly set with plants.

Schuster Gem. Imp.— This does not make a very vigorous growth; foliage light green; fairly well supplied with runners.

Tippecanoe — Of very vigorous growth; foliage good green; leaves large and wrinkled; makes runners freely; thickly set with plants.

Van Deman — Of vigorous growth; foliage dark green; runners long, well set; has blossomed and fruited through the summer; good sized fruits being found August fifth.

The following twenty varieties are given in the order of their productiveness:

Matted Rows.	*Stool Rows.*
Burt's Seedling.	Stayman's No. 1.
Middlefield.	Lida.
Mt. Vernon.	Capt. Jack.
Stayman's No. 1.	Burt's.
Crescent.	Legal Tender.
Enhance.	Garden.
Daisy.	Daisy.
Miami.	Wilson.
Haverland.*	Smith's No. 77.
Chas. Downing.	Stayman's No. 2.
Legal Tender.	Long John.
Stayman's No. 2.	Windsor Chief.
Lyons Seedling.	Dawley.

New Dominion.	Haverland.*
Leonard's Seedling.	Coleman's No. 1.
Excelsior.	Excelsior.
Lady Rusk.	Mt. Vernon.
Bubach.	Henderson.
May King.	Louise.
Louise.	Manchester.

EARLY VARIETIES.	First bloom.	First fruits ripe.	Length of picking season in days.	LATE VARIETIES.	First bloom.	First fruits ripe.	Length of picking season in days.
Bidwell	May 12	June 15	4	Belmont	May 27	June 21	5
Bomba	5	15	9	Bubach	22	17	15
Crescent.........	12	15	15	Cardinal	24	18	6
Coleman's No. 1.	5	15	10	Carmichael......	31	25	4
Haverland	5	15	13	Daisy	23	18	10
Hoffman.........	5	13	9	Gold.............	30	18	10
Jessie...........	5	12	6	Gandy...........	28	22	9
Jewell	12	14	4	Johnson's Late..	30	28	8
Lida	5	14	12	Kentucky........	23	19	12
Mrs. Garfield....	8	14	10	Mammoth	26	19	10
Old Iron Clad ...	5	12	4	Miami...........	26	19	11
Parry	5	15	8	Ohio..............	26	22	9
Stayman's No. 1.	12	15	12	Ontario	23	19	8
Stayman's No. 2.	16	14	16	Prince of Berries	26	19	9
Lady Rusk	5	15	6	Hinman	23	22	4

One of the most important considerations to the grower of strawberries is the health of the vines, inasmuch as the yield of fruit is to a great extent dependent on the previous years growth. Through this section the only troublesome disease of the strawberry is the leaf blight which is quite destructive to some varieties. The following table has been compiled to show the varieties most subject to the attack of this disease, as they have been tested here.

* One picking of this variety was allowed to become too ripe and many berries could not be handled, else it would have stood fifth or sixth.

Strawberry Blight — Prevalence in Different Years.

	1886.	1887.	1888.	1889.	1890.
Bidwell	Slightly	Slightly	Badly	Free	Free.
Belmont				Free	Slightly.
Burts				Badly	Badly.
Bomba				Slightly	Slightly.
Bubach				Free	Slightly.
Charles Downing	Badly	Slightly	Badly	Slightly	Badly.
Cornelia	Badly	Slightly	Badly	Badly	Badly.
Coville's Early	Slightly	Slightly	Badly.		
Cardinal				Free	Free.
Cloud					Slightly.
Carmichael				Free	Free.
Crawford				Free	Free.
Captain Jack					Badly.
Crescent				Slightly	Slightly.
Crimson Cluster				Free	Free.
Coleman's No. 1					Free.
Daisy Miller	Badly	Free	Slightly.		
Daniel Boone				Slightly	Slightly.
Dawley				Free	Free.
Daisy				Free	Slightly.
Enhance				Slightly	Badly.
Excelsior			Badly	Free	Slightly.
Felton					Very slightly
Farnsworth				Slightly	Slightly.
Garretson	Badly	Slightly	Badly.		
Garden				Slightly	Badly.
Gold				Slightly	Badly.
Gandy					Slightly.
Hampden				Badly	Badly.
Haverland				Free	Free.
Henderson				Slightly	Slightly.
Hoffman				Free	Slightly.
Hinman					Badly.
Ivanhoe				Free	Slightly.
Itaska					Badly.
James Vick	Badly	Free	Free	Free	Very slightly
Jersey Queen	Slightly	Slightly	Badly	Badly	Slightly.
Jessie				Slightly	Free.
Jewell				Free	Free.
Jumbo	Badly	Slightly	Badly	Slightly	Slightly.
Kentucky				Slightly	Badly.
Legal Tender	Slightly	Slightly	Badly	Slightly	Badly.
Lennig White	Very bad	Slightly	Badly	Slightly	Slightly.
Longfellow	Slightly	Slightly	Badly	Free	Slightly.
Lida				Slightly	Slightly.
Louise				Slightly	Slightly.
Lady Rusk					Free.
Long John					Badly.
Mammoth				Slightly	Badly.
Manchester	Badly	Badly	Slightly	Badly	Very badly.
May King	Free	Free	Very slightly	Free	Free.
Mt. Vernon	Very badly	Slightly	Badly	Slightly	Badly.
Mrs. Garfield	Very slightly	Slightly	Badly	Badly	Very slightly
Miami				Slightly	Badly.
Monmouth					Badly.
New Dominion				Badly	Slightly.
No. 70				Free	Very slightly
Ohio				Slightly	Badly.
Old Iron Clad				Free	Free.
Ontario	Slightly	Slightly	Free	Free	Free.
Parry	Free	Badly	Very badly	Badly	Free.
Piper's Seedling	Free	Badly	Badly	Slightly	Badly.
Primo	Very badly	Badly	Very badly	Slightly	Free.
Prince of Berries	Slightly	Free	Slightly	Free	Slightly.
Pine Apple				Free	Free.
Russell's Advance					Badly.
Sharpless	Free	Free	Slightly	Free	Free.
Souv. de Bossuet				Free	Badly.
Stayman's No. 1					Free.
Stayman's No. 2					Free.
Smith's No. 77					Free.
Scarlet Queen					Slightly.
Summit				Slightly	Free.
Viola					Free.
Wilson	Very badly	Very badly.	Very badly	Badly	Slightly.
Woodruff				Slightly	Slightly.
Warfield				Slightly	Slightly.

Extracts from Report of Strawberries grown by L. J. Farmer, of Pulaski, N. Y., the Season of 1890.

Atlantic, H.—A late berry, beautiful, firm, glossy and extra large; as yet yields poorly.

Bubach, P.—With us the Bubach is a most valuable variety; it ripens mid-season and is very productive, the most productive large berry save Eureka. The color is rather light but its immense size secures for it the highest price.

Burts, H.—The Burt is the best berry we know for wet soils or rainy weather; it will stand more grief than any we know of, berries firm enough to be left on vines several days; fruits light color; a good shipping berry. Plants rugged and free runners.

Cloud, P.—On rich soil this seems to exhaust itself in making runners, but I have seen it on moist gravelly loam between blackberries where the growth of runners was prodigious and the crop of fruit very large; the berries are of a good color and very firm; one of the best shipping varieties we know.

Crawford, H.—Plants rather slow growers and require good culture; fruit similar in color to Eureka; ripens late.

Crescent, P.—This has never failed to give a good crop; sells for the same as Wilson and is fully twice as productive.

Crystal City, H.—Extra early; fruits small, few in number, ripening together, is of value only as a fertilizer of some very early pistillate variety.

Cumberland, H.—This has never done well here. Fruits regular in shape, large and fine flavor; unproductive.

Daisy, P., *Pearl* H.—These two varieties should always go together as they ripen at the same time, are of the same color and both are regular. The Daisy is larger than Crescent and as productive. Pearl shaped like a cone, very firm.

Eureka, P.—For vigor of plant and beauty of fruit the Eureka is without a peer. It will spread to the width of fifteen feet in one season; it ripened latest of all, the first picking, June thirtieth. In shape somewhat like Sharpless; bright red color, very glossy and attractive; berries firm and solid to the core.

Gandy, H.—This is regular in shape, firm, and does not get soft towards the last; only moderately productive and valuable only for home use and a market that uses late fruits.

Gypsy, P.—Plants of fine growth with healthy foliage; last year fruits resembled Wilson but larger. This year on account of the wet weather they did not fertilize well and the fruits were small and hard, it seems to be a clear pistillate. I have great faith in this variety.

Hampden, P.— Resembles Manchester and has the same failing of rusting.

Haverland, P.— This variety produced the largest quantity of fruit but a large per centage was inferior; is too watery for shipment but for a local market and home use can not be excelled. Quality fine; it blossoms earliest of all but did not ripen till mid-season.

Hoffman, H.— Produced a lot of small inferior plants; the fruit was an entire failure although the plants blossomed well.

Jersey Queen, P.— This was a surprise to us, as from reports we did not expect any thing from it. The fruit was large, attractive, and quite productive, valuable only for fancy near market.

Jessie, H.— Does fairly well, but only about half as productive as Bubach; we consider it the best flavored of all and a valuable berry for fancy trade.

Jewell, P.— Plants blossomed profusely and were loaded down with fruits; the plants blighted very badly just as the fruits began to ripen and the berries dried up in the sun.

Logan, H.— In value this ranks with Monmouth, dwarfish, fair growth; productive, fruits round, good flavor, bright color.

Long John, H.— An entirely distinct berry, long, and resembles blackberry. Fruits fair size, dark color and firm. Plants are productive.

Mammoth, H.— Produced a few large specimens and many small ones; a slow grower.

Monmouth, H.— Of dwarfish growth and not being vigorous, ripens extra early, fruits similar in shape and firmness to Wilson but large and of better color.

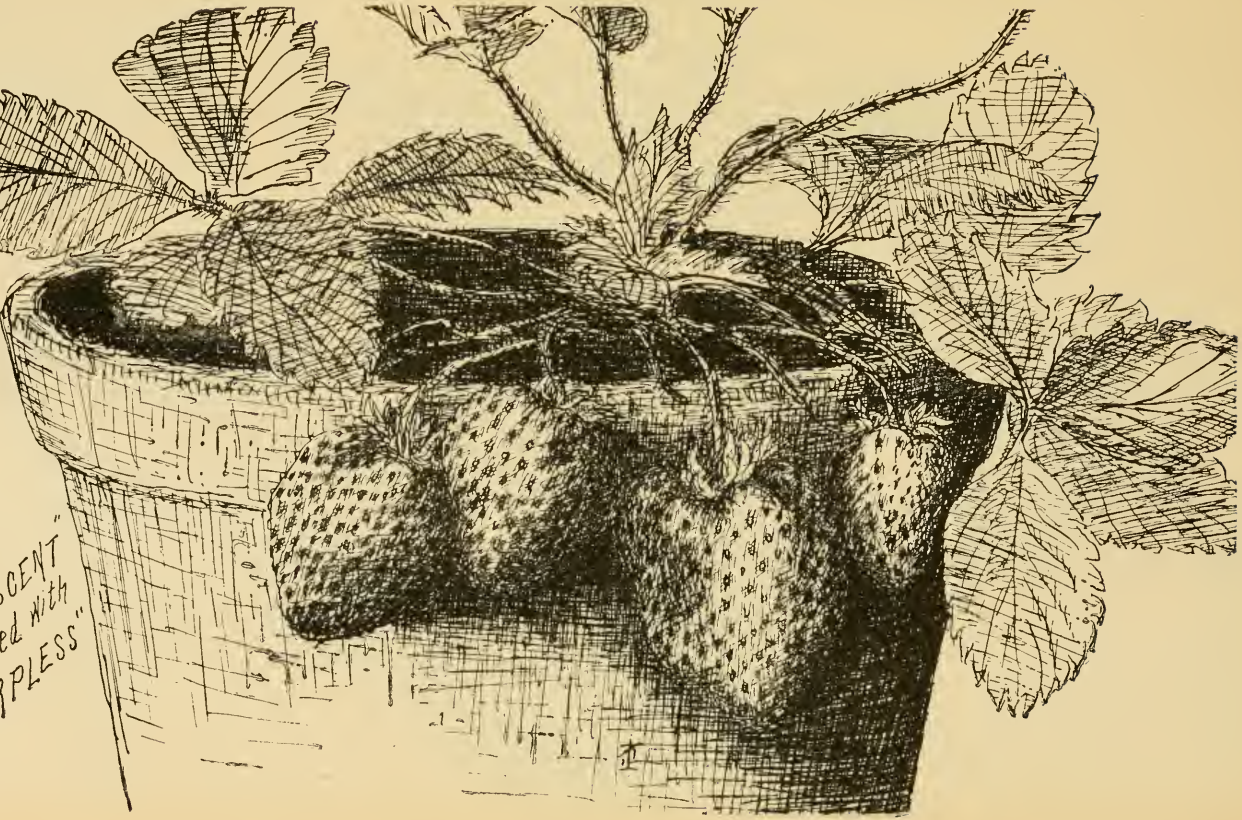
Pineapple, H.— This variety is a good grower with fine foliage; is easily affected by unfavorable weather when in blossom. Soft, of poor color and good only for home use.

Sharpless, H.— You can not tell the plants from Jessie; not as productive. Jessie is a great improvement over Sharpless with us.

Viola, H.— The plants are free growers, somewhat like the Jessie in appearance; fruits quite large but poor color, unattractive, white tipped; are exceedingly poor in flavor having a musky, disagreeable odor.

1
"CRESCENT"
Fertilized with
"OLD IRONCLAD"

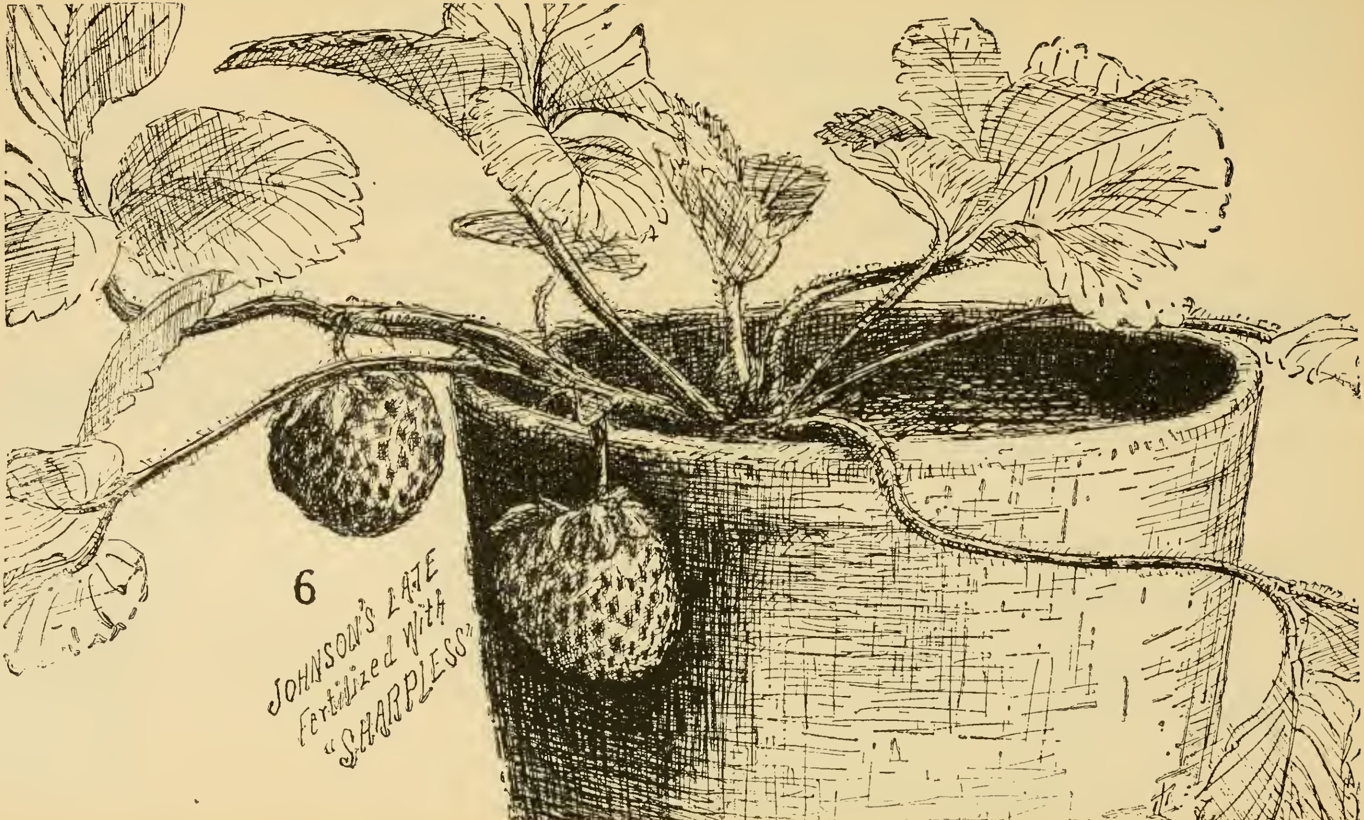

2
"CRESCENT"
Fertilized with
"LENNIG WHITE"



3
"CRESCENT"
Fertilized with
"SHARPLESS"


4
"CRESCENT"
Fertilized with
"DAWLEY"


5
"JOHNSONS
LATE"
Fertilized with
"LENNIG WHITE"



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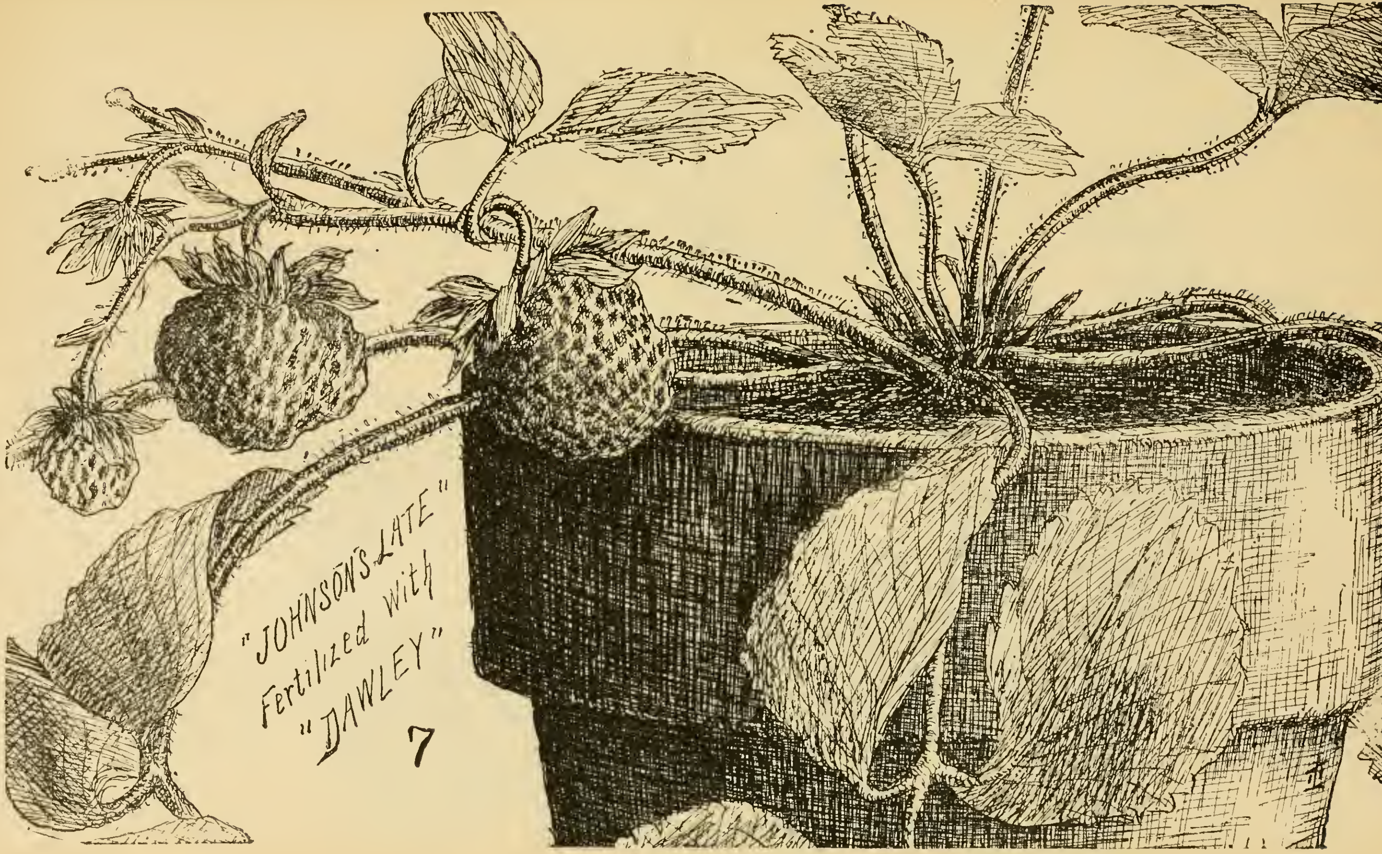
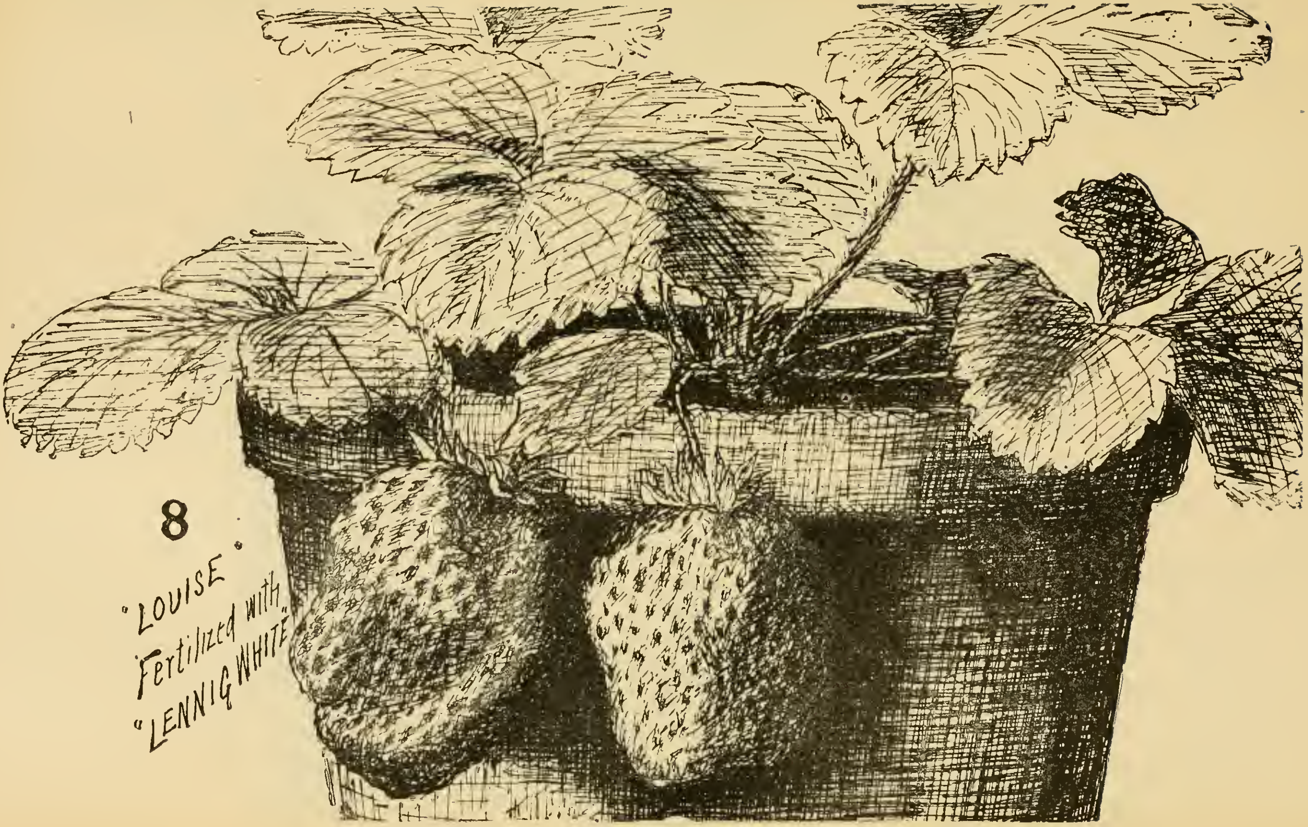

"JOHNSON'S LATE"
Fertilized with
"DAWLEY"
7



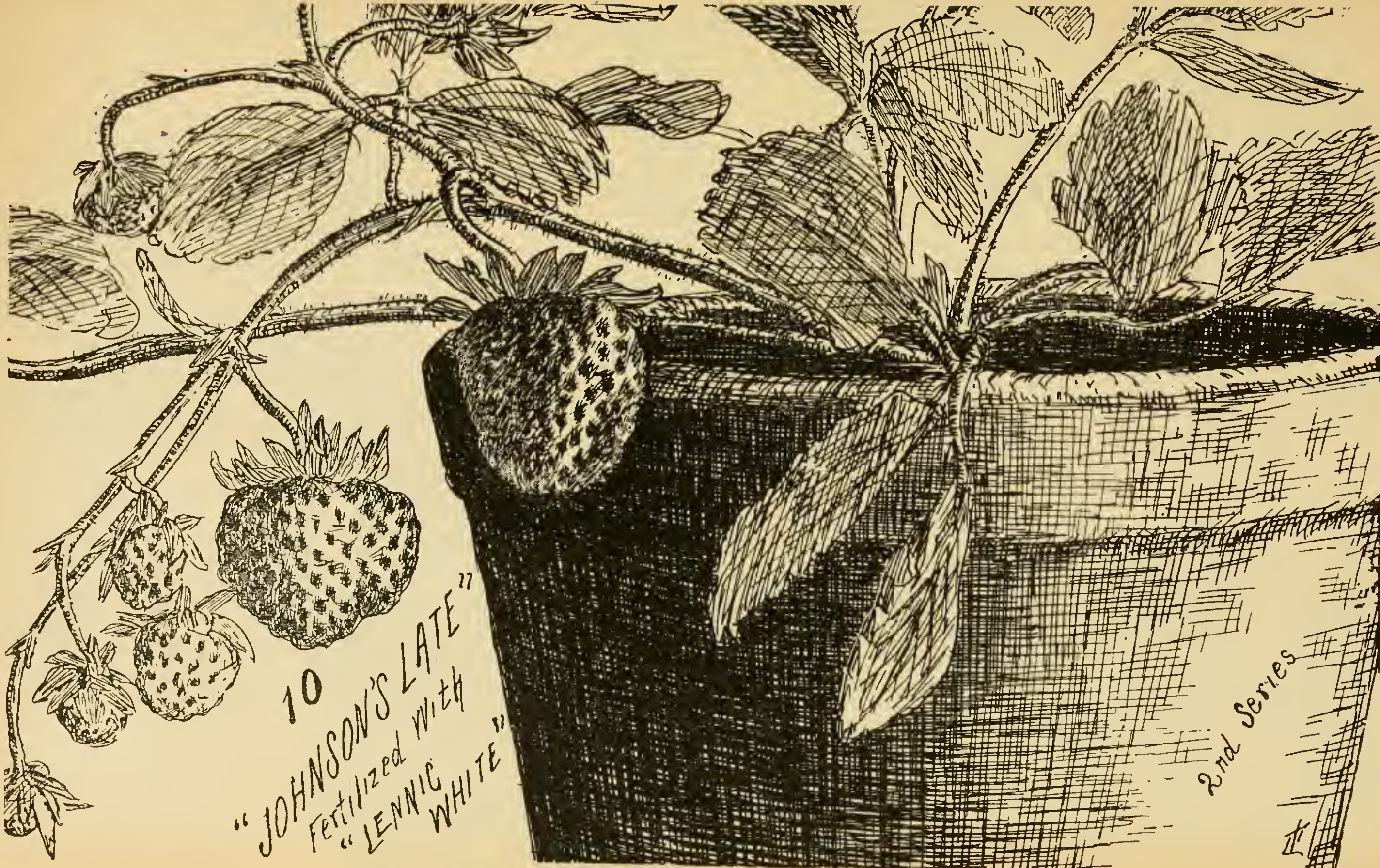
8

"LOUISE"

Fertilized with

"LENNIG WHITE"


2nd Series
9
"JOHNSONS LATE"
Fertilized with
"LENNIG WHITE"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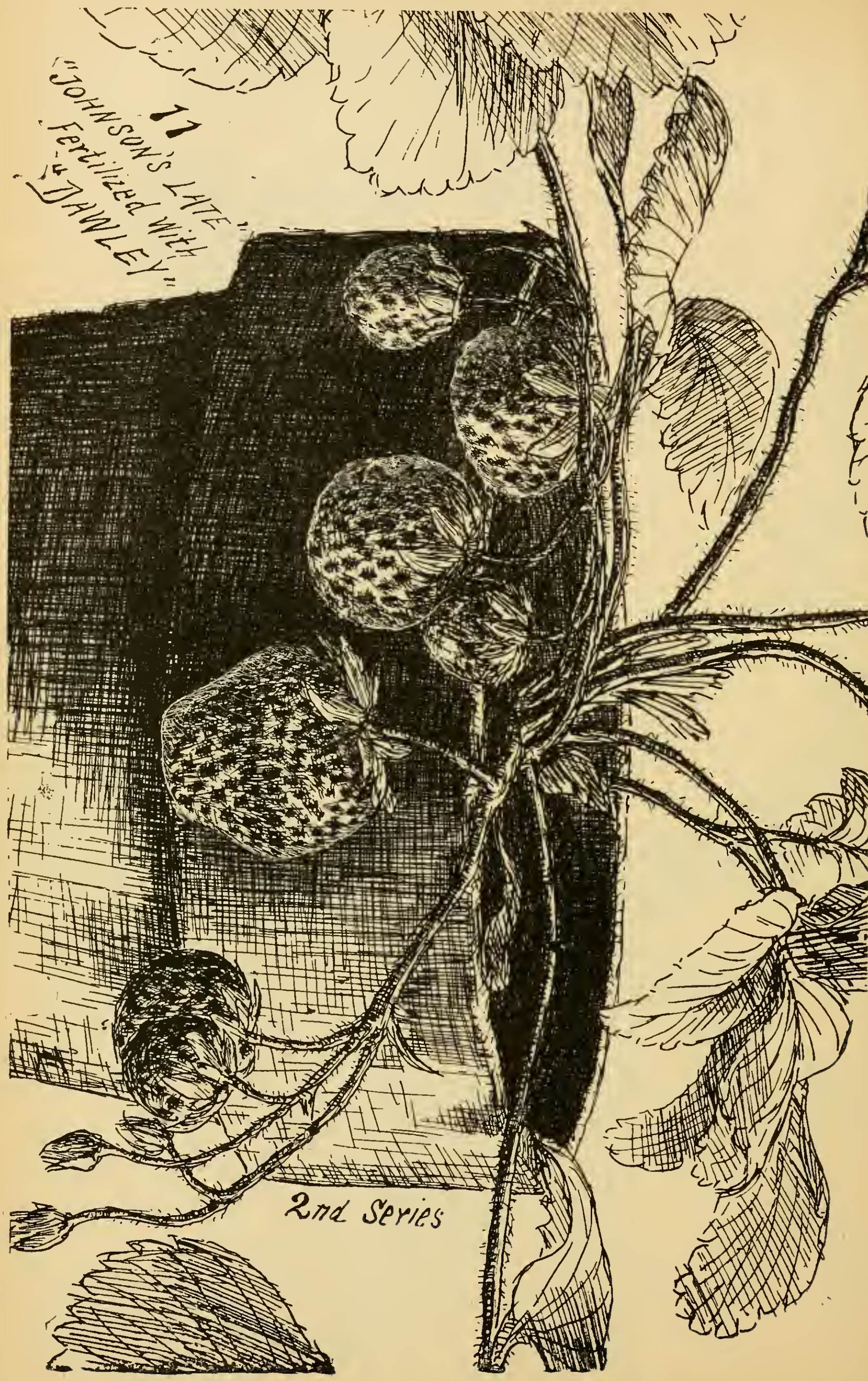
"JOHNSON'S LATE"
Fertilized with
"LENNIG
WHITE"
2nd Series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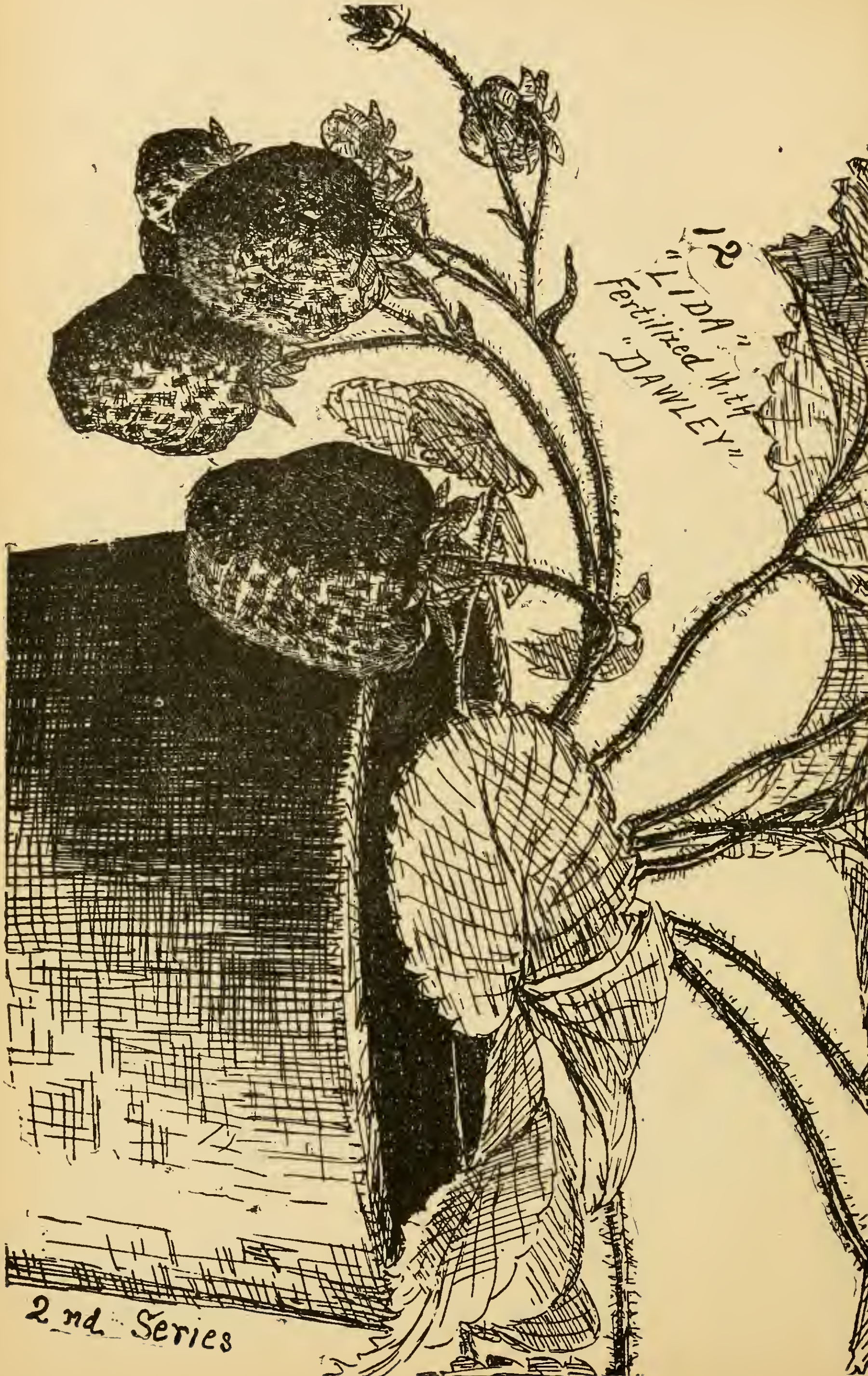
"JOHNSON'S LATE"
Fertilized with
"DAWLEY"
2nd Series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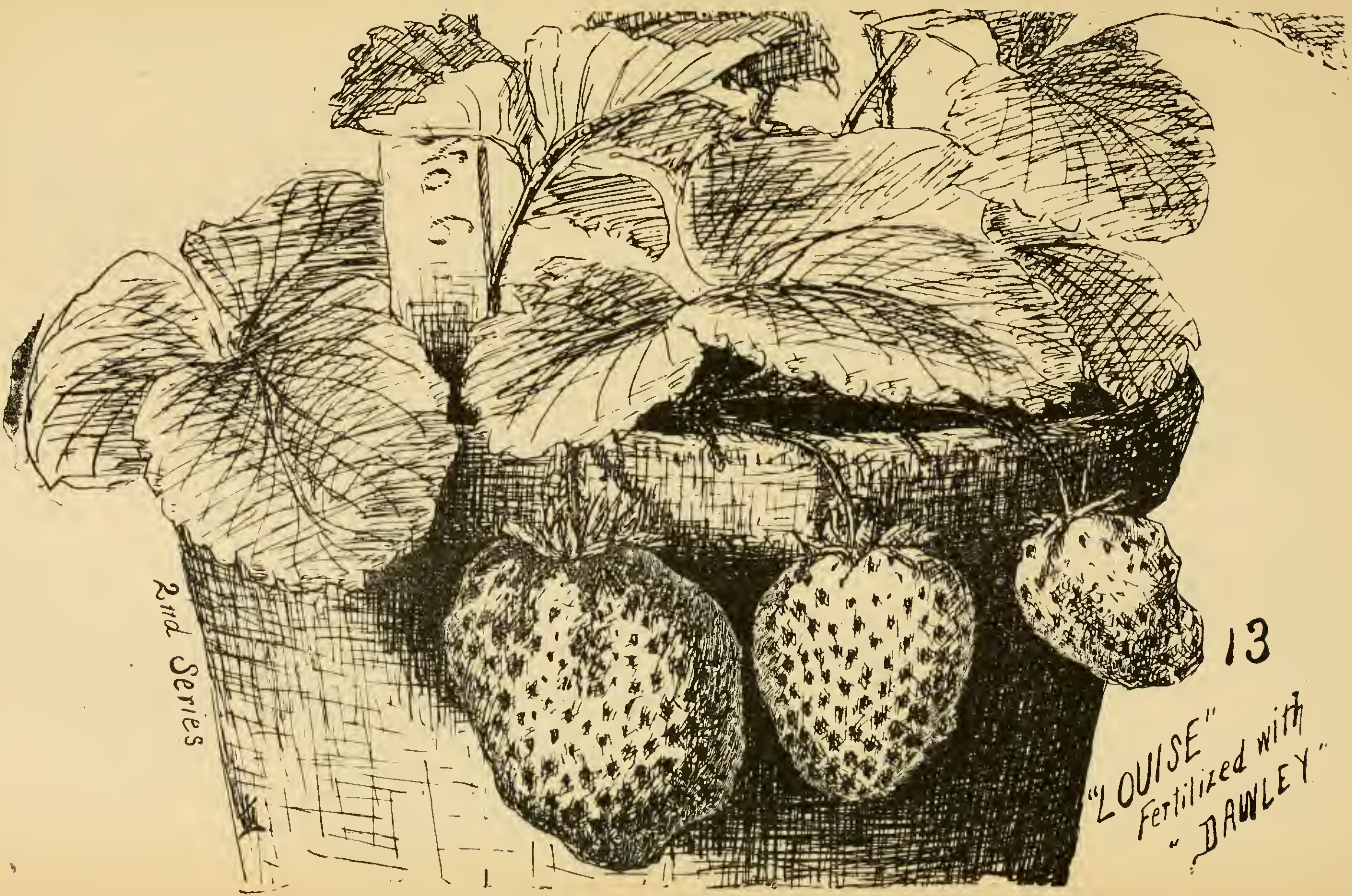
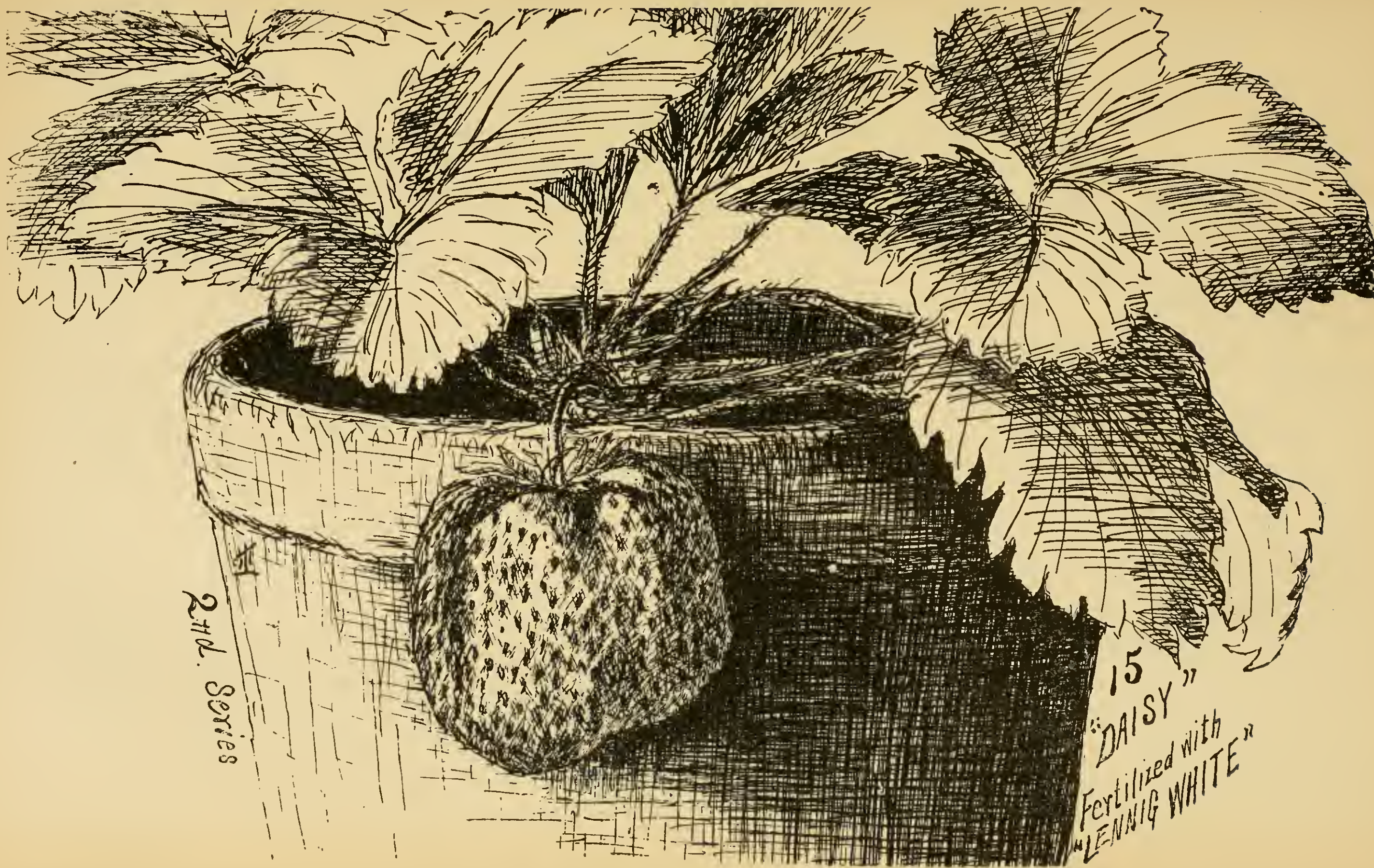
"LIDA" Fertilized with "DAWLEY"
2nd Series


2nd Series
13
"LOUISE"
Fertilized with
"DAWLEY"


14
"DAISY"
Fertilized with
"LENNIG WHITE"
2nd Series


15
"DAISY"
Fertilized with
"LENNIG WHITE"
2nd. Series

Warfield No. 2, P.— This berry ripened more marketable fruits than any other on our grounds. It ripens with Crescent, is more productive and holds its size better to the close of the season. Like the Wilson it should be picked for market when it first turns.

Wilson, H.— In a few places in Oswego county the Wilson still does well but it has not done well with me.

NEW STRAWBERRIES.

Florence.— A beautiful plant of rather tender appearance.

Great Pacific.— In appearance of plant and fruit this seems to be a magnified crescent.

Hermit, H.— Strong grower, hardy plant.

Lady Rusk.— Resembles the old Charles Downing in growth. The largest specimen was picked from this variety. It is dark colored and as the introducer claims, dries up rather than rots by standing.

Mark.— Is a slow grower like Wilson; tough appearance.

Miami.— Our Miami plants came from the same place and were very inferior in size. They have done well however, and are making a fair growth of extra large bushy plants.

Michel's Early.— Is the toughest plant we have. They came from Arkansas in March, were buried in a snow bank till spring and kept in the same box till June. Despite this every plant grew and are the most vigorous of all. There were blossoms on the plants when they came, but they blossomed again and appeared to be very productive.

Mrs. Cleveland, H.— Fine grower, very pretty but too light colored to be very hardy, we think.

Oliver.— A tall, rank, hardy appearing plant.

Parker Earle.— Bore extra fine berries all summer. Resembles Haverland in shape but is better in color and flavor. Plants vigorous but do not run like Michels.

Sadie.— Is a fine runner with a tough appearance.

Tippecanoe.— From the numerous weaklings we bought of this variety last spring only three survived. These three have made a fine growth and appear to be making large plants.

Waldron.— This is about perfect in growth. It had extra strong fruiting stems full of blossoms, but we cut them all off.

Walton.— A poor, weak grower.

Warfield No. 1.— A good grower but not so vigorous as No. 2; has a hardy appearance.

Yale.— Poor grower, quite similar in color and general appearance of plant to Mammoth.

GREEN'S NURSERY CO., ROCHESTER, N. Y., REPORT ON STRAWBERRIES.

Bubach.— Still holds its reputation as a first-class variety.

Cloud.—Makes plants fast, productive; fruit tart; will be the leading berry for canning eventually, we think.

Edgar Queen.— Michel's Early, Farnsworth and Pearl are the most promising in appearance of the new varieties not fruited on our grounds.

Gandy.—Two-year plants bore well on muck land. Fruit very large and firm, valuable for a late variety for market.

Of the new varieties:

Hilton. — Promises well, vigorous, healthy, very productive, fruit large; quality medium to good.

Jessie.— On well drained land wonderfully productive. Fruit large to very large; on wet clayey soil not so good.

Lady Rusk.— Fruit large, good quality, dark color, promises to be a favorite.

Miami.--Not unlike Cloud, fruit rich color and makes plants fast.

Parker Earle.— Of great promise; spring set plants loaded with fruit; plants healthy and strong.

Pineapple.— Fruit good size but not productive enough on our soils.

Warfield.— Productive, rich dark color, medium size. We have planted more for fruiting.

EXPERIMENTS IN CROSSING VARIETIES.

There has been considerable work done at this Station within the past three years in crossing varieties and making fruit selections. Of 1,000 seedlings fruited the seasons of '88 and '89, but twenty were saved as showing any indication of being of value. Of these twenty, fifteen have been discarded this season. Of 700 seedlings fruiting this year for the first time, less than fifty have been noted as good enough to give one more year's trial. This shows how very seldom it is that seedlings, even when crosses, give results commensurate with the time and bother of raising them. This last winter there has been a large amount of work done in the green-house in the way of systematic crossing of varieties, or in other words, breeding for a purpose. When the pollenized plants perfected their fruits, many of them gave fruits so utterly unlike the fruits of either of the parents that, with the special idea of studying the potency of the pollen of different varieties, drawings of several were made, some of which are incorporated in this report. So much has been said against the theory of the influence of pollen showing on the first fruits that the pollenized plants bear, that these plates will be of interest to those who are endeavoring to solve this question.

A Description of Plates.

Cut No. 1.— Crescent fertilized with Old Iron Clad. Fruits are more of Iron Clad type than Crescent, but the largest fruit flattened much more than is typical of either parent.

No. 2.— Crescent fertilized with Lennig White. The large fruits totally unlike either parent. Of Sharpless type and color.

No. 3.— Crescent fertilized with Sharpless. All fruits close to Crescent type. Not any resemblance to Sharpless.

No. 4.— Crescent fertilized with Dawley. One fruit of slightly Dawley type.

No. 5.— Johnson's Late fertilized with Lennig White. Fruits type of Johnson's Late.

No. 6.— Johnson's Late fertilized with Sharpless. Fruits, type of Johnson's Late.

No. 7.— Johnson's Late fertilized with Dawley. Fruits of Johnson's Late type.

No. 8.— Louise fertilized with Lennig White. This gives a strange result. As a cross on a variety received here as Louise (but pistillate and of the same shape as Lida) both parents bear almost round fruits. Both fruits are very large, flattened and in every respect almost identical with Sharpless.

Nos. 9, 10 and 11 are valuable as showing with increased emphasis the pollen-resisting qualities of the variety Johnson's Late as compared with any other variety used in our tests. Nos. 12 and 13 show slight trace of the Dawley type, noticeably the latter. Nos. 14 and 15 give conflicting results which are only harmonized by the fact of one blossom alone being fertilized, thus putting the entire vigor into the only fruit borne, thus causing an abnormal growth.

It will be noticed that every plant of Crescent, without regard to the pollen variety, had fruits of wide variation. Plants of

Johnson's Late fertilized with three different varieties show great resisting qualities as every fruit is of the type of the female plant. This is in line with the question to be solved, viz.: Can a pistillate plant of vigorous growth and marked characteristics (fertilized with pollen from a weaker growing variety yet potent to transmit its staminate parts) be made to hold its habits and also become perfect flowering. If so, can we not produce strains of strawberries as distinct and as well adapted to the several uses, for shipping, canning, table, etc., as there have been bred distinct breeds of cattle, etc.

I am aware that something has been done in the line of systematic breeding of grapes, but only in a small way. The field is a large one, and it is to be hoped that it will be filled with workers and a special effort made to carry on this line of work.

The fruits resulting from these crosses were sown when fully ripe and many of the seedlings are now (January first) in bloom in the Station green-house.

RASPBERRIES.

In addition to the twenty-eight varieties fruited and reported on in the eighth annual report of this Station there were in fruit this year seventeen newer varieties, several of which have merit.

Although there was a slight increase of anthracnose, this disease did not prevail to any serious extent. At fruiting season the ground immediately surrounding the canes was heavily mulched and frequent cultivation given. By this means the severe drought in July did not affect the yield appreciably.

As the varieties described last year have many of them developed other characteristics, it has been thought best to repeat the descriptive list of last year, with this season's notes appended.

The yield of the leading varieties have been so different this year from last that a list of the ten most productive of each year has been made, showing the variation.

RASPBERRIES.

The ten most productive in order of their productiveness.

1889.	1890.
Golden Queen.	Caroline.
Philadelphia.	Turner.
Caroline.	Muskingum.

1889.	1890.
Thompson's Early Prolific.	Shaffers.
Naomi.	Pomona.
Montclair.	Cuthbert.
Macomber's No. 2.	Golden Queen.
Meredith Queen.	Reder.
Reder	Philadelphia.
Shaffers.	Macombers.

BLACKCAPS.

The five most productive.

1890.	1890.
Ada.	Carman.
Smith's Prolific.	Hilborn.
Spray's Early.	

A DESCRIPTION OF VARIETIES.

Ada.—This is a blackcap of very vigorous growth; has fruited here the past two seasons. It is of more than average productiveness. Fruits usually large, firm and very showy. Late; picking season from July seventeen to thirty.

Brandywine.—Although this has proved more productive this season than last, it has but little to recommend it but its firmness, as its flavor is too pronounced. Season late.

Carman.—A very early blackcap of vigorous growth. Proves quite productive. Fruits of good size, fine color and high flavor, borne in large clusters, and but few fruits blasted. This will be a good variety to plant for extra early.

Caroline.— After four years' trial on the Station grounds, this proves to be the best light colored raspberry under test. It is perfectly hardy and as early as any; the fruits are a lemon yellow, of good size and very fine flavor; and while too soft for shipment, they can be carried to near market, and for home use none excel it.

Carpenter's No. 2.— A very vigorous growing variety with smooth canes. Fruits of more than average size, firm and of fine flavor.

Champlain.—This has not proved quite hardy; canes badly killed out last winter; this season's growth of canes, however, has been very vigorous. Season from medium to late.

Clark.— A fine flavored berry of good color; firm and a long season from July seven to twenty-eight; fairly productive.

Coleman's No. 1.— Not a very vigorous growing variety, but fairly productive. Fruits small and soft, but of fine flavor.

Crimson's Cluster.— This year's growth of canes very much better than the previous one; the suckers seem to grow close to old canes; not very productive, but fruits large, of fine appearance and quite firm.

Crystal White.— Proves quite tender; fruits soft, light brown color and of fine flavor.

Cuthbert.— A grand old variety, grown more extensively than any other, as it is a fine shipping berry and ripens very evenly. Picking season from July nine to twenty-eight.

Erie.— A very productive variety; fruits about color and size of Philadelphia. It is claimed for the Erie that it will fruit in the fall from young canes in sufficient quantity to be profitable, but thus far it has not given even a meager supply. Season from medium to late.

Erhart Cap.—Made a very weak growth last year. No fruit this season.

Genesee.— This made but little growth last year, but has done well this season. Fruits of large size, a good red color and of pleasing flavor, but very soft. The fruits drop from plant as soon as fully ripe. Foliage quite distinct, large and wrinkled.

Golden Queen.— Last year this gave the best yield of any variety tested, and while it falls behind several others this year, it keeps up with the Cuthbert, of which it is supposed to be a seedling. Its attractive color, firmness and exquisite flavor make its claim as a valuable variety good. Season medium.

Hale's Early Cap.— Not early here. Plants of vigorous growth. Fruits average small, with white bloom that detracts from their appearance, borne in large clusters, but a great many fruits blasted. These blasted fruits were not due to anthracnose.

Hansell.— An extremely early berry, but of rather weak growth; bearing canes badly affected by rust, the young canes but slightly.

Harris Seedling.— Growth weak, and not enough fruit to describe fully.

Hilborn.— A sturdy growing variety. Produces a good crop of large sized, slightly conical fruits of a dark black color. A large number of berries in each cluster blasted. The young growth of this variety made a very rank growth this season. Stopped back early, and by the middle of July had grown laterals to the length of twelve inches. Season medium to late.

Lost Rubies.— Of little value as tested here.

Macomber's No. 2.— A productive variety of vigorous growth. Fruits resemble blackcap. Season medium.

Marlboro.— This is an early variety formerly extensively grown, but is inclined to rust, and growth not very strong. More productive this year than last. Season long.

Meredith Queen.— This variety winter-killed very badly, and produced but few fruits.

Miller's Woodland.— Of weak growth; canes small; more productive this year than last. Season from early to late.

Montclair.— Not as productive as last year, but early, and a good family berry.

Muskingum.— Of the Schaffer type. Not as tall, but as vigorous. Fruits as dark as the Schaffer when fully ripe; equally as soft, and decay on plants sooner than the Schaffer. Season medium to late.

Naomi.— This has nothing especial to recommend it.

Orange — This is a tender berry for this climate, and does not produce fruit enough to make it profitable.

Parry's No. 1.—Made a weak growth last year, and had but few fruits, but these were of good size. Late.

Parry's No. 2.—Made a good growth last year. Produced a more than average crop of large-sized fruits, perfecting almost every one. Texture of fruits firm.

Philadelphia.— A well-known variety superseded in most localities by finer kinds. Season long.

Pomona.— One of the most productive varieties grown here; of vigorous growth and fine appearance. Fruits a pleasing red, large and firm. Season very long, from July seven to thirty.

Rancocas.— An early variety of weak growth; foliage badly affected with rust; not of any value here.

Reder.— This is a productive variety; early and continues fruiting through long season. The berries crumble badly, which destroys its usefulness as a market variety, but for a home berry it will give good satisfaction.

Reliance.— A handsome growing variety; fruits much like Philadelphia, but not as productive.

Scarlet Gem.— Of very weak growth and few fruits. Will need one more season's trial.

Shaffer's Colossal.— Grown through this section in large quantities for canning purposes. It has the peculiarity of rooting from the tips of canes like the Blackcaps. Is very hardy and, all things considered, a valuable variety.

Silver Queen.— This was badly winter-killed. Fruits soft and of too light a color to be of value, as the slightest touch discolors them.

Smith's No. 2.— Made a weak growth last year and perfected but few fruits this year. This season's growth is more vigorous.

Smith's Prolific Cap.— This variety made a very vigorous growth last year, so much so as to be easily distinguished from all others. This year's growth was very rank, the canes being stopped back in June, and at fruiting time the laterals had made a growth of ten inches. It is very productive, with extra large fruits of a bright black color, slightly conical, borne in very large clusters with only an exceptional blasted berry. It is a valuable market variety on account of its firmness and productiveness.

Spray's Early Cap.— A vigorous growing variety. Produces an abundant quantity of good sized fruits, firm and dry.

Stayman's No. 5.— Made a good growth last year ; bears a heavy crop of more than average sized fruits of good color and very firm. Flavor not very pronounced.

Superb.— Well spoken of in a few localities. A fine berry, but not very productive.

Thompson's Early Pride.— This and Thompson's Early Prolific have the same habit of growth, ripening fruits the same date and continue bearing through the same length of season, from early to late. The quantity of fruits were practically the same. While the Early Pride gave the largest fruits last year, there seems to be no difference in size this season. The fruits of both varieties are firm and of good color.

Turner.— One of the most productive varieties on our grounds. Growth of canes very symmetrical, forming a fine bushy plant. Fruits soft, but of very fine flavor. I think this will prove a good variety.

BLACKBERRIES.

Notes of Varieties.

Agawam.—This has been the most vigorous and productive variety tested on the Station grounds. It has resisted the winters well, prvoing as hardy as any. While the fruits are not among the largest, they are of good size. The plants seem to resist drought well, every fruit maturing. It continues in bloom after the first fruits are ripe, making its season long. Early.

Ancient Briton.—Of vigorous growth, hardy and productive. Fruits of but medium size, but very sweet. Late.

Barnard.—Of weak growth; leaves large, resembling the wild varieties. Leaves on bearing canes very much affected by rust No fruits this year.

Dorchester.—The growth of this variety lacks vigor. Plant succumbs to drought easily, making fruits imperfect. Of native type.

Early Cluster.—Of vigorous growth, quite productive and of good flavor. A large part of fruit dried up while immature. Early.

Early Harvest.—Of rank growth, hardy, early and productive. Not of large size, but fine quality. Early.

Erie.—Closely resembles the Lawton, but appears to be more vigorous and holds fine healthy foliage. Very productive, but fruits are not of the best quality. Midseason.

Kittatinny.—An old variety of merit. Rusts very badly in some sections, and is not perfectly hardy. Where it does do well it will yield fruits of the largest size and finest flavor. Midseason.

Lawton.—Hardy in this section, and of growth rank. Fruits sour and have a hard core unless perfectly ripe. Late.

Lincoln.—Of vigorous growth, with very large canes. The few fruits which ripened this year were of true wild flavor.

Minnewaska.—Of rank growth, very hardy, and of average productiveness. Fruits of very large size and good quality. Late.

Snyder.—This has made a very vigorous growth this year, but had but few fruits, and those dried up by drought. Early.

Taylor's Prolific.—Growth very vigorous. This variety possesses about the same qualities as the Snyder or Stone's Hardy, but the fruits are slightly larger. Midseason.

Wilson's Early.— Of good growth and very productive. Fruits of the largest and of good flavor. It has wintered well thus far. Early.

Wilson's, Jr.— The growth of this is more vigorous than is that of the Wilson's Early, and the fruits are of the same size and season as Wilson's Early. Winters well.

CURRANTS.

This being the first season of bearing for several of these varieties, there was not kept an accurate account of the yield of each, but from observation and notes taken through picking season a fair idea of the relative value of the leading varieties was formed. It has been observed that there is more and more inquiry in regard to good varieties of black currants by fruit growers and gardeners, showing that there is a growing demand for them in the markets, which is gratifying, since they are of the easiest culture and very productive. A leading small fruit grower in this vicinity assured me that he could dispose of the product of fifty bushes at good prices ; and I have no doubt that, where they are grown in sufficient quantities, the making of them into jelly or marmalade would be profitable.

The following is a description of the leading black varieties tested this season :

Baldwin's Black.— An upright growing variety of medium productiveness. Clusters short, and fruits of but medium size and ripen unevenly. Season late.

Black English.— Of spreading habit and vigorous growth. Very productive. Fruits of large size and from seven to ten on a stem. Clusters ripen evenly the full length, enabling the bulk of crop to be picked at one time. Season early.

Black Naples.— Upright growth ; vigorous and early. Very productive of large sized fruits which ripen at one time. Cluster loose with many fruits missing.

Champion Black.— A dwarf, upright growing variety, and fairly productive of good sized fruits. Clusters short, and the fruits ripen evenly. Season early.

Crandalls.— This variety has been tested here but one year, but from observations made and reports from other stations it is unlikely that it will become a very extensively grown variety. The fruits are of medium size with but very few on each bush, and while the flavor is not as pronounced as in the old black varieties, it has no particular flavor of its own to recommend it. The bushes are liable to be split by high winds and should be staked.

Lee's Black Prolific.— Of spreading habit and vigorous growth. Very productive of medium sized fruits. Clusters long, with a great many green tips. Season early.

Ogden's Black Grape.— Of spreading habit. Very productive of large, jet black fruit. Clusters rather small, but numerous. All fruits ripen at same time, making but one picking necessary. Season early.

Prince of Wales.— Of spreading habit and vigorous growth. Quite productive. Clusters long with a large number of green fruits on tip when the bulk of fruits are ready to be picked.

Saunder's No. 1 *and No.* 2.— Are of the same type. Neither of them are any improvement on either Ogden's Black Grape or Black English.

The red and white garden varieties grown here are as follows: Cherry, Fay's Prolific, Glorie des Sablons, London Red, Prince Albert, Red Dutch, Versailles, Victoria, White Dutch and White Grape.

These are all well known varieties and need no description. Fay's Prolific seems to be the leading favorite, and it is worthy of all that is said of it, but the Cherry currant, if given a well enriched clay soil, will yield nearly as large fruits, and except the difference in foliage would be taken for the former. These two varieties are enough for general planting, except for a very late crop, when Prince Albert, a variety with distinct dark green, deeply cut and pointed leaves, can be used. Of the white varieties either White Dutch or White Grape will give good satisfaction. The former has the best flavor and the latter the largest fruits. In connection with the study of currants it was thought advisable to note the effect of two fertilizers, potassic sulphate and potassic chloride, on the chemical composition of the fruit. This work promised to be of interest, as many have claimed that the tendency of the chloride was to increase the acid of the fruit, while the action of the sulphate was to increase the amount of sugar. To the presence of free acid is largely due the sourness, and to a great extent the quality of the currant. The acids most common in fruits are tartaric, citric and malic. But as malic acid is by far the most common, and usually present in larger quantities, it is customary to calculate the entire amount of free acid present as malic acid. This although not scientifically accurate, gives a good basis upon which to determine the relative acidity of fruits, and in the following table the entire amount of free acid is calculated as malic acid :

VARIETY.	Fertilizer used.	Water.	Dry matter.	Sugar.	Free acid.*
		Per ct.	Per ct.	Per ct.	Per ct.
Fay's Prolific	Potassic sulphate	85.88	14.12	3.47	4.12
Fay's Prolific	Potassic chloride	86.76	13.24	2.86	4.17
White Grape	Potassic sulphate	83.80	16.20	2.86	3.39
White Grape	Potassic chloride	85.89	14.11	2.73	3.13

Conclusions drawn from such limited data would be obviously incorrect, inasmuch as the differences noted are not sufficient to overcome individual traits. The difference in the amount of acid present in Fay's Prolific differently fertilized is within the limit of error in analysis, while it is worthy to note that in the case of dry matter and sugar content the precentage is higher in those fertilized with the sulphate. Whether the differences are due to the influence of the fertilizers used, it is impossible to state at this stage of our investigations.

GOOSEBERRIES.

Much interest has been manifested in the results obtained at this Station, in preventing the mildew from destroying the gooseberry crop, and as each season gives more positive proof that the application of potassium sulphide is a sure preventive, the time seems not far distant when this fruit will be again generally grown in marketable quantities.

The following varieties were fruited here this year:

Crown Bob,
Crystal,
Downing,
Houghton,
Industry,
Mountain Seedling,
Pale Red,
Smith's Improved,
Triumph,
Wellington's Glory,
Whitesmith,
New, of Roesch,
Pearl.

At fruiting time the product of one plant of each variety was weighed, and, with the exception of Crown Bob, each gave over

*The acid was determined by titrating with N-10 Normal Na OH, using as indicator phenolphthalein.

five pounds of fruit per plant. To ascertain the market value of the large varieties as against the small, a five-pound basket of each variety was taken to a leading grocer in Geneva, who set his price on them and sold them readily at fifty cents per basket for the large, and forty cents per basket for the small varieties, a difference of only ten cents. This is accounted for by the fact of there not being any gooseberries in the market. The grocer said he could have sold any quantity at those prices. At half those prices, gooseberries will be a very profitable crop. Such varieties as Industry, Triumph, Whitesmith, Roesch, Seedling or Pearl, all of which bear fruits of the largest size, will pay even when the market is stocked with the older varieties.

BEANS, BUSH.

DESCRIPTION OF VARIETIES.

Saddle Black Wax.— A variety sent out last spring by Burpee & Co. Pods ten inches long, very strongly recurved, smooth and of clear yellow color. Makes a very fine snap bean. Ripe beans are long dark black.

Henderson's Dwarf Lima.—This variety ripened earlier this season than last, and gave a fair picking before being harvested. The pods are small, each containing from three to four beans. They are of the size of the Case Knife bean, but flatter. The habit of growth, size of pod and general appearance are similar to the Dwarf Carolina.

Dwarf Carolina.— Similar to the above with this exception, that there are three distinct strains of seed, white, brown and speckled.

Sieva.— It is very likely that the bush Lima is a dwarfed selection of this, as the only perceptible difference between them is that this variety is inclined to run or climb, although not enough to need poles.

Currie's Rust Proof Wax.— This makes an early and tender string bean. The ripe beans are very large, long and blue-black.

Cylinder Ivory Pod.— This was reported by us last year as being identical with Cylinder Black Wax, the habit of growth, size of pod, color and shape of bean being the same. This year the Ivory Pod grew to the greater height, was slightly more productive and continued longer in bearing than the Cylinder Black Wax. The originator claims that they are better for string beans, as they continue green longer than the Black Wax. The beans are long and deep black.

Ferris.— A very thrifty growing variety, evidently a selection of some other variety. The pods are long and very tender. The beans are half round, very plump and clear white.

Hopkins Improved Valentine.— Growth eighteen inches high. Pods short and round and usually borne in clusters. The beans are short and thick and mottled blue and brown.

Burbank's No. 621. — This needs poles or brush, as it grows to the height of three or four feet. The pods are well filled with large white beans flattened on the sides. A showy market bean.

BEANS, POLE.

Burpee's Sunshine Wax.— Grows from seven to eight feet in height. Very productive. Pods of a bright yellow color, very mealy and stringless. Season early.

Lee's Prolific Pole.— Growth from six to seven feet high. Very productive. Pods usually only four inches long but very tender. The beans are kidney-shaped and white striped with brown.

Rocky Mountain Pole. — Growth from six to seven feet high. Leafage very light green. A very early variety. Pods long, recurved and very much wrinkled. The beans are of a dun color, and often three-fourths of an inch long.

TABLE OF YIELD.

BEANS.	Seed from	Number of pods on 10 plants.	Number of beans in 100 pods.
Burpee's Saddleback Wax	Bupree	180	475
Henderson's Bush Lima	Henderson	425	345
Dwarf Carolina	Land	280	275
Silvia	Hallock	325	295
Currle's Rustproof Wax	Cleveland	160	495
Cylinder Ivory Pod	Jones	165	490
Cylinder Black Wax	Henderson	120	465
Ferris	Ferris	560	390
Hopkin's Improved Valentine	Cleveland	245	440
Improved Refugee	Cleveland	220	510
Yosemite Wax	Henderson	200	310
Burbank's 621	Burbanks	190	480
No. 1	Hatt	215	615
No. 2	Hatt	115	465
No. 3	Hatt	125	470

CORN.

A DESCRIPTION OF THE VARIETIES TESTED THE SEASON OF 1890.

Burlington Hybrid.— A tall growing variety, each stalk usually bearing two ears, which are from eight to nine inches long. Ten-rowed and kernels thickly set from butt to tip. Very sweet. The kernels, when dry, resemble the White Flint, and are not wrinkled.

Cleveland's Colossal — Grows to the height of six feet. Stalks of medium stoutness usually bearing two ears. Kernels well set on the ear.

Creedmoor.— Growth six feet high. Stalks very stout, bearing two ears, which are of large size. Kernels very large. A very prolific variety of fine quality.

Dreer's First of All.— A very dwarf variety growing but three feet in height. Usually but one ear on each stalk. Ear six inches long. Kernels very large. Only valuable as an extra early variety.

Farquar's First Crop Sugar — Of dwarf growth. Four and one-half feet high. Stalks have a reddish tinge. Ears borne singly and six to eight inches long. Eight-rowed and large kernels. Early.

Ne Plus Ultra.— This is a variety of Shoe Peg corn which has been sent out under several different names. It is of very fine quality and medium early.

Livingston's Gold Coin.— This variety has been tested here the past two seasons and has proven to be of little value. The ears are very large, but lack in quality, and being very late, it has for a rival the Evergreen corn, which is much superior in quality.

CELERY.

NOTES ON VARIETIES.

Dilk's Half Dwarf.— Stalks average eighteen inches. Bunches up solid with good heart. Seems to be a good keeping variety.

Heart's Content.— Stalks average twenty-four inches. Very compact and crisp. Not of very pronounced flavor. Stalks blanch to a fine yellow.

New Rose.— Stalks average twenty-four inches. Well set together and heart solid. Flavor very nutty. It has but slight indications of either a pink or rose color, as its name would imply.

New Giant Pascal.— Stalks average twenty-six inches. Very large and broad and heart loose. Inner stalks inclined to project from bunch. Flavor fine, improving with age. No signs of hollow stalk as is claimed by some.

The Schumacher.— Stalks twenty-four inches, large and crisp and heart solid. Flavor not of the best, but being a splendid keeping variety is extensively grown by market gardeners.

CABBAGE AND CAULIFLOWER.

A continuation of the comparative tests of home-grown and imported seed, begun last season, has been carried on this year, and the accompanying table will show the results obtained. It will be noticed that while there is a wide difference in the weight of a given number of seeds of some of the varieties, notably the Improved Jersey Wakefield, the results do not show that any advantage is thereby obtained in the marketable product; but the data gathered through the growing season show that the largest and heaviest seed made a quicker germination and a more vigorous growth when transplanted. As each head was allowed to attain its maximum growth, the record of earliness has been omitted, but there was little difference in the time of edible maturity of the cauliflowers or between the early varieties of cabbage. In order to make the test as complete as possible two plantings of each were made. Those for the first crop were set out April twenty-nine and those for the second crop July eight. The late set plants of each variety were a continuation of the rows of those set early. The results seem to show that neither the Long Island nor the Puget Sound grown seed are in any way inferior to the imported, and as it can be grown and sold cheaper than the imported seed, there is no doubt that the industry of growing those seeds will be developed to quite an extent.

EARLY CAULIFLOWER.

VARIETIES.	Seed from	Origin of seed.	Weight of 300 seeds in grains.*	Number of plants set.	Number of heads harvested.	Average diameter.	Average weight.
						Inches.	Pounds.
Early Padilla	Till		15.430	20	12	7	4
Early Snowball	Till	Imp. Germany	18.312	20	10	7¾	2¾
Erfurt Dwarf Earliest	Hal	Imp. Germany	15.632	20	14	7	2¼
Early Alabaster	J. S.		19.922	20	10	7¼	2¼
Erfurt Dwarf Earliest	March	P. S.	13.742	20	20	7¼	3½
Early Padilla	Till	P. S.	16.819	20	11	9	4
Kronk's Perfection	Far	Imp. France.	18.173	20	11	8	3
Landreth's First	Land	Imported	14.881	20	10	7½	2¼
La Normand	Vil	Imp. France	11.535	20	6	7	2
La Normand	Hal	Imp. France	10.346	20	5	10	2½
Perfection	March	P. S.	17.502	20	14	8	2¾
Snowball	March	P. S.	17.607	20	14	8	2
Thorburn's Gilt Edge	Thor		22.682	20	15	8	2¾

* Grains recorded as Troy weight.

37

LATE CAULIFLOWER.

VARIETIES.	Seed from	Origin of seeds.	Weight of 300 seeds in grains.	Number of plants set.	Number of heads harvested.	Average diameter.	Average weight.
						Inches.	Pounds.
Early Padilla	Till		15.430	18	15	5⅔	1¼
Early Snowball	Till	Imp. Germany	18.312	20	19	6¼	2½
Erfurt Dwarf Earliest	Hal	Imp. Germany	15.632	20	20	7	2½
Early Alabaster	J. S.		19.922	20	20	7	2¾
Erfurt Dwarf Earliest	March	P. S	13.742	20	18	6½	2½
Early Padilla	Till	P. S	16.819	20	19	5¾	1¾
Kronk's Perfection	Far	Imp. France	18.173	20	19	5¾	2¼
Landreth's First	Land	Imported	14.831	20	20	5½	2½
La Normand	Vil	Imp. France	11.535	20	20	7¾	2¼
La Normand	Hal	Imp. France	10.346	20	20	5	2½
Perfection	March	P. S	17.502	20	18	5½	2¾
Snowball	March	P. S	17.607	20	20	7¾	2¼
Thorburn's Gilt Edge	Thor		22.682	20	20	5¾	2¼

EARLY CABBAGE.

VARITIES.	Seed from.	Origin of seed.	Weight of 300 seeds in grains.	Number of plants set.	Number heads harvested.	Average diameter.	Average weight.
						Inches.	Pounds.
All Seasons	Till.	P. S.	17.245	20	17	8½	6½
Brunswick	Vil.	Imp. France	12.241	20	16	7½	4½
Blirchfield's Giant	Hen.	Imp. England	15.896	20	18	3⅔	6⅞
Burpee's All-Head Early	Bur		14.879	20	14	4½	8
Cleveland's Conqueror	Cleve.	Long Island	17.823	20	16	5½	8
Cleveland's Intermediate	Cleve.	Long Island	18.164	20	7	8½	4½
Etamps	Vil.	Imp. France	12.859	20	10	7⅛	3½
Early Jersey Wakefield	Till.	P. S.	17.257	20	7	5½	3
Early Winningstadt	Till.	P. S.	12.082	20	17	7½	3½
Improved Early Jersey Wakefield	March.	P. S.	53.317	20	17	6	2¾
Excelsior Flat Dutch	Till.	P. S.	17.585	20	18	8	5
Henderson's Early Summer	Till.	P. S.	18.837	20	19	7½	4
Milan	Vil.	Imp. France	11.772	20	20	8¾	7¼
Mann Rock Red	Cleve.	Long Island	14.492	10	2	11	11
Marblehead Mammoth	Till.	P. S.	23.745	20	18	11⅓	13
Oxheart	Vil.	Imp. France	16.282	20	9	5½	7½
Premium Flat Dutch	Hal	Long Island	18.127	20	16	10¾	6
Premium Flat Dutch	Till.	P. S.	20.877	20	17	9	7
Premium Flat Dutch	Till.	P. S.	23.048	20	19	8½	6
Vandegaw	Till.	Long Island	14.341	20	14	7	4½
Vandegaw	Hal	Long Island	17.005	20	19	7	5

LATE CABBAGE.

VARIETIES.	Seed from	Origin of seed.	Weight of 300 seeds, in grains.	Number of plants set.	Number of heads harvested.	Average diameter.	Average weight.
						Inches.	Pounds.
All Seasons	Till	P. S.	17.245	20	20	9½	12
Brunswick	Vil.	Imp. France	12.241	20	20	7½	8
Bleichfield's Giant	Hen	Imp. England	15.896	20	19	8	10
Burpee's All-Head Early	Bur	....	14.879	20	19	7½	7½
Cleveland's Conqueror	Cleve	Long Island	17.823	20	20	8½	8¼
Cleveland's Intermediate	Cleve	Long Island	18.164	20	20	9½	7¾
Etamps	Vil.	Imp. France	12.859	20	15	6	3¾
Early Jersey Wakefield	Till	P. S.	17.257	20	20	7¾	7¾
Early Winnigstadt	Till	P. S.	12.082	20	19	5	5¼
Improved Early Jersey Wakefield	March	P. S.	53.317	20	19	7¾	4¼
Excelsior Flat Dutch	Till	P. S.	17.585	20	20	9⅓	9
Henderson's Early Summer	Till	P. S.	18.837	20	20	8¼	9½
Milan	Vil.	Imp. France	11.772	20	20	7	9¼
Mann Rock Red	Cleve	Long Island	14.492	10	7	7	8
Marblehead Mammoth	Till	P. S	23.745	20	17	7	9
Oxheart	Vil.	Imp. France	16.282	20	20	7½	....
Premium Flat Dutch	Hal	Long Island	18.127	20	20	8½	9
Premium Flat Dutch	Till	P. S.	20.877	20	20	7¾	9
Premium Flat Dutch	Till	P. S.	23.048	20	20	8	7½
Vandegaw	Till	Long Island	14.341	20	20	9	9
Vandegaw	Hal	Long Island	17.005	20	20	9	9½

PEAS.

A DESCRIPTION OF VARIETIES.

Angel's Premier, Angel.—A half dwarf variety with light green leafage. Pods usually borne singly. Very productive. Peas wrinkled. One of the finest table peas tested here.

Beuist's Early Morning Star, Hal.—Of medium growth with light green leafage. Pods borne singly. Very productive, and very early.

Burpee's Quality.—This is a half dwarf variety of fine flavor. Peas wrinkled and usually borne in pairs. Productive and early.

Burpee's Quantity.—Similar to the above except in growth, which is tall. Not more productive this season than Burpee's Quality.

Burpee's Profusion.—A tall growing variety with light green foliage. Pods usually borne in pairs. Peas of very large size. Very productive.

Chelsea, Hen.—Half dwarf. Very early and productive. Flavor very fine for an early variety, somewhat resembling in flavor late Marrow. Peas small and wrinkled.

Electric, Till.—A tall growing variety. Early and productive. Quality not of the best. Pea smooth and white.

Melting Sugar, Hen.—An edible pod variety, of no value except when used as are string beans. Pods of the largest size and without strings.

Summit, N. B. & G. Co.—This has proved as productive and early as last year. While the flavor is not of the best, its productiveness will make it a valuable variety for market purposes. Peas smooth and white.

Shropshire Hero, Hen.—An intermediate pea of rank growth. Long pods, well filled with wrinkled peas of fine flavor. Very productive.

Vick's Dwarf, Vick.—Early and productive. A very fine wrinkled variety.

POTATOES.

There was planned and carried to partial completion a repetition of the variety test of last year; and in connection an extensive test of four of the leading varieties most generally grown in the country, namely: Early Rose, Beauty of Hebron, White Star and Burbank. These four were procured from fourteen different sources, with a description of the soil in which they were grown, the climatic conditions and the prevalence or freedom from rot. These four varieties were planted under the same conditions as near as possible, with the intention of making a study of the crop obtained from these tubers, which had been grown upon a large variety of soils in widely separated sections of the country, and previously contaminated with or free from rot. There were also planted an equal amount of seed from ten varieties that were last year free from decay, with ten varieties that last year had the largest per cent of decay. These twenty varieties were all grown at this Station last year under identical conditions. Owing to the extremes of weather, the past season having been very wet until the middle of June, then extremely dry until August, with heavy rains through parts of September, also the prevalence of a rot of the potato in a very severe form, our work has been an entire failure, with the exception of the test of seed from healthy and affected tubers. The results of this trial are given in the following table. It will be noticed that in the yield of merchantable tubers there is but slight difference in the results, neither is there any material difference in the yield of small tubers, while the percentage of decay is very much larger in those from infected tubers; still the latter would have given much the larger yield but for the presence of rot, as a large percentage of those decayed were of merchantable size.

Potatoes.

A Test of Healthy versus Infected Seed.

Station Number.	Seed from Tubers Free from Decay in 1889.						Station Number.	Seed from Tubers with Largest Per Cent of Decay.					
	Merchantable Tubers.		Small Tubers.		Decayed Tubers.			Merchantable Tubers.		Small Tubers.		Decayed Tubers.	
	Number.	Weight.	Number.	Weight.	Number.	Weight.		Number.	Weight.	Number.	Weight.	Number.	Weight.
		Lbs. Ozs		Lbs. Ozs		Lbs. Ozs			Lbs. Ozs		Lbs. Ozs		Lbs. Ozs
120	26	4—15	54	3— 9	8	— 10	110	15	3— 1	31	1—11	44	— 6
121	7	—13	46	2—13	5	— 7	111	32	5—13	81	4—10	24	2—14
122	5	—14	88	3— 2	6	— 14	112	24	5— 4	49	2— 5	43	6—14
123	28	3—10	51	2— 9	5	— 6	113	21	3— 4	47	3— 3	59	8— 4
124	18	3— 1	34	1—11	....	— —	114	23	3—12	62	3—13	8	—12
125	31	4— 5	50	2—11	4	— 8	115	21	4— 6	42	2— 7	26	4— 1
126	29	7— 7	22	1— 8	15	1 12	116	22	3—12	64	4—15	30	4—
127	16	2—	39	1—12	....	— —	117	26	5— 6	46	3—	23	4— 6
128	40	9— 7	13	1— 1	10	— 15	118	19	4—10	33	1—10	23	5— 4
129	33	6— 4	41	2—11	37	5 15	119	16	3— 4	13	1—	52	11— 7
	233	42—12	438	23— 6	90	11 7		210	42— 8	468	27— 9	332	48— 4

Per cent decay .... 11.88.

Per cent decay................................ 30.74

SWEET POTATOES.

This year's trial of sweet potatoes included nine varieties: Southern Queen, Spanish Red, Providential, Early Golden, Bermuda, Early Peabody, Brazilian, Old Maurice and Cuba Yam.

The results obtained were similar to those of last year, the plants yielding tubers in paying quantities. The tubers grown last year were packed in dry road dust and stored in a room with an average temperature of 60° Fahr. At intervals through the winter they were tested as to their quality, which continued excellent until after the middle of January, when it was found that they became very soggy when cooked, and they were worthless after that time. We succeeded in keeping enough tubers over to start plants from this year, and hope to acclimate them so that they may be kept with very little trouble.

This year at harvest, the tubers appeared very wet, and, as an experiment, a portion of each variety was taken to a hop house and left on the kiln fifty-two hours, being turned at intervals. The accompanying table will give the percentage of water evaporated from them. These varieties will be tested through the winter to ascertain if drying has had the effect of making them more palatable.

When the potatoes were growing last season they attracted the attention of a number of farmers in this vicinity, and there was a large demand for plants this spring. The Station gave to all who asked for them plants enough to make a test on their different soils. There has been a number of reports from those who had plants from the Station, and, without exception, all are pleased with the results. Those who planted on sandy soil speak of them as being as fine in quality as those shipped from the South, and very productive. If the rot of the sweet potatoe, which has been quite prevalent in the South, continues, it may be that the culture of them in this State will become a leading industry, as they are free from any disease thus far in our tests.

	Estimated yield per acre.	Per cent water evaporated by drying.	Kiln Dried.				
			Water.	Dry matter.	Invert sugar.	Sucrose.	Starch.
	Bush.						
Bermuda	244	28.73	60.28	39.72	2.82	4.80	25.08
Brazillian	131	26.67	63.72	36.28	3.16	4.44	23.99
Cuba Yam	89	......	58.37	41.63	2.50	4.66	27.29
Early Golden	143	26.67	68.40	31.60	2.35	3.22	.....
Early Peabody	291	28.94	74.22	25.78	1.11	2.02	16.55
Old Maurice	104	35.00	......	......	....	....	.....
Providential	388	19.64	77.63	22.37	1.79	2.33	14.25
Southern Queen	292	20.33	67.97	32.03	1.35	3.78	21.97
Spanish Red	383	27.33	71.12	28.88	1.96	3.10	19.33

TOMATO TESTS.

A Comparison of Yields.

In these tests seven plants, each of nineteen of the newer varieties of tomatoes, were used. The plants were set in a young vineyard that had been top-dressed with bone meal at the rate of 200 pounds to the acre. The soil being in a good state of tilth. In setting the plants, each row was run east and west, then a wire trellis was run north and south, taking in the eastern plant of each variety. The next plant in each row was kept trimmed, allowing the sunlight to penetrate to the soil and reach every fruit. The three following plants were allowed to mat at will. The sixth plant was trained to a stake and the extreme western plants were grown on a wire trellis. The trimmed plants in almost every case gave the first ripe fruits, but both west trellis and stake plants ripened ten fruits as early as did the trimmed plants. It will be noticed in the following tables that the staked and west trellis plants of every variety gave a very small yield. This is accounted for by the fact of there being a clay knoll running through the vineyard. While this was well manured the previous year, and was in good tilth, the rains of early summer caused it to become very heavy and to bake through the summer.

This may also have had something to do with the early ripening of fruits on the staked and west trellis plants. During the fruiting season there was a very heavy rainfall, there being for the two months of August and September a little over ten inches, notwithstanding which there was very little of the tomato rot, and the only effect of the frequent showers was to retard the ripening of the fruits. In fact it has been very generally noticed through this section that the tomato has been very backward in ripening through the whole season. By referring to the table, it will be seen that, in all but one case, the yield of green tomatoes was in excess of the ripe, making the yield of ripe tomatoes fall below the average. Still in this immediate vicinity the green fruits sold for about as much as the midseason ripe ones, causing but little loss on account of the weather.

The test of tomato seeds, ripe fruits versus green fruits; large versus small fruits (page 329 of eighth annual report) has been continued this season, the results confirming those of previous years, also the remarks on the same page in regard to the scant foliage being one of the causes for earliness in ripening, seem to be particularly proven by the results attained this season with plants that have been kept trimmed.

DESCRIPTION OF TOMATOES TESTED.

Atlantic Prize.— Of but medium growth. Not very productive but early. Fruits of medium size, usually smooth and of good color.

Brandywine.— Of rank growth. Foliage large and long leaf stalks. Very productive. Fruits average large size, smooth and a very fine shade of red. Showy when sliced. Season medium.

Chemin.— Of rank growth. Plants very productive. Fruits under size, flattened on sides, giving them a squared appearance. Flesh of a mealy nature. Very fine flavor.

Dwarf Champion.— This has not been as productive this year as last. Fruits of good size and fine quality. Season medium.

Early Ruby.— Growth weak. Foliage finely cut. Fairly productive. Fruits small and irregular. Season early.

Glen Cove.— Of rank growth and foliage large. Season medium. Very productive of large sized fruits. Smooth and of fine appearance. Very meaty.

Ignotum.— This variety has become very popular on account of its productiveness, fine appearance and keeping qualities. It is certainly a fine acquisition.

Lorillard.— Growth stocky, with dark green leafage. Fruits of medium size, round, smooth and of fine color. Very meaty.

Matchless.— Of rank growth. One of the most productive grown here this season. Fruits large and smooth, often showing flattened sides. Cells numerous, with a large quantity of seeds. Season medium.

McCullom.— This variety ripened its fruits earlier this season than last, making it a medium season. One of the most productive varieties. Fruits of good size, fine color and good quality.

Cleveland's No. 57.— Of rank growth and large foliage. Productive. Fruits of medium size, smooth and very solid, often flattened on blossom end. Season medium.

Cleveland's No. 115.— Growth weak and scant foliage. Very early and productive. Fruits of medium size, very solid, often ribbed. A very promising early variety.

Nichols Stone.— Vines of vigorous growth. Fruits from large to very large size, firm and of good color. Season medium.

President Cleveland.— Of vigorous growth and very productive. Fruits good market size, very meaty and mealy. Season late.

Red Cross.— Growth rank and large foliage. Productive. Fruits of good size, very meaty, and flesh of a fine color.

Table Queen.— Foliage finely cut and very dark green. Fruits very irregular. Not productive. Season early.

TEST WITH GREEN AND RIPE SEED OF TOMATO.

This test was started in 1883 and has been carried on up to date, and in every case giving from seeds of green fruits a very early product.

The variety chosen for this test was Cook's Favorite, of which variety six samples were taken, the first showing no signs of maturity, the second pale green, the third showing a faint tinge of red, and so on to the sixth which was fully ripe. In the spring of 1884 these seeds were planted under uniform conditions, and the results obtained are as follows: The plants from the greenest seed ripened ten fruits before those from any other sample had ripened one. The plants from ripe seed were the last to ripen fruits. The seed from green fruits, however, vegetated very poorly and the plants were not as vigorous as those from ripe seed, but were very prolific.*

In 1885 the test was continued, and to intensify the influence of immature seed the seed was taken from the plants grown from immature seed of the previous year. The results obtained are as follows: Both the plants from ripe fruits and those from green fruits ripened one fruit on the same day, but the first ten fruits were on plants from immature seed, a week in advance of those from mature seed. The foliage of those from green seed had a shrivelled appearance, and blighted badly. The fruit was small and decayed rapidly.†

In 1886 the results were the same, there being a difference of seven days in the ripening of the first ten fruits, the same weakened condition of the plants from green seed being noticed. In 1887 there was a difference of nineteen days in favor of the immature seed. The record for 1888 is not available, but in 1889 there was a very great difference in the ripening, it being twenty-three days from the ripening of one fruit on plants from immature seed to the ripening of one fruit on plants from mature seed. Notes taken that season say: Plants from mature seed vigorous and fruits large; plants from immature seed fruits numerous but small; vines weak and fruits exposed to the sun. The season of 1890 gave much the same results, the plants from immature seed ripening fruits ten days in advance of those from mature seed. The growths of vines in 1890 were more vigorous than in previous years and the fruit larger. This was probably due to the fact that the specimen fruit selected for seed in 1889 was of large size and while very green had nearly obtained its maximum development. It is evident that the immature seed give the earliest fruits and also that such seed lack vitality to give a large per cent of germinations and a good growth of leafage, but it is yet a question of how much further towards a perfectly ripe fruit it will be best to go to procure seed that will give more vigor of plant and still retain the early ripening qualities of immature seed. (Dr. Sturtevant says in regard to this fact, *Garden and*

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* See Third Annual Report New York Agricultural Experiment Station (1884), page 224.

† Fourth Annual Report, page 182.

Forest, July 23, 1890, page 355: "A weakness in the plants has been a serious drawback, and while green seed seems unfitted for immediate use by the grower, yet it is by no means certain but that this feebleness may be trained out by the experimenter.") This will probably be done as suggested above by selecting a medium between very green fruits and entirely ripe fruits. If by being able to select fruits at the proper time we shall hasten the ripening of the largest part of the crop by one week, it will be of immense value to growers. These tests are still being carried on and hopes are entertained of the ultimate success of the experiment.

TOMATOES — TABLE OF YIELD.

	VARIETIES.	East Trellis.		Matted Plants.		Trimmed Plant.		Staked Plant.		West Trellis,		Average Yield per Plant.	
		Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.
			Lbs. Ozs		Lbs. Ozs		Lbs. Ozs		Lbs. Ozs		Lbs. Ozs		Lbs. Ozs
Ripe	Atlantic Prize	33	10—12	92	30¼	42	13— 8	9	3— 8	12	3— 8		
Green...	Atlantic Prize	22	4	156	26	11	2	28	3— 4	22	3— 4		
	Total................	55	14—12	248	56—4	53	15— 8	37	6—12	34	6—12	61	14— 1
Ripe	Brandywine	29	18— 8	59	25— 4	28	10— 4	13	6	7	3		
Green...	Brandywine	94	21—12	184	37—12	60	11	28	5— 4	17	4		
	Total................	123	40—4	243	63	88	21— 4	41	11— 4	24	7	74—1	21— 5
Ripe	Chemin	26	8—12	108	31—12	12	3	24	7	15	4— 4		
Green...	Chemin	80	25—12	276	42	100	12	55	6	48	6		
	Total................	106	34—8	384	73—12	112	15	79	13	63	10— 4	106—2	20—15
Ripe	Dwarf Champion	15	6—12	41	15—12	12	3— 8	16	4—12	5	1—12		
Green...	Dwarf Champion	50	13—12	122	32	41	6— 4	11	3	24	6		
	Total................	65	20—8	163	47—12	53	9—12	27	7—12	29	7—12	47—6	13— 2

Tomatoes — (*Continued*).

	Varieties.	East Trellis.		Matted Plants.		Trimmed Plant.		Staked Plant.		West Trellis.		Average Yield Per Plant.	
		Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.
			Lbs. Ozs		Lbs. Ozs		Lbs. Ozs		Lbs. Ozs		Lbs. Ozs		Lbs. Ozs
Ripe.....	Early Ruby	34	12— 4	72	21—12	40	11—12	10	3	13	4		
Green ..	Early Ruby	53	18— 4	162	20— 4	39	5— 4	43	6	31	2		
	Total	87	30— 8	234	42	79	17	53	9	44	6	71	14—3
Ripe	Glen Cove	24	8—12	81	32— 8	20	10	9	4—12	6	2—8		
Green ..	Glen Cove	106	22—12	185	86—12	85	26— 8	17	2	49	6		
	Total	130	31— 8	266	69— 4	105	36— 8	26	6—12	55	8—8	83—1	21—5
Ripe	Haines' No. 64	36	16— 4	65	26	24	9—12	12	4	11	5—8		
Green ..	Haines' No. 64	99	24—12	135	27— 4	70	13	36	3— 4	40	5		
	Total	135	41	200	53— 4	94	22—12	48	7— 4	51	10—8	75—3	19—1
Ripe	Ignotum	30	15	55	27— 4	12	5— 8	7	4	22	7—8		
Green ..	Ignotum	77	25— 8	130	33—12	36	9—12	28	7— 4	40	7		
	Total	107	40— 8	185	61	48	15— 4	35	11— 4	62	14—8	62—6	20—2

TOMATOES — (*Continued*).

	VARIETIES.	East Trellis.		Matted Plants.		Trimmed Plant.		Staked Plant.		West Trellis.		Average Yield per Plant.	
		Number fruits	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.
			Lbs. Ozs		Lbs. Ozs		Lbs. Ozs		Lbs. Ozs		Lbs. Ozs		Lbs. Ozs
Ripe	Ignotum, extra select'd	19	11— 4	54	26— 8	19	10	8	4	29	5—12		
Green...	Ignotum, extra select'd	123	37— 4	145	33— 8	41	9— 8	22	8	31	8		
	Total...............	142	48— 8	199	60	60	19— 8	30	12	60	13—12	71— 1	21— 6
Ripe	Ignotum	....	....	41	12	11	5— 8	15	7—12	15	7— 4		
Green...	Ignotum	....	... .	53	21	23	10	34	7	44	9— 8		
	Total...............	....	....	94	33	34	15— 8	49	14—12	59	16—12	38— 8	11— 3
Ripe	Lorillard...............	....	....	41	12—12	23	8	22	9—12	21	8		
Green...	Lorillard...............	....	....	115	21— 4	61	15	59	10— 4	49	9— 4		
	Total........	....	....	156	34	84	23	81	20	70	17— 4	55— 6	13— 3
Ripe	Matchless	15	8—12	61	26—12	24	9	22	9 — 8	20	8—12		
Green...	Matchless	74	31	192	53	66	17	32	7— 8	58	13— 4		
	Total...............	89	39—12	253	79—12	90	26	54	17	78	22	80	26— 2

TOMATOES — (*Continued*).

	VARIETIES.	East Trellis.		Matted Plants.		Trimmed Plant.		Staked Plant.		West Trellis.		Average Yield Per Plant.	
		Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.
Ripe	McCullum's Hybrid....	13	8	53	28	10	4	4	1— 8	19	10		
Green...	McCullum's Hybrid....	69	27	162	45— 8	38	19— 8	64	18— 4	67	21		
	Total...............	82	35	215	73— 8	48	23— 8	68	19—12	86	31	72—5	26
Ripe	Cleveland's No. 57......	35	7—12	64	33—12	24	9— 8	24	10— 8	25	9— 8		
Green...	Cleveland's No. 57......	76	17	134	28— 4	42	10— 4	42	11— 8	82	13		
	Total...............	111	24—12	198	62	66	19—12	66	22	107	22— 8	80	21—5
Ripe	Cleveland's No. 115.....	55	14	148	41— 4	40	13	38	8—12	42	7—12		
Green...	Cleveland's No. 115.....	94	19— 8	211	27— 4	70	8— 8	78	11—12	91	9— 4		
	Total...............	149	33— 8	359	68— 8	110	21— 8	116	20— 8	133	17	122—3	23
Ripe	Nichol's Stone..........	....	....	47	12	55	15—12	11	6— 4	17	8—12		
Green...	Nichol's Stone..........	....	....	115	32—12	27	9	56	13	30	5— 8		
	Total...............	....	....	162	44—12	82	24—12	67	19— 4	47	14— 4	35—1	14—3

TOMATOES — (*Concluded*).

	VARIETIES.	East Trellis.		Matted Plants.		Trimmed Plant.		Staked Plant.		West Trellis.		Average Yield per Plant.	
		Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.	Number fruits.	Weight fruits.
Ripe	Pres. Cleveland	33	9— 4	74	24—12	35	8— 8	18	6— 8	4	1— 8		
Green...	Pres. Cleveland	108	30— 4	211	44	78	17	57	14	24	5—12		
	Total	141	39— 8	285	68—12	113	25— 8	75	20— 8	28	7— 4	91— 5	23
Ripe	Red Cross..............	29	9—12	92	31—12	28	11— 4	5	2	7	2— 8		
Green...	Red Cross..............	76	23— 8	255	38	57	15	40	7— 8	28	6— 8		
	Total	105	33— 4	347	69—12	85	26— 4	45	9— 8	35	9	88— 1	20— 7
Ripe	Rhines' Seedling.......	10	6—12	24	13—12	13	9— 4	8	5—12	4	2		
Green...	Rhines' Seedling.......	38	19	54	27	36	14—12	22	11	12	3—12		
	Total	48	25—12	78	40—12	49	24	30	16—12	16	5—12	31— 7	15— 1

Insects, Insecticides and Fungicides.

The insect pests have been about as numerous as in previous years, with the exception of the flea beetle. These have been more numerous than at any time since the Station has been established, their depredations not being confined to their usual diet, radish, turnip, cabbage, etc., but they also attacked tomatoes and potatoes, causing in case of the latter a partial failure of the crop. These depredations seem to have been confined to the Station grounds, since no complaints have reached us from elsewhere. It is quite probable that the cause of the large numbers of insects found here is the growing of the same crops on a small area year after year. Several applications were made on potatoes and tomatoes for this insect, one of which, tobacco dust, was partially effective on tomatoes, checking the spread of the beetle from infested plants to those not infested. As to potatoes, there was no remedy found except to brush them off. See report of Farm Superintendent. These beetles were also very destructive to cabbage and cauliflower, and several agents were tested, but without any permanent relief. On May eight the following applications were made: Tobacco dust, dry; lime, dry, and Paris green in solution at the rate of two teaspoonsful to three gallons of water. Neither of these were very efficacious, the lime giving as good satisfaction as either of the others.

The currant worm made its first appearance on gooseberries in large numbers on May twenty-four, and in using poison for the purpose of destroying them, a combination insecticide and fungicide was used. Hellebore for currant worm, one teaspoonful to one gallon of water, and potassium sulphide as a fungicide, one-half ounce to one gallon of water. This did not prove satisfactory, so far as checking the mildew was concerned, and an application of sulphide of potassium was used alone, which gave good results. Not only has every plant of gooseberry sprayed this season resisted the mildew, but plants kept as checks this season, that were sprayed last year, have shown but slight signs of this fungus. We have never been successful in preventing the mildew by one application of the sulphide, but have had to continue the treatment three or four times each season, the atmospheric conditions influencing, to a large extent, the development of this mildew.

The disease of the Hollyhock (*Puccinia malvacearum*), noticed in the eight annual report, was found this spring to have attacked the very young growth of the plants; and at the suggestion of Professor Dudley of Cornell University, a solution called Condys patent fluid was used in spraying them. This seemed to check the growth of the fungus, but as the disease had been so severe the previous year, it was impossible to utterly destroy it. The matter will be taken in hand at an earlier date the coming season, and a more thorough test made. The patent fluid consists of one teaspoonful of permanganate of potash to one quart of water. On June twenty-seven it was noticed that the asparagus beetles were very numerous on the young growth of asparagus. Two different poisons were used, hellebore, one teaspoonful to one gallon of water, and Paris green, one-fourth teaspoonful to two gallons of water. The latter was by far the most effective, one spraying being sufficient to destroy almost all of them. The hellebore not being of much benefit, the Paris green was used on the beds that had been sprayed with it, and the same good results followed. These applications were made after the cutting season had passed, and in no way can hurt the crop for market.

Paris green was also used when planting tomatoes, each plant being dipped in a solution of one-half teaspoonful of Paris green to four gallons of water. This proved of value, as there were very few plants destroyed by the potato beetle, while in other years it has been almost impossible to save the young tomato plants, except by hand picking the beetles. This operation of dipping is simple and quickly done, and surely paid for the trouble this season.

The plant protector, manufactured by Sherman & Crouch, Sidney, N. Y., was used again this season, giving good satisfaction. In fact it would have been almost impossible to grow certain of our crops without them or other similar protection.

REPORT OF ACTING POMOLOGIST.*

The past season has been in many respects as peculiar as any in the memories of our oldest fruit growers. Last spring the expectation of an abundant crop of apple, pear, plum, cherry, quince and in fact nearly, if not all, of our fruits growing in this climate seemed fully justified. Orchards bloomed freely, and with the apple it was the "off year," as it is commonly called; therefore an abundant harvest was looked for the past autumn. Instead of our expectations being realized, the apple crop has proved a complete failure; pears a very light crop, probably less than fifty per cent; peaches and plums a total failure except in a very few orchards. A notable exception is that of a plum orchard owned by Smith & Sons at Peach Orchard, on the east shore of Seneca lake; this orchard set an average crop of fruit, and in the face of unfavorable weather matured a fair percentage of the crop, while another orchard planted with about the same varieties at Lodi, a short distance east and on the same side of the lake, blossomed freely but failed to bear fruit. Quinces gave a fair crop. Raspberries and blackberries not uniform, and in many sections below an average crop. The grape and strawberry seem to have been the only satisfactory fruit crops of the season, and in many localities the former has been rendered a partial, and in some vineyards nearly a total failure by black and brown rot and mildews.

The total failure of the apple crop in western New York, which is one of the leading fruit sections in the country, is a very serious matter; add to this the failure of crop last year due to more natural causes, and we are confronted by conditions tending to discourage the most sanguine. A great deal of interest has been awakened and many theories advanced as to the cause of the failure, but very little of general investigation has been undertaken, and there seems to be no satisfactory reason given to account for a total failure of crop in orchards where the bloom seemed to be

* G. W. Churchill.

more than sufficient to insure an abundance of fruit. The spring was wet and cold, with heavy rains about the time apple orchards were in full bloom. This is assigned as the main cause by many, on the supposition that the excessive moisture destroyed to a great extent the pollen, thus interfering with the perfect fertilization of the pistils, and causing the fruit to drop when about the size of peas or buck-shot. I find no data to prove that such was the case. It is not an unusual thing to see a perfect crop of fruit in wet seasons; and even after a cold backward spring.

Another, and no doubt more reasonable explanation is the universal prevalence of the scab fungus (*Fusicladium dendriticum*) which has been on the increase of late years in the apple orchards of our State; a description of which will be found further on in this report. The conditions for the growth and spread of this fungus have been perfect, as the spores grow at a low temperature and are aided in their development by moisture. These are the conditions that have been prevalent for two seasons past. Unfortunately the trouble was not anticipated in time to determine fully the amount of loss to the crop from this cause. Some venture the assertion that the blossoms were attacked by the fungus before the petals had fallen; but there is no proof of this, and it seems somewhat improbable. As the early spring gave promise of abundance of fruit, preparations were made to continue the spraying experiments commenced last year, and new ones were planned; and in nearly all cases the first applications were made, but none could be carried to completion. The report may be divided as follows:

THE GRAPE.

The failure of autumn fruits has brought the grape to notice more prominently than ever before, it having been the one exception to the general rule the past season. With the addition of the many species and variety hybrids, and natural seedlings, offered as improvements on our older sorts, and claimed to be adapted to wider areas and diversity of soils and climate, large tracts of land before considered worthless for fruit culture, especially the steep banks that border our inland lakes in this State, have been cleaned of underbrush and debris, terraced in many places where too steep to pursue flat culture, and planted to the vine. The success attending the earlier ventures of many of the pioneers in the movement has created the impression that the grape could be as universally planted in this State as the maize or potato plants, with greater returns on the investment. The fallacy has been stimulated by the introduction of new varieties, and by grape growers offering vines of unheard of qualities and impossible accomplishments, such as "freedom from disease under most favorable conditions. "Mildew proof, rot proof, never looses foliage, perfectly hardy, etc." We do not know that these claims are meant to be misleading, or are maliciously intended to defraud planters, but they are, to say the least, thoughtless, and in the end work injury to both introducer and purchaser, because they are false and unreasonable. There is undisputed evidence that some varieties possess greater immunity from and resistive power to diseases than do others, and why? First, because they have been intelligently bred and judiciously selected; second, they are adapted to the soil and climate and have become thoroughly acclimated and indigenous to a greater or less extent of country. But distribute them promiscuously over varied soils and they soon show signs of weakness, and prove entirely worthless in many cases; or at least a sad disappointment to their most ardent admirers. Under such conditions they will easily breed disease and become a menace to healthy vines in their vicinity. The product is also inferior in appearance and quality, and has to be forced on consumers at prices below cost of growing the fruit. The marketing of such grapes this fall, from localities and soils not adapted to vine culture, or the varieties grown, and where diseases has been prevalent, has had more to with the forcing of prices below the point of possible profit than has overproduction. We would, therefore, advise those contemplating the planting of vines, either for vineyard culture or home market, to acquaint themselves as far as possible with their soils, the best modes of planting, training, and care of the vine known to practical vineyardists, and then study the varieties growing in their own neighborhood and select from them those that are giving the best returns. Then if you wish to try newer sorts, do so in a small way with a few vines of each, keeping within your means, for very likely you will find nine out of every ten varieties tested prove costly investments. Another thing to be learned, which is of much importance to the vineyardist, is the characteristic appearance of the different fungi which attack the vine and its fruit, so that he may upon the first appearance of the malady, intelligently apply the remedies found to be the most certain to protect him from loss. The Station has not engaged in growing the vine except as a test of the varieties, and these have remained quite exempt from the attacks of fungi. We have been in constant communication with growers, and numerous inquiries are received asking for advice as to the best methods of dealing with insects and fungi. We have therefore compiled some of the most interesting reports of visits to the larger vineyards in the immediate vicinity, and at Hammondsport, on Keuka lake, where some of the largest vineyards in the State are located. The reports will show the nature and prevalence of disease, with the estimated amount of injury to the crop, in both treated and untreated vineyards. They will also give formulas and methods used in applying the fungucides on a large scale and by some of the most practical and energetic growers in the valley, they having had the advantages of personal instruction from such specialists as Colonel Pearson and Professor F. Lamson Scribner, of our own country, and Professor Viala, sent as commissioner by the French government to make an investigation of diseases affecting the American grape during the month of July, 1889, when this section was visited so disastrously by black and brown rot. We have also added descriptions of the most common of the fungi attacking the vine, foliage and fruit of the grape, compiled from the department circular and other reliable sources. We make no apology for offering these reports and compilations, as nearly all of the correspondence in this department relative to the grape during the past year has contained questions that are answered, as far as present knowledge of the subjects will warrant, in these reports.

PENN YAN, N. Y., *August* 8, 1890.

DR. PETER COLLIER,

New York State Experiment Station, Geneva, N. Y.:

DEAR SIR.— In accordance with your suggestion, the writer visited Hammondsport, N. Y., and examined the vineyards in the immediate vicinity, with a view of verifying the current reports as to the prevalence of black rot (*Physalospora Bidwellii*), as well as downy mildew (*Peronospora viticola*) and powdery mildew (*Uncinula Spiralis*), and, if possible, to ascertain whether any or either of these diseases of the grape vine prevailed in the vineyards near Orleans and Phelps.

We met Mr. Churchill, of your Station, and were accorded every facility in making the examination through the considerate courtesy of Messrs. Henry S. Fairchild and Trevor Moore, of Hammondsport, N. Y. These gentlemen are well known as foremost among the practical and successful grape growers of this section, and in addition to an experience in vineyard culture from boyhood and youth (Mr. Fairchild having been engaged in grape growing since 1858 on his own land, and Mr. Moore having from boyhood engaged in grape culture, now conducting and giving his entire time and energy to the personal management of his large vineyards) had the advantage of instruction and advice from our well-known Colonel Pearson, Professor F. Lamson Scribner and Professsor Viala, the commissioner sent by the government authorities of France to investigate the diseases affecting American grape vines, during the month of July, 1889, during the prevalence of the black rot and brown rot, the latter being the downy mildew attacking the berry.

Both Mr. Fairchild and Mr. Moore were so instructed by these practical scientists as to the distinguishing characteristics of these diseases as to be able to recognize them upon inspection, and distinguish between them, and this knowledge was freely imparted to our party. They were also instructed as to the best remedies and preventives, which were applied with the thoroughness and intelligence which these gentlemen display in the treatment of their vineyards in general, and to which may be attributed the success of the treatments so far; and the writer is willing to put himself upon record so far as to express the opinion that when, if in any case the directions of the United States Department of Agriculture have failed, in cases when these instructions have been given, it has been because of want of promptness and thoroughness in the applications.

The treatment has been as follows: Two sprayings with Bordeaux mixture, using six pounds copper sulphate, six pounds lime, twenty-two gallons water, applied in quantities of forty-four gallons to the acre of from 700 to 1,000 vines, through a Vermorel nozzel, using a horse-power pump with two sprayers, one on each side of the machine, each rigged with two Vermorel nozzles, one set to spray the fruit, the other the upper leaves. This required one man on each side of the machine and one man to drive, and enabled the spraying of from five to seven acres per day. Where the ground was too steep for the horse machine, either the Eureka or Goot knapsack sprayer was used, fitted with the Vermorel nozzle. This enables the spraying of about two acres per day per man. The copper sulphate used was pulverized, the lump sulphate not being as soluble in water, costing about seven cents per pound. The lime was quick lime (not air slacked).

The first application was made just before blooming; the second as soon as the vines were out of bloom. These two applications were followed by one application of ammoniacal copper carbonate, three ounces carbonate copper in one quart ammonia, 22°, Beaume, in twenty-two gallons of water, applied in same quantity (forty-four gallons to acre) with same appliances.

The time of applicatiou was about July twenty-four. The result of these applications can best be determined by comparison, although the general statement may be made that while there was an occasional leaf and berry affected with black rot and brown rot, close scrutiny was necessary to detect disease in either Mr. Fairchild's or Mr. Moore's vineyards, which, so far as damage to the fruit or vines is concerned, can practically be said to be of no consequence at this writing.

The result of the experiment, however, is more clearly shown by a comparison between Mr. Moore's vineyards, all of which was treated as above, and his neighbor's, Mr. Rose, not treated, and only separated by a narrow path, locally known as a "section line" (no fence between), and same variety of grape, cultivation, size, growth and fruitage of the two vineyards the same. In Mr. Moore's treated vineyard a row of seven vines showed no black rot or brown rot on either fruit or leaves, except, perhaps, an occasional spot on the leaves so old and so affected by the sprayings as to be indistinguishable as either the effect of black rot or downy mildew, while his neighbor's untreated vineyard showed fully fifty per cent of loss by both black and brown rot on the fruit, both occurring on the same bunch.

A closer comparison may be made by the statement that the first vine in the untreated vineyard showed this condition in both new and old cases of both black and brown rot, frequently both ou the same bunch of fruit, while the first vine in the treated vineyard, not over ten feet between the two, was practically free from affection of any kind.

It might be generally stated that what specimens of either black rot (*Physalospora*) or brown rot (*Peronospora*) were almost universally old affections arrested by the treatment, and were principally of old specimens of the brown rot, and the query seems to be in place here whether if the ammoniacal copper carbonate had been made earlier the brown rot might not have been sooner arrested, and if this does not suggest the earlier spraying with the ammoniacal solution, say immediately succeeding the second Bordeaux spraying, if indeed not taking its place, if, as seems to be the case, brown rot prevails in localities which are exempt from black rot.

Hardly a trace of the ammoniacal spraying appears on the fruit; very seldom is there a trace evident, and the most minute chemical analysis fails to show more than an indication of copper solution on fruit which had been sprayed, not sufficient to indicate by any of the almost infinitesmal signs used in such analyses. In this connection the following questions in effect were put to both Messrs. Fairchild and Moore, and answered as follows:

Q. Would you advise the immediate spraying of an untreated vineyard in which there was no appearance of the disease, with the ammoniacal solution? A. Yes, if done at once.

Q. Why? A. The disease may make its appearance at any time.

Q. Would you advise such treatment of a vineyard in which either rot has made its appearance? A. Yes.

Q. Why? A. To arrest the disease, and to save the foliage, without which the vineyard can not either ripen its fruit, or its wood for another year's crop, and also to prevent the appearance of the disease for the succeeding year.

Q. Would you spray with the ammoniacal solution a vineyard fully loaded with fruit? A. Yes; as under a change in atmospheric conditions the disease may occur at any time on any vineyard.

Q. Then you would not fear an injury to the fruit in appearance or otherwise from spraying with ammoniacal solution? A. Not in the least.

It might be interesting to note that one of the men employed by Mr. Moore applied some Bordeux mixture left from spraying the latter's vineyard to eight rows in his own vineyard of about three acres before blooming. The result is that, comparing the untreated vines in the remainder of his three acres with the eight rows treated only once, the untreated vines would have been benefited to the extent of at least one hundred dollars in value if the present crop had been so treated.

Mr. Moore states that where a clinging bunch affected by the black rot had been left on the vines over winter (all affected berries of the last crop having been carefully plowed under) the neighboring vines were completely peppered this year with black rot.

So far as the writer is able to make a comparison, there is no black rot at either Phelps or Orleans, but would advise Mr. Churchill's early visit to both localities to examine and compare specimens taken from Lake Keuka.

Some vineyards at Lake Keuka are affected by the diseases in some cases to the extent of fifty per cent of the crop, while others are free. Spraying has been done in other vineyards than Messrs. Fairchild's and Moore's, in all cases with beneficial results.

As this is written where there are no facilities for copying, will you be kind enough to return this, preserving a copy should you care to do so, or sending me a copy at the address below, so that it may serve as a report to my company.

I have requested Mr. Churchill to examine this report with your permission and to frankly state his dissent, in case he should not coincide with me in his views.

Very respectfully.

(Signed) . G. G. LANSING,

For Niagara White Grape Co., Lockport, N. Y.

P. S.— We found no well defined cases of powdery mildew (*Unciunla spiralis*), a few specimens of Phyloxera, principally on foreign varieties.

GENEVA, *August* 12, 1890.

NOTES TAKEN IN THE NIAGARA VINEYARDS NEAR PHELPS AND ORLEANS.

The first vineyards visited were those of Mr. David Cosad, about three miles south of Phelps. He has three vineyards, comprising in all about twenty-five acres. I found his vineyards in a very healthy and promising condition, both as to quality and quantity of fruit and freedom from disease. A few cases of downy and powdery mildew were found, but neither seemed active. Only one case of black rot was found in his vineyards, and it had affected but two berries, both of which were on the same bunch. No indications could be found on the vine or on the remaining clusters of fruit. Mr. Cosad thought the disease was lessening rather than on the increase, and that the vines and fruit had showed signs of improvement in the past few days. Mr. Cosad has the material for the ammoniacal copper solution and intends to begin spraying at once, although he has ceased to be alarmed for the safety of his crop.

Next I visited the vineyard of Mr. Whitbeck, about one mile north of Mr. Cosad's, Mr. C. kindly offering to go with me for the balance of the trip, and I gladly accepted his offer. I found here the nature of the soil had changed quite perceptibly, the limestone underlying this section coming nearer the surface and in some places cropping out. The vines in this vineyard are in the main in good condition of growth, but they show more signs of disease than in any of the vineyards visited. The downy mildew and brown rot were especially noticed on the east side of the vineyard. The ground is lower here, forming quite a depression, and is bounded on the east and south by woodland. This would seem to indicate that the circulation of air through this part of the vineyard was not as perfect as at other points. Mr. Whitbeck told me that two years ago, after a late frost in the spring, it was noticed that the vines and fruit were injured more in this part of the vineyard than in any other. This fact would seem to strengthen the supposition. Some black rot was found, but it did not appear to be spreading very rapidly. The same is true of downy and powdery mildew.

I then drove to the farm of Mr. F. H. Newell, a short distance south of Phelps. He has a small vineyard, comprising about eight acres. This was where I was asked to look out for anthracnose, but after a careful inspection none was found. I found a few berries cracked open, exposing the seeds, but as the canes were healthy, I attributed the injury to powdery mildew. There were traces of the mildews, and a very little black rot, but they did not appear to be in active operation. This is an older vineyard and the vines are larger than in either of the preceding. They are in a very promising condition and heavily ladened with fine looking bunches of fruit.

Next in order I came to the vineyard of Mr. V. B. Wheat, a short distance north and east of Orleans. Mr. Wheat was one of the first planters of the Niagara in this section. At no other place was finer fruit found than in this vineyard. This is where Mr. Lansing reported grey rot, but it is without question powdery mildew, and is quite evenly distributed throughout the vineyard. Black rot and downy mildew were also found, but none of these seemed to be gaining ground, and this was the testimony of every grape man with whom I talked during the day.

From this vineyard I drove to that of Mr. Whitney, about one-half mile east of Orleans. The only thing found here, in addition to those already noted in the other vineyards, was one vine slightly affected with anthracnose. The fruit is looking well and there is but little mildew. The last and sixth vineyard visited was that of Mr. Anderson, a short distance east of Mr. Whitney's. Here I found phylloxera on the leaves of several vines, and this is the first time that I have found it on the Niagara grape. I noticed it on a vine of Vitis Aestivalis growing on the roadside just across and east of Mr. Wheat's vineyard, and this led me to look very closely for it in his vineyard, but none was noticed. Mr. Anderson's place is about a mile east and south of Mr. Wheat's. The only other difference noticed was that this vineyard was not under as good cultivation as the others.

Respectfully submitted.

G. W. CHURCHILL.

The following extracts from a letter of Mr. F. O. Fairchild, are presented to show the results of his work the past season, and the benefits resulting from the sprayings in his own and neighboring vineyards:

HAMMONDSPORT, N. Y., *December* 5, 1890.

G. W. CHURCHILL, *Geneva, N. Y.:*

DEAR SIR.— Yours of the third is at hand and contents noted. In reply I would say that I had little or no black or brown rots and their mildews, where sprayed. The same is true of Mr. T. Moore. On the test rows left unsprayed the brown and black rot showed a loss of five to ten per cent. Our foliage continued healthy, and held on until maturity and frost, while on many not sprayed the leaves colored and dropped prematurely. The fruit did not color well or ripen. Mr. Charles Carey used it on Delawares, and where not used the fruit was very inferior. I do not call to mind over fifteen growers who used the spraying. The loss in many vineyards was from ten to twenty-five per cent. There has been much powdery mildew this year here, as well as elsewhere, especially in the Brocton district. Here it showed itself most on vines about 300 feet above the lake, mostly on Concords and Delawares, yet was seen on all varieties. There has been too many poor Delawares and Catawbas this season in this section, owing to these mildews, overloading, and poor culture. The immense crop in Chautauqua county of inferior fruit put upon the market in the latter part of the Concord season is, in my opinion, the cause of the extreme low prices, in connection with poor Catawbas. My fruit is very free from black and brown rot, well colored and ripened. I intend to be prepared to spray my entire vineyards next season before they blossom, immediately after, and again about July fifteenth, if the season seems to require it.

Yours.

F. O. FAIRCHILD.

THE BLACK ROT.

Physalospera Bidwellii. (Saccardo).

The black rot rarely attacks the berries of the grape before they are two-thirds grown; the disease more often manifests itself on berries of nearly full size. It is rare also that all the berries in a bunch are affected, at least at the first infection; there are nearly always some few in each cluster that escape the disease.

In its first manifestations there usually appears upon one side of the berry a livid brown spot, which gradually increases in size until the entire grape is uniformly discolored, imparting to it the appearance of rottenness, although its original contour and firmness are retained. Even before the completion of this change it usually happens that the part first affected becomes darker in color, and minute black pimples or pustules are developed, imparting a roughness to the surface. At the same point the berry now begins to lose its fulness, an irregular depression appears, which soon extends into a general withering of the berry, the pimples meanwhile having multiplied so rapidly as to cover its entire surface. The destruction of the berry is complete; it is hard, dry, shriveled to one-half or one-fourth its original size, the folds of the skin being closely pressed upon the seeds and raised into strong, prominent and irregular ridges. These last, and the little pimples which are easily seen with the naked eye, are characteristic of this form of rot. The rotted berries remain firmly attached to the supports for a long time, sometimes even till the following spring.

The disease does not extend from one berry to another by contact, nor through the tissues of the pedicels and common peduncle, but there is a distinct infection for every berry diseased.

The manifestations of the black rot do not always appear as detailed above, for not infrequently the first evidence of the disease is the sudden appearance of one or more circular, slightly depressed spots of a bluish-black color, in the center of which there soon appear a few of the little pimples or pustules above referred to. These spots increase in size, the pimples in number, and ere long the berry exhibits the black and shriveled appearance already described.

These changes are effected in from one to five days, varying with the atmospheric conditions. Some authors assert that the same fungus which produces the rot in the berry also attacks the young shoots and leaves, but I am not yet convinced that this is so. (F. Lamson Scribner, Report on the Fungus Diseases of the Grape-vine, Dept. Ag. Bulletin, No. 11, 1886.) But as to the last sentence of the foregoing, see Dept. Ag. Report, 1887, page 326, by the same author, as follows:

In Bulletin 2 of the Botanical Division, page 40, grape-leaf spot disease was treated as distinct from black rot, for the writer at that time was not convinced of their identity although the close similarity of the pycnidial spores of *Phyllosticta labruscoe* with those of *Phoma uvicola* was, of course, observed.

Special attention has been directed to this subject during the past summer, and as the result of extended field observations I have been forced to conclude that the grape-leaf spot fungus and the fungus of black rot of grapes is one and the same.

The brown spots upon the leaves figured and described in my report on the fungus diseases of the vine must, then, be regarded as simply the manifestation of the black rot on the foliage.

The fact of the identity of the leaf form with that occurring upon the berries is especially important in connection with the question of treatment, for black rot, like the downy mildew, must be treated preventively. As a rule, the black rot fungus first attacks the leaves some days, and often a week or two before the berries are affected. It may be sometimes observed on the foliage even before the vines have bloomed.

By watching the foliage, the vineyardist may be warned of the presence of this dreaded parasite in good season, and upon the first signs of its manifestations upon the leaves, he ought to begin the application of remedies or preventives, in order to protect the fruit. Evidence is accumulating that the sulphate of copper compounds possess some value in checking this disease. We have been assured, by some experimenters, that there was a very decided improvement in respect to black rot in vineyards treated with these preparations, compared with those not treated.

DOWNY MILDEW.

Peronospora Viticola (De By.)

Appears in more or less conspicuous white patches. Pale green or yellowish spots of irregular size and outline, appear upon the upper sides of the leaves as the first manifestation of the disease, corresponding points on the lower surface soon exhibit the outside development, the spore bearing filaments of the fungus, in the form of white patches that are very conspicuous on the smooth leaved varieties of grapes. As the disease progresses, the yellowish spots of the upper surface assume a brownish hue, which gradually becomes more intense, finally having all the characters of completely dead and dried tissues. These spots may be quite small late in the season; the older leaves attacked are often covered all over with minute brown spots, which are usually sharply defined, being limited by the nerves in the leaf; again they may be so large as to nearly cover the whole surface, in which case the destruction of the leaf is quickly accomplished.

Under the final action of the fungus, the leaf becomes thoroughly dried and shriveled as if burned, and the tissues are particularly brittle. It very rarely occurs that the mildew itself occurs on the upper surface of the leaf. In severe cases, the growth of the fungus extends to the young shoots, although the conidia-bearing filaments do not appear, excepting upon the youngest and most tender of these, the action of the mycelium checks their further developments, and finally the tissues are killed.

The effect upon the shoots is often to produce dark colored, slightly depressed markings as a consequence of the sinking away of the tissues beneath. These markings are quite distinct from the deep and lacerated lesions of anthracnose.

It has been stated that the mildew only attacks the berries when they are quite young, and so far as observed by the writer this is true. The affected berries rarely attain more than one-fourth their full sizes often remaining no larger than small peas; they soon turn brown or, when the fungus fruits upon them, gray in color. There is thus produced a kind of "rot" which is popularly named "brown rot" or "gray rot."— F. Lamson Scribner's report, United States Department of Agricultural, Fungus Diseases of the Grape-vine. (Page 7.)

ANTHRACNOSE.

Sphaceloma ampelinum (De Bary).

On the shoots there first appear minute brown spots, a little depressed in the middle with a slightly raised darker colored rim or border. These spots soon increase in size, elongating in the direction of the striæ of the bark, the central portion becomes more evidently depressed and usually takes on a grayish hue. The bark is finally destroyed, and, in severe cases, the woody tissues beneath appear as if burned or corroded so deeply sometimes as to reach the pith.

The appearance and action of the fungus on the leaves is similar to that upon the stems, and it is certainly very evident that where the diseased spots are numerous, and the action of the fungus proceeds without interruption, both shoots and leaves must succumb to the parasite. The intensity of the disease upon the shoots may cause the destruction of the young leaves, even when the

41

latter are not directly attacked. On the berries, so far as my own observations are concerned, the severity of this disease has been especially manifest in its effects upon the fruit. * * * There is a small spot, grayish in the center, where the cuticle of the berry has been destroyed, with a dark brown border. Previous to the bursting or rupturing of the cuticle the entire spot is of a dark brown color, retaining a more or less regular rounded outline, and between the light colored central portion and the dark border line, there is developed a well defined band of bright vermillion. Finally, under the action of the disease, the berries begin to wither and dry up, leaving nothing, apparantly, but the skin and the seeds. There is no browning of the tissues of the berry as in the case of the black rot, nor does the skin shrivel as in that disease, leaving prominent and very irregular ridges, but the circular spots first formed are easily seen and the colorings characteristic of the disease retained. A berry may be attacked upon one side when it is not more than one-half grown; it then becomes irregular in shape, the diseased part making no further development, and it sometimes happens that this side cracks open exposing the seeds, which are gradually forced out by the unequal growth of the berry.

THE POWDERY MILDEW.

Uncinula spiralis (Berkeley & Curtis).

The powdery mildew makes its appearance usually during the early days of June, and continues its development late into the autumn. Its entire growth is upon the outside of the invaded plant, no portion, excepting the minute suckers, or haustoria, which are said to penetrate the epidermal cells, ever entering within its tissues. It appears in dull, grayish-white patches, most conspicuous on the upper surface of the leaves, and when growing thickly on the young shoots or berries, its mycelium imparts to these organs a similar hue. It never has the bright lustrous, or frosty appearance that characterizes the downy mildew, and the livid brown or seemingly scorched blotches on the leaves that the latter fungus occasions are wanting, although in thin-leaved varieties of foreign vines a discoloration takes place through the whole thickness of the leaf, visible at the points below the patches of fungus growth on the surface above. In a few instances I have seen the mycelial growth so dense upon the leaves as to give them the appearance of having been spattered and blotched with whitewash, the spots being a pure dead white. Below these spots, on the under surface, there were visible decided discolorations and a slight convexity or malformation, the lower layers of cells in the leaves having continued to grow, while the development of the cells near the upper surface was prevented by the action of the fungus. This mildew is also found on the lower surface of the leaves, but never to the same extent as upon the upper side, and as it is only in the latter part of the season that it has been observed there at all, its presence is doubtless due to an extension of growth from other parts, as from the petiole.

Upon the young and tender shoots the fungus is often particularly abundant, its action being to check their growth. Its presence on the older and half-ripened shoots is indicated by distinct but irregular brownish blotches in the epidermis. Sometimes the *Uncinula* appears during the season of bloom, and, coming on the newly expanded flower, causes them to abort. Attacking very young berries, when these are no larger than shot or small peas, their growth is permanently checked. Cases have come under my observation where the *Pernospora*, the *Uncinula*, and the fungus of the black rot were all engaged in their work of destruction upon a single bunch of grapes. It is needless to say that the destruction was complete. Upon the older berries the presence of the powdery mildew is made evident, before the mycelial threads have obtained sufficient growth to become conspicuous themselves, by the minute brownish spots produced by the action of the suckers on the epidermal cells. These spots eventually become confluent, the epidermis dies or is so affected that it will no longer expand with the growth of the berry, and consequently bursts, first forming tiny then gaping tears, the result being the death and decay of the berry. Oftentimes the fungus spreads over only a small portion of the berry; this part ceases to grow and a much distorted or imperfectly formed fruit is the result. The distortions are often carried so far that the berries crack open, exposing the seeds. We sometimes find nearly full-grown berries completely overgrown with the mycelium of the *Uncinula*, so that the brown specks above mentioned, if present at all, are completely hid from view. These berries eventually become dry and shriveled, and finally drop off.

GRAPE-LEAF BLIGHT.

Cercospora viticola (Saccardo).

Lower and more shaded leaves more or less thickly covered with rounded or irregular brown spots, varying in size from one-twenty-fourth to one-eighth of an inch in diameter, with a clearly defined darker colored and slightly thickened or elevated border. The discolorations extended through the thickness of the leaf, but while the diseased areas on the upper surface were perfectly smooth there could be seen, with the aid of a pocket lens, on the under side numerous projecting hair-like points. As the disease progresses the tissues of the leaf in the vicinity of the spots becomes affected, changing to a pale green or yellow, and finally the whole leaf perishes.

This blight, when prevalent, may cause considerable damage to the foliage, and consequently to the vine, but unless the season be a very wet one, it is not likely to do much damage, except, perhaps, in lower or damp situations or upon vines improperly cared for.

The form of this fungus above described is the only stage in its development yet known.

No remedies are known for either the "leaf-blight" or "leaf-spot" diseases, but it is very probable that the general treatment advocated for the downy mildew and anthracnose will have a direct tendency to limit their development.

WHITE ROT.

Like the black-rot fungus, this produces minute pycnidia or spore conceptacles, which appear at the moment when the berries commence to ripen. These lie just beneath the cuticle, through which they finally burst, first appearing as shining rosy points, then white, and finally brown. When fully developed, the pycnidia are surrounded by a thin membrane of a rather dark brown color. The ovid spores are borne upon slender stalks or basidia, either simple or branched, which spring from a layer of very delicate tissue occupying the lower part of the pycnidum.

No remedy is known for white rot, but it has been observed here, and very generally treated in France, that where the vineyards have been treated with eau celeste, or the Bordeaux mixture, the disease was far less prevalent than in similarly located vineyards not treated.

Bitter Rot.

Accounts of this disease have been published in Comptes Rendus, September 12, 1887; Agricultural Science, volume 1, page 210; Colman's Rural World, October 13, 1887, proceedings New Jersey Horticultural Society, for 1887, page 114.

That which especially characterizes this disease in distinction from the black rot is that it begins its ravages at the time when the berries commence to ripen, and continues until their perfect maturity. Excessive humidity is even more essential to its development than to that of the *Physalospora.* The importance of this malady is evident, for, under favoring conditions, it may destroy the fruit that has escaped the ravages of black rot. The fungus attacks the shoots, the common peduncle of the bunches and its ramifications, but it is upon the berries that its action is most conspicuous. A rosy discoloration, brighter on varieties with white fruits than on dark-colored sorts, is the first manifestation of the disease. This discoloration extends rapidly by concentric zones until the whole berry is involved, the berries, however, retaining their original contour, or only appearing to be slightly wilted, and becoming even more juicy than is normal. Soon numerous, small, slightly elevated points appear over the surface, and in two or three days these little elevations, which are the points where the fungus is maturing its fruit, have completed their development. The berry then becomes shriveled, as in the case of black-rot, but in a different fashion. The berry remains clear brown or deep purple in color, never becoming so black as in black rot, and the pustules which stud the surface are less numerous and less convex. In advanced stages the berries lose their hold upon the pedicels and fall to the ground at the slightest jar. Those destroyed by black rot usually remain strongly adherent and generally fall with their pedicles attached.

Bitter rot is most to be feared when frequent rains occur during the ripening period; but, like other fungus diseases of this class, it is sure to be most severe in poorly drained soils and on vines previously weakened by mildew. (Department Agriculture Report, page 324.)

Descriptive Notes on Black Grapes.

August Giant.— Has made a very poor growth. Bore a few small bunches of fruit the present season. Color black; berry large and of excellent flavor, resembling some of Rogers' hybrids in many respects. Season with or just after Concord.

Bacchus.— A wine grape of the Clinton family, introduced by Mr. Ricketts. A strong grower and has been healthy here. It is larger than Clinton (one of its parents) in both bunch and berry, and superior to it for a late table variety. It can be left on the vine very late if bagged, improving in quality. Bunches overlooked at picking were found in perfect condition the middle of November.

Barry (Rogers' No. 43).— Vine a very strong grower and quite healthy in foliage. Fruit mildewed slightly the past season; ripens a little before Concord. A black grape of very good quality and large in bunch and berry. Like most of the Rogers' hybrids, it fails to bear a full crop here.

Burnet.— Originated by Mr. Dempsey of Ontario from a cross between Black Hamburg and Hartford. Vine is very strong grower and hardy. Bunch large and somewhat loose. Color black, resembling Black Hamburg in flavor. Mildews very badly here. Of no value except as an amateur in favored localities.

Champion of Talman.— One of the earliest varieties of black grapes. Vine a very strong grower, and does well over quite a large area. Mildews some in unfavorable seasons. Bunch and berry of good size and form. Quality very inferior, but often brings good prices in market when not in competition with grapes of better quality. Its main value is in its earliness, making it a good variety for localities with short seasons.

Concord.— Too well known to need description. It still stands at the head of black grapes, all things considered.

Eaton.— Seedling of Concord. Has not had a fair chance for growth here, as it was used to replace a variety that had died out, and planted between two bearing vines. It has made a good growth, however, under these adverse circumstances, and has borne a number of quite perfect bunches this season. Bunch large, shouldered. Berries very large, much larger than Concord, very juicy. Quality no better than, if as good as, Concord. About the same season. Will probably make a reputation on size of bunch and berry.

Eumelan.— An old variety introduced several years ago by Dr. Grant. It is medium in growth; difficult to propagate, and for this reason is not often found in collections. One of the best amateur varieties. Color black. Bunch medium in size, often quite compact. Of fine flavor and moderately productive.

Hartford Prolific.—Another very strong grower. Does not require as close pruning as many of our other varieties. For a long time it held first place as the earliest black grape, but it has been superseded by Worden, Moore's Early and Champion. It is, however, the equal of the above in quality. But it should be dropped from the list of vineyard varieties, owing to the fault of the berries dropping from the pedicels when allowed to thoroughly ripen on the vines, or after picking. It should be retained for home use.

Highland.—Has made a very moderate growth here, and produced but little fruit. The quality is good, and though late, has ripened better than Catawba. Can not rate it above average.

Isabella.— One of the oldest black varieties, and was for a long time the standard by which grapes of the same color were judged. Vine is a strong grower, but does not require as close pruning as most varieties. It often becomes defoliated before the fruit ripens, and is quite subject to mildew. Not considered profitable except in favored localities.

Monroe.— Originated by Ellwanger & Barry. Vine a good grower. Bunches quite large and compact, generally shouldered. Berry medium in size, pulp very tender and seed separates from it readily. Quality not of the highest.

Moore's Early.—A pure native of the Concord family. It is a strong, vigorous grower here, and has been quite free from disease. It is as early as any black grape in our collection, and better in quality than Champion, or, we should say from one year's experience in fruiting, Janesville. The bunches are not large and are inclined to looseness. Berries larger than Concord and about the same quality. It is a very shy bearer here, so much so that we should place it on the amateur list for this locality.

Norwood.— Very weak growth. A few small, no perfect bunches. Quality good. Season about with Concord. Nothing commendable as grown here, except quality.

Senasque.— Vine vigorous. Bunch medium to large, sometimes shouldered. Very sprightly but not high flavored. Would doubtless make a good wine. Valueless here on account of mildew.

Wilder (Rogers' No. 4).— Vine a very strong grower and one of the best of Rogers' black hybrids. Bunch and berry very large. It is a shy bearer here and has behaved much like Salem.

Worden (Worden's Seedling).— A seedling of the Concord. A very strong vigorous grower, hardy and productive. Bunch large and as compact as Concord. Berry larger and of finer flavor. Not a perfect shipper, as the berries crack more readily than those of Concord. Very valuable for home and near markets, and is being extensively planted. Ten days to two weeks earlier than Concord, depending on locality.

RED GRAPES.

Agawam (Rogers' No. 15).— This is another of Rogers' hybrids. Very rank in growth. Mildews badly. Has reflex stamens, and has not borne a satisfactory crop of fruit at the Station. The quality is fine, when well matured. Ripens about with Concord.

Amber Queen — Is a very strong grower. Bunch medium in size. Color dark red. Quality good. Both fruit and foliage mildewed badly here the past season, rendering it worthless.

Black Maderia.— The vine we are growing for this variety is not true to name, or the name is a misnomer, as the fruit is decidedly red in color. It mildews badly, and for the past two seasons has not borne a perfect bunch of fruit.

Brighton.— An early red grape ripening about with Hartford Prolific, Delaware and Eumelan. The vine is vigorous in growth, and is a very promising variety, if planted with others blooming at the same season to aid in the fertilization of its blossoms. It is a red grape of very fine quality, considered by many to excel Delaware. In appearance it resembles Catawba. It mildews quite badly here in some seasons. Should be given a trial.

Catawba.— A strong grower, and healthy, but too late for this immediate locality. One of the standard varieties in vineyard culture, both for table and wine. But unfortunately its late ripening in the past two or three unfavorable seasons has tempted many vineyardists to place it on the market as soon as colored. This practice is seriously affecting its sale, and if persisted in will drive this grand old variety from our markets.

Iona.— Not a very strong grower. Has never borne a good crop of fruit here. It is a red grape of the finest quality when well ripened. Earlier than Catawba, but is unreliable, and can not be recommended for extended vineyard planting.

Jefferson.— The Jefferson is a cross between Concord and Iona; by Mr. Ricketts. The vine is a very strong grower, and has proved healthy and hardy here. The bunches are very large and double shouldered and of handsome appearance. It resembles Iona in color, contains more sugar, and when perfectly ripened surpasses it in flavor. It is late in ripening. Where the climate and seasons are favorable to its development, it should make the best red grape on the list. It should be given a trial wherever there is a probability of its ripening.

Lindley (Rogers' No. 9).— A very strong grower. Wants more room and longer bed canes than most varieties. Will often do well if allowed to run over a tree quite at will. It has reflex stamens, hence does not fertilize its blossoms perfectly. Should be planted near varieties blooming at the same time, as Brighton, Champion, Niagara and others. Its flavor is peculiar, but very pleasant and refreshing. One of our best red grapes when successfully grown.

Mary.— In vigor and health of vine, color and quality of fruit, this variety seems to be identical with Lindley (Rogers' No. 9).

Poughkeepsie.— Originated with Mr. A. J. Caywood, from a cross between Iona and Delaware. It favors the Delaware in growth and general appearance. The vine has been healthy and of medium growth. Berry and bunch larger than Delaware, shouldered and often double-shouldered. Quality good. Would have to be classed with the garden varieties here.

Rochester.— A seedling; originated and sent out by Ellwanger & Barry, of Rochester, N. Y. The vine is a strong grower and very productive. It is difficult to propagate successfully. Bunches very compact, so much so that the berries are often indented by their pressure against each other. The past season the vine dropped its leaves partially, and the fruit was lacking in flavor from this cause. Too much of the foxy flavor of the native cross has been retained by the variety to make it a universal favorite. We should class it with the local garden varieties.

Salem (Rogers' No. 53 or 22).— The Salem is a cross or variety hybrid between Black Hamburg and an unnamed Labrusca of New England. It is one of our finest local varieties, darker red in color than Catawba. The skin is very thick, making it a good keeper. Bunches medium in size, moderately compact. It mildews very badly here and is a shy bearer.

Ulster Prolific.— Originated with Mr. A. J. Caywood, from a cross with Catawba and an edible variety of the wild Aestivalis. It is a red grape of very fine quality. The vine has made a weak growth at the Station.

Vergennes.— A chance seedling from Vergennes, Vt. Vine a very vigorous grower, and this year has borne a large crop of very fine fruit. Bunches long, inclined to be a little loose; berries large, skin thick; of excellent flavor; a good shipper, and one of the best keepers; is said to dry into "perfect raisins." A few days earlier here than Concord. One of the most promising of the red grapes, and can be used instead of Catawba here.

Woodruff Red.— The Woodruff Red is a seedling of Concord, originated at Ann Arbor, Mich. The vine is one of the strongest growers on the Station grounds. In appearance it is very handsome, of a peculiar red color, and this fact will doubtless make it a popular variety in the markets. In quality it is very ordinary, and has quite a strong foxy flavor.

WHITE GRAPES.

Centennial (Marvin's).— A medium grower, but appears healthy in wood. Foliage somewhat scant. Set a larger crop of fruit this season than it could mature. Should have been thinned. Bunch medium size. Berries quite small. Color not easily described. It is green on one side, with a decided blush in the sun, increasing to red when fully ripe. May prove a valuable variety for home use and amateur collections. Its color would be an objection in open markets.

Dutchess.— Vine is a strong grower, inclined to be tender. Bunch medium, greenish white, covered with black dots. Quality fine. As subject to mildew as any variety grown on the Station grounds.

Empire State (one of Mr. Ricketts' seedlings).— Parentage, Clinton and Hartford. It is a white grape. Season a little later than Concord. Of very weak growth, and has borne two or three imperfect clusters this season. Has proved a failure here so far.

Geneva.— The Geneva is a specie hybrid of a native Black Fox grape and Muscat Alexandria the product crossed with Iona.

In hardiness the vine seems to take on the character of the native Fox grape. Color greenish white. Size of cluster medium. Compact. In quality it did not reach our expectations.

Green Mountain.— It is claimed that the Green Mountain grape is a chance seedling found in the Green Mountain region of Vermont. It is a very strong grower and has proved hardy here. It mildewed slightly this season. It was a little tardy in ripening, as were many of the other varieties, but the first in season of the white grapes. It is claimed by Ellwanger & Barry, of Rochester, N. Y., that the Winchell, propagated and sent out from their nursuries for the past four or five years, is identical with the Green Mountain. We have at the Station a young vine of Winchell which bore a few small clusters of fruit this season, but no fair comparison could be made from the first crop of fruit of one, and the fruit from the older vine. Next season, if both fruit, a more intelligent comparison can be made.

Hayes (Francis B. Hayes).— Originated with John B. Moore, of Massachusetts. Vine a strong grower. Mildews a little in some seasons. Ripens just after Green Mountain and Moore's Early. Bunch medium in size. Fruit golden in color when fully ripe, and of the finest quality. Moderate or shy bearer. But for this fault it would be one of the most promising on the list of white grapes.

Jessica.— Originated in Canada. Medium in growth. Somewhat inclined to mildew. Has borne a good crop of fruit this season. Color white. Bunch about the size of Delaware, berries somewhat larger. Flavor very sweet and pleasant when fully ripe. One of the earliest of the white grapes.

Lady.— Is a seedling of Concord; introduced by the Hon. G. W. Campbell, of Ohio. It is not quite as strong a grower as Jessica at first, but improves in this respect as it grows older. Will stand close planting and rich soil. Season very early. Color white. Quality very good, influenced somewhat by the amount of fruit on the vine. Will often overbear if not thinned. It is, strictly speaking, a garden variety.

Lady Washington.— Is a cross between Concord and Allen Hybrid; by Mr. Ricketts. It is a very rank grower, stronger even than Concord. It produces very large, loose and often double shouldered bunches of greenish white fruit, turning to golden yellow when allowed to fully ripen on the vine. It mildews here usually, and is too late for this section of the State.

Moore's Diamond — This variety originated from seed of Concord fertilized with Iona, by Jacob Moore, Esq., of Brighton, N. Y. The vine is a vigorous grower, and in general characteristics of wood and foliage inclines to the Concord. Color greenish white, turning to a lighter color, rather than yellow when fully ripe. The bunches are of good size, uniform and often double shouldered and attractive. The berries are of good size and adhere well to the peduncles, even when overripe. Skin firm with white bloom, making it a good shipper and attractive in market. Although not given as extended a test as some of the other varieties, we should put this at the head of the list of "all around" white grapes.

Niagara.— This variety in its growth and adaptability to a variety of soils might be called a white Concord. So far as tested here it is perfectly hardy, and for the past two seasons has been free from disease. Color white, turning to yellowish or golden in the sun if left hanging on the vines till fully ripe. Bunch very large, shouldered, sometimes double shouldered. Skin firm, making it a good shipper. It is very sweet and juicy, the seeds separating readily from the pulp. Very ordinary in quality, with a pronounced foxy flavor.

Pocklington.— Said to be a seedling of Concord. Not as strong a grower as its parent, but has proved hardy in wood and foliage. Fruit large and handsome, of a golden color when fully ripe and exposed to sun. Berry very large. Bunch quite compact. Sells well in market, but is of poor quality. Like Niagara and Martha it is pronouncedly foxy.

Prentiss.— Seedling of Isabella. Vine not a strong grower, but has been quite free from disease here. Bunch very compact, seldom shouldered. Berry medium size, round, pale yellow when fully ripe. Skin thick. Quality about like Pocklington. Has nothing to recommend it here.

THE PEACH.

All attempts to obtain varieties of the peach that can be relied upon to fruit with regularity, or to bear a crop often enough to make the orchards remunerative, have thus far proved failures in this locality. Varieties that are known to be tender in fruit bud, and those that are called iron clad and expected to endure ordinary ranges of temperature without injury, have shared a like fate. Again a few plantations in favored localities, and containing both classes referred to, have given larger returns to their owners than have any other of the fruits. This seems to indicate that one of our very best fruits is in a fair way to become useless to us, from the lack of varieties suitable to be grown under present conditions of soil and climate. The fact that there are so many difficulties in the way of the profitable growing of this fruit should not discourage fruit growers or cause them to abandon the culture of the peach in this section, but it should act as a stimulus to induce them to make a more determined effort to overcome the obstacles attending this important branch of our fruit industry. Covering the trees by placing sorghum and corn stalks around them for protection to the fruit buds has been tried for the past three or four years at this Station. The results have not been satisfactory. The trees protected were the first to bloom the past season, and as liable to injury by late frosts as those not protected. Orchards can be planted in such a way that by cutting the roots on two sides of the trees they can be laid over and covered for the winter months, and straightened and supported by stakes in the spring. This is to be repeated each year as long as the tree lives. This is, no doubt, a good plan in climates so severe that the tree would be killed, as well as the fruit buds, if not protected in some manner. In a mild climate where the trees are perfectly hardy this should be unnecessary, and the better way would be to obtain in some manner varieties that answer our requirements. This we believe can be accomplished by the growing of seedlings from selected seeds, and from crossed varieties, until we obtain the kinds suitable to our needs; and then endeavor to so fix their type or characteristics as to make them reproductive from seed. We believe this to be not only possible but practicable, and that it will in time be recognized as the true basis for the origination of varieties of our orchard fruits, and their perpetuity, as well as by our present methods of bud and cion propagation. There is more interest manifest in these problems in the west and north where it is more difficult to obtain varieties of sufficient hardiness to withstand the lower range of temperature to which the trees are subjected. In the eastern and middle States the ease with which trees are grown has a tendency to make us careless of our methods of propagation. We mean by this that little thought seems to have been given to selection, or as to whether there is any advantage gained by taking buds, cions or offsets from healthy and well-formed specimens of the trees and plants we wish to multiply ; or if the same taken at random from the trees and plants not salable [as is often practiced, that those of larger size and perfect symmetry may not be disfigured and thus rendered less salable], are just as good. It seems to be generally conceded by propagators that disease can be transmitted by the use of unhealthy cions. Again the work performed at the Station in the past in the selection of potatoes, which are grown from offsets, and the notable work of President Smith of Wisconsin on the Wilson strawberry, seems to prove that there is an advantage gained by selection. We believe that there is an unlimited field open for investigation along these lines, and we have prepared the outlines for a number of experiments which we hope to have under way in the near future, bearing directly on these problems.

SOME OF THE MOST COMMON FUNGI — WITH PREVENTIVES.

The Station is in almost daily receipt of requests for Bulletins relating to fungus diseases of fruits, with the best known remedies and modes of applying them ; to rid orchards and vineyards of the fungi which are prevalent in all sections. The Station has not prepared a bulletin devoted to this subject, for the reason, mainly, that so much was being published from Experiment Stations and through the medium of the agricultural and horticultural press relative to the work that it would be considered superflous. We find that such is not the case, but that a large majority of the residents of this State are not familiar with the appearance of the different diseases, or in possession of the requisite knowledge and apparatus to carry on the work of extermination successfully. We therefore, present some of the fungi most commonly met, and give formulas and directions for using the remedies that have been found most beneficial at this and other stations.

GRAPE DISEASES.

The black rot caused by the fungus (*Physalopora Bidwellii*) is the most destructive and widespread of the maladies affecting the grape. Downy mildew, brown and gray rots, are all caused by a single fungus known as *Peronospora viticola*. When this fungus attacks the leaves it causes downy mildew. When found on the fruit, giving it a light brown appearance, it is called brown rot. And, again, when attacking the young fruit, covering the berries and stems with grey-white mould, which arrests their growth at once, causing them to shrivel and dry, gray rot is the term applied. Powdery mildew (*Uncinula spiralis*) attacks the upper side of the leaves, and is seen in meal-like patches on the young shoots and fruit. It continues to increase in thickness until it causes the cracking of the berries and renders them susceptible to the attacks of other rot agencies.

For preventing the growth of the various fungi mentioned, copper in some of its salts, either in a plain solution or in combination with other chemicals, has been found the most reliable agent.

To make this more plain, we will give the method of treatment that we should pursue in our own vineyard. Commencing while the vines were perfectly dormant, we should spray the vines with a plain solution of sulphate of copper, made by dissolving one pound of the sulphate in five gallons of water. We should next spray with Bordeaux mixture when the vines were in full leaf and before the blossoms had opened, and follow this with a second application in about ten or fifteen days, depending upon the weather and development of disease. After this we should watch the vines and fruit carefully, and if the disease continued active we should apply the fungicide at intervals of ten to twenty days until checked.

As the berries approach full size, and before beginning to color, we should substitute the ammoniated carbonate mixture, for the Bordeaux. By this mode of treatment the spotting of the fruit, which is the main objection to the Bordeaux mixture, is avoided, and the labor of treating the ripe fruit with acid washes is saved. The failure to obtain the results expected in the use of fungicides, is very often due to a lack of promptness and thoroughness in their application. It is hard to see the necessity of fighting an unseen enemy, but it should be borne in mind that the only safety lies in rendering the spores of fungi inactive. This is especially true in cases where the winter or resting spores are abundant.

ANTHRACNOSE (*Sphaceloma ampelinum*, DeBary).

This disease, like black rot and downy mildew, attacks all parts of the vine, leaves, growing shoots and fruits, and seems to be harder to combat than the above-named diseases. Conflicting statements are given as to the effectiveness of the copper compounds when used as remedies for this fungus. In reply to an inquiry received last July, with specimens of the vine showing the disease in an advanced stage of development, the following line of treatment was outlined: "The season is so far advanced and the disease has obtained such headway, as evidenced by the samples of vines sent us, that it will be hard work for you to check it this season, but we should cut off all the diseased wood that can be spared from the vines and burn it, together with leaves that have fallen. Then spray the remainder of the vines with eau celeste, made by dissolving one pound of sulphate of copper in two gallons of hot water. After it has cooled add one and one-half pints of commercial ammonia. When ready for use, dilute to twenty-two gallons with water. Next spring prune and burn all diseased canes, and spray once with the mixture before the buds begin to expand and again as the buds are opening. Continue this treatment at intervals of ten days or two weeks until you have made four or five applications. Also try sulphur and powdered lime, in equal parts, applied with a sulphuring bellows on the first appearance of the disease." To find if the department at Washington could give additional, or a more perfect, treatment for this disease the question was submitted, with a copy of the above. The following reply was received from Prof. B. T. Galloway, Chief of the Division of Vegetable Pathology:

WASHINGTON, D. C., *August* 13, 1890.

DR. PETER COLLIER, *Director New York Experiment Station, Geneva, N. Y.:*

DEAR SIR.—Your favor of August fourth addressed to the Secretary and concerning the treatment of anthracnose of the grape has been referred to me. I can offer but few suggestions that will aid you, as the treatment you have recommended covers fully all we know on the subject. The fact is we are yet in the dark as regards an effective preventive of this disease. We have experimented with almost everything, and so far the mixture of sulphur and lime seems to have given the best results. In some cases Bordeaux mixture, ammoniacal solution and the other copper preparations seem to have checked the disease, while in others it has not produced the slightest effect.

Briefly, the line of treatment we usually adopt is to cut out the canes which show the disease, early in the spring before the buds start. Then we spray or wash the vines thoroughly with a strong solution of sulphate of iron, doing this of course before the buds begin to swell. The vines are then watched closely, and at the first appearance of anthracnose we apply the sulphur and lime powder by means of a bellows. It will certainly do no harm to spray with Bordeaux mixture or other copper preparations, beginning the applications as you suggest, as soon as growth starts.

Respectfully.

(Signed.) B. T. GALLOWAY,

Chief.

APPLE AND PEAR SCAB (*Fusicladium dendriticum, and Fusicladium pyrinum*, Fckl).

These fungi are so closely related that for general treatment they may be classed as identical and the same remedies applied in all cases. They are found on the leaves and young twigs as well as the fruit, and may be said to be universally distributed through every orchard where the fruit which they attack is grown. There may be a few exceptions in favored localities where the disease has not found a place, but they are rare. Some varieties are more free from it than others, as R. I. Greening, the Russetts, Ben Davis, Maiden's Blush, Rawle's Janet Duchess, Yellow Bellflower, Wine Sap, etc., while Early Harvest, Fameuse or Snow Apple, Northern Spy, Fall Pippin, and many more, are rarely exempt from the scab.

On the leaves.—It appears first in small olive-green spots, quite round and well defined. As it grows older it takes on a velvety appearance and the patches or spots become irregular, often running together and extending to the young growth.

On the fruit.—The development of the disease on the fruit is much the same as on the leaves. Starting from the center, the spots grow or extend outward until large portions of the fruit are covered. The fruits become deformed as the portions affected are arrested in their development, making the fruits one-sided and very unsightly. The fungus attacks the fruit very early in the season, often when about the size of small peas, and possibly before all of the petals have fallen; but this is not definitely

43

known. The season of its greatest activity is during the cool, moist weather of spring and fall. It often nearly if not quite ceases growth during the hot, dry summer months. The ease with which the fungus develops makes it reasonable to infer that the danger is not past when the fruit is harvested; but that the disease may be transmitted from infected to sound fruits by contact in storage.

Remedies.— As in the rots and mildews of the grape, the treatment for apple and pear scab must be preventive. No satisfactory results can be looked for after the fungus has developed into active growth. For this reason the treatment should commence earlier than is recommended by most workers, and while the trees are dormant, by washing or spraying the trees with sulphate of copper in solution, using one pound of copper to ten or twelve gallons of water. As the fungus is known to live through the winter on the branches, leaves and fruit buds of the tree, this early application is of the utmost importance. The second spraying should be made as soon as the first leaves appear on the trees, and a third as soon as all the blossoms have fallen, and it is likely that a fourth spraying will be necessary when the fruit is about half grown. After the second or third spraying, however, the periods may be regulated as thought best to secure the greatest amount of good. The fungicide which has given the best results after the first spraying is the ammoniacal carbonate of copper.

Formula for the fungicide.—"The experience of the past season would lead us to recommend using, as a convenient formula, a solution composed of one ounce of carbonate of copper dissolved in one quart of aqua ammonia (strength 22 Beaume) diluted with 100 quarts of water. One and one-half gallons of the solution are sufficient to thoroughly spray a tree of medium size, and two gallons for one of large size. It follows, therefore, that four ounces of carbonate of copper and one gallon of ammonia will make 100 gallons of the diluted solution, which is sufficient to spray fifty large or about seventy medium trees once." (E. S. Goff in Seventh Annual Report of Agricultural Experiment Station, University of Wisconsin.)

Another fungicide that has given good results is the "modified *eau celeste*," containing carbonate of soda.

Formula.— Dissolve one pound of sulphate of copper in two gallons of water. In a separate vessel treat one pound of carbonate of soda. After the two solutions have been mixed, and chemical action has ceased, add one and one-half pints of commercial ammonia and dilute to thirty gallons with water. Extended experiment is still needed to determine the time at which the first spraying should be made, also the number necessary, and the strength of the solution required to obtain the best results, as by dilution the cost is lessened, and also the danger of injury to the foliage reduced to the minimum.

Black-knot of the plum and cherry.— The black-knot of the plum and cherry is distinctly an American disease and is recognized at a glance by the rough wart-like swelling which cover the branches and sometimes even appear on the trunks of the trees. Where the fungus is not checked, whole orchards soon become affected, and are a serious menace to every healthy tree in the vicinity. The fungus was described about seventy years ago by the mycologist Schweinitz, who thought, however, as many do still, that the trouble was due to insects, from the fact that there is often found the larva of insects imbedded in the galls. But since the very careful and systematic study of the black-knot by Dr. W. G. Farlow, in 1886, there is no reason to doubt that it is caused by a parasitic fungus, the spores of which, after ripening, become detached from the knots and are carried by the wind or by insects to healthy trees, where in some manner they penetrate to the cambium layer, where they take root and grow, reproducing galls similar to the one from which they become detached.

Preventives and remedies.— As the galls are found on the native plum and cherry, growing wild in fence corners and abandoned places, they should be sought out and burned. When found on cultivated trees, the knots should be at once cut and burned, and the wound treated with a strong thirty per cent solution of iron sulphate. If the work is done while the trees are dormant, they can be sprayed with the same solution, which will be likely to destroy any spores resting on the trees awaiting a favorable time for development. Where the knots are cut off, after treating the wounds with iron sulphate, cover with a linseed oil paint.

INSECTS AND REMEDIES.

The apple.— Attacking the trunk ; is the flat-headed apple-tree borer (*Chrysobothris femorata*, Fabr.) and the round-headed apple-tree borer (*Saperda candida*, Fabr.). The eggs of the flat-headed borer are fastened by the female beetle under the loose rough bark, or in crevices on the trunk, and sometimes the larger branches of the tree. In this climate they are generally deposited in the latter part of June or first of July. They soon hatch, and the young worms begin burrowing through the bark, and when the sap wood is reached, if the tree is small, they often girdle it completely. In larger trees they burrow deeper into the trunk as the larva grows stronger, returning to the sap wood again where between it and the bark they complete their transformation to the perfect insect. They then eat through this thin layer and escape to continue the work of destruction.

The round-headed borer deposits its eggs singly on the outside of the tree near the roots. It then hatches and works its way into the tree in much the same way as the former, but remains longer in the sap wood before tunneling into the heart of the tree. It is also longer completing its cycle from larva to beetle. The time given by most entomologists is three years.

Remedies.—A wash of soft or whale-oil soap, made of about the consistency of common paint by adding washing soda and water, and applied with a broad brush to the trunks and large branches of the trees is a preventive; as they do not like to deposit their eggs on this viscid substance. A little crude carbolic acid makes the wash still more offensive to the beetles. After the borer has entered the tree the only effectual remedy is the knife and a short piece of wire. The trees should be examined the latter part of August or early autumn, and where there are indications of the borer, cut through the bark, and if the larva is not found probe with the wire in the channels made by the borer, and he will usually be destroyed.

Attacking the branches.—The wooly louse of the apple. This insect is often found at the base of apple trees and around suckers growing from the root, also on the trunk, and at the base of the limbs, and in wounds made by pruning or accident. They gather in masses having the appearance of cotton, or at a little distance may give the impression that the tree has been whitewashed.

Remedies.—The wash recommended for the borer, if applied with a stiff brush, will be found beneficial. Kerosene emulsion is also effectual.

The oyster-shell bark louse.—This insect is more common in the northern United States and Canada, but several inquiries in regard to it have been received the past year from this State. It appears in scales resembling somewhat the shell of an oyster, brown in color, and distributed thickly over the branches and trunks of the trees, often on small trees nearly covering the entire surface; where so numerous they seriously affect the vigor of the trees, and in case of small trees sometimes cause death.

Remedies.— The scale coverings serve as a protection to the eggs which are deposited under them; often to the number of 100 under a single scale. It also protects the young louse while developing. If the trees are gone over with a very stiff brush or old broom, many of the scales will be removed and the eggs destroyed. After this use a wash, as recommended for borers, or the washing soda can be used alone, by dissolving from one-half to three-fourths of a pound in a pail of water, and spraying or syringing it on the trees. In the spring when the eggs are hatching, which in this climate will be in the month of May, or early in June, a spray of kerosene emulsion, or sour milk and water with a little kerosene added, will also prove effectual.

On the leaves.— The insects most injurious to the foliage of the apple are the apple tree tent caterpillar, the forest tent, the yellow necked and the red-humped apple tree caterpillars; the fall web worm, the canker worm, the leaf rollers, folders and bud worms, the apple-leaf bucculatrix and the aphis.

Remedies.— The caterpillars and web worms can be easily controlled by tearing out the nests, when the worms are massed in them, and crushing, or by spraying the nests and adjacent branches with Paris green and water. Leaf rollers, folders and bud worms can be controlled by the use of the spray also. The canker worm is a more formidable enemy, but with a thorough application of proper and simple remedies it can be subdued. As the female moth is wingless its movements are necessarily very slow, and it can be easily captured while crawling up the trunk of the trees by bands of paper or thin cloth tied securely around the tree and smeared on the under side with coal tar or printers' ink. These bands should be taken off and the tar or ink renewed as often as it becomes dry. A large percentage of the larva of the moths that escape these traps can be destroyed by spraying the trees with Paris green and water. If the larva have been permitted to feed on the trees and the caterpillars enter the ground to complete their transformation into the perfect insect, the ground should be worked very thoroughly around the trees to the depth of about six inches, as by this means many of the tender pupa will be crushed.

The Apple-tree Aphis (*Aphis mali*, Fabr.).— This little pest appears so early in the season, when the trees are sending out the first tender leaves, that much greater injury is done the tree from the attacks of the louse than is usually recognized. They suck from the tender foliage the sap contained in the leaves, causing them to curl, and when badly infested, to wither and drop off. They should therefore be destroyed as quickly as possible after their appearance.

Habits of the Aphis.— In order to successfully deal with plant lice, it is well to keep in mind some of the main points in their life history. The first to be considered is the eggs. These can be found during the winter attached to the branches, and in the crevices of the bark, and especially around the buds, where they were deposited the previous fall. They are oval in shape, shiny black in color. They can be seen with the eye on close inspection, but with the aid of a common magnifying glass they are easily detected. As soon as the buds begin to expand in the spring these eggs hatch out and the lice begin to feed by inserting their beaks and drawing the juice from the tender foliage.

The first broods of the aphis are all females. These mature in ten or twelve days and commence the reproduction of living young. These broods again mature in about the same length of time and continue to multiply their species at about the same ratio. This continues until the aphis become simply innumerable. Occasionally winged females appear and by distributing themselves on adjacent trees form new colonies. Toward the latter part of the season males begin to appear and a new stock of eggs are deposited by the females for the coming year.

Remedies.— The first should be preventive. By using a wash for the trunks and larger branches, applied with a stiff brush, the eggs deposited on these will be crushed or otherwise destroyed. Any of the alkaline washes, some of which have been referred to, will answer the purpose. For the smaller limbs, not conveniently washed, it is necessary to resort to spraying with some substance that will penetrate the egg covering. Kerosene emulsion has been used with good results for this purpose, and also for spraying the trees later in the season to destroy the remnant hatched from eggs that were not reached by the first application. A convenient formula for the emulsion is one quart of soft, or one-quarter of a pound of hard, soap dissolved in two quarts of boiling water. After the soap is all dissolved stir in one pint of kerosene, while the mixture is still hot. The whole should then be thoroughly churned by passing the mixture through a force pump until a perfect emulsion is formed. When ready to use stir in enough water to make two gallons. In order to insure success in the use of the remedy it should be applied on the first signs of the appearance of the lice. As the emulsion kills by contact better results will be obtained before the leaves curl, thereby offering protection to the aphis.

Injury to the fruit.— The insects that work the greatest injury to the fruit of the apple are the codling moth, the apple curculio and the apple maggot.

The codling moth begins to make its appearance about the time of the opening of the apple blossoms. As the moth works at night it is seldom seen, but the work of the destructive little pest is too well known to need description. The eggs are laid singly, generally in the calyx of the fruit as it is just forming. It hatches in about a week and the worm at once begins to eat its way into the fruit. In about four weeks the first brood attain to maturity and the fruit begins to fall to the ground. The worm generally escapes before the fruit falls, but not always. In either case the worm generally finds its way to the trunk of the tree, where it conceals itself under the rough bark, and spins a tough silken covering to which are attached pieces of bark or other debris that may come in their way for the purpose of concealment. The change to the chrysalis takes place in about three days, and in about two weeks the moth from this first brood escapes to continue the work.

The apple curculio.— This is a beetle a little smaller than the plum curculio. It is dark brown in color, and can be distinguished from the plum curculio by its long slim snout, which in the female is as long as the body and in the male about half the length. In neither can they be folded under the body as can those of many of the other species of curculio.

It is a native American pest, and was originally confined to the wild crabs and haws. It is single brooded and can be found within the fruit in all stages of development, from the middle of June to the middle of September. It injures the fruit by making round holes with its snout, in feeding, and also in preparing a place to deposit its eggs.

Remedies.— Both Paris green and London purple are used to destroy the codling moth. Our experiments with these poisons lead us to favor Paris green as a remedy. It is of greater specific gravity and does not remain in suspension in water as long or as well as London purple, but it is more uniform in its composition, and can be used with less danger to foliage. We have found one pound of the poison to 200 gallons of water strong enough for the first spraying, which should be made as soon as the blossoms have all dropped from the trees. This is to be repeated in from seven to fifteen days, depending on the amount of rainfall. After this the strength can be reduced to 250 or even 300 gallons to the pound. The number of sprayings will depend upon the weather to a great degree. In a moderately dry season three should be ample. This treatment should also answer largely for holding in check the apple curculio. Where the trees are small, jarring may be practiced the same as for the plum curculio, in addition to the above.

The apple maggot.— This little pest is a small footless maggot pointed in front and cut off squarely behind. It tunnels in the pulp of the apple, little winding channels with now and then a round excavation about the size of a pea. The perfect insect is a small fly which lays its eggs in the fruit during the month of July, and is partial to summer and fall varieties. It is also often found in fruit after it is stored in the fall and winter, and is becoming quite a serious pest in many parts of the country, and especially in sections of New York State.

Remedies.— Owing to the season, and the mode of insertion of the egg by the fly into the flesh of the fruit, it is not possible to destroy the maggots by the use of poisons. The only remedy so far known is to destroy in some way the fruit. As the fruit generally ripens prematurely and falls to the ground, this can be accomplished by pasturing hogs or sheep in the orchards, confining a sufficient number of animals to keep the fruit picked up clean as fast as it drops from the tree, so that no chance may be given the maggot to enter the ground for pupation.

Insects injurious to the Pear.— A whitish grub resembling the peach-tree borer attacks the trunk of the pear. The remedies given for the apple-tree borer can be employed in this case as well.

Attacking the leaves.— Many of the insects described as feeding on the foliage of the apple, attack the pear. When these appear, the same remedies can be used as recommended for the apple. In addition to these, the leaf slug often appears in numbers sufficient to endanger the life of the tree. They can be easily and quickly checked, by dusting the trees with fine dry earth or air-slaked lime. We have used for this purpose an insect gun manufactured by Leggett & Brother, New York city. We have found it very effectual and convenient in the application of dry substances.

Injury to the fruit.—The codling moth, which is so destructive to the fruit of the apple, is also very liable to attack the pear. The plum curculio and the quince curculio also injure the fruit to quite an extent. The same remedies can be used as described for other fruits.

The Plum.— The peach and apple-tree borer injure the plum and can be prevented as already described.

For the insects that injure the foliage, Paris green and water can be used in spray, being careful to use the mixture properly diluted, never stronger than one pound of the poison to 200 gallons of water. Great care should also be taken to have the liquid kept in constant motion, so that the Paris green may be kept in suspension in the water; otherwise the last of the mixture in the tank will be double, or triple the strength of that first applied, and will be sure to injure the foliage.

For combating the curculio, which is the real bugbear to the plum grower, the mixture mentioned above is used and phenomenal results are reported by many experimenters. Others have not succeeded as well, and we believe that in seasons of heavy rain-falls and in cases of severe attacks where the beetles appear in unusual numbers, jarring should be combined with the use of poisons, and that better results will follow.

The Peach.— The peach-tree borer is a very dangerous enemy of the peach, and unless careful watch is kept will entirely destroy an orchard before the fact of its presence is realized. The best remedies are the use of the knife late in autumn or early in the spring, and the preventive washes as recommended for the apple.

For insect attacks on the foliage and fruit, the same remedies can be used as on the plum; reducing the mixture to 300 gallons and equal precautions should be taken to guard against injury to the foliage.

* VARIETIES OF FRUITS ADDED TO THE TRIAL ORCHARDS IN 1890.

APPLE.

American Best.
Baker.
Champagne.
Early Joe.
Flanders Pippin.
French Pippin.
Lake.
Litiz Beauty.
Manchester.
Marigold.
Mellot.
Moore's Sweeting.
Morriss Red (Steeles).
Mountain Sweet.
Newman's Seedling.
No Name.
Red Stratiner.
Rioter.
Ronk.
Rubicon (Blue Pearmain).
Seedling Green.
Seedling Not Named.
Seedling Red.
Seedling of Rambo.
Seedling Sweet.
Streaked Pippin.
Strode's Birmingham.
Suenker.
Summer Heagalo.

RUSSIAN.

Aport Orient.
Bogdanoff.
Boiken.
Borovinka.
Charlock Reinette.
Crimean.
Golden Reinette.
3 M.
22 M.
24 M.
Persian Boy.
Red Eiser.
Striped Winter.
Titivoka.

CRAB APPLE.

Bryers' Sweet.

PEAR.

Andrews.
Columbia.
Dix.
Duchess of March.
E 47.
Exeitier.
Hasenschenck.
Late Bartlett.
Leeche's Kingsessing.
Ontario.
Philadelphia.
Queen.
Ravenwood Early.
Red Garden.
Seedling.
Seedling.
St. Crispin.
Stevens Genesee.
Winter Seckle.
Younken Favorite.

* For list of varieties planted previous to 1890, see report of 1889.

PLUM.

Ashes Seedling.
Cling Stem.
G 44.
Gloss.
Ottoman Seedling.
Pringles Purple.
Prince of Wales.
Rood.
Seedling.
Spaulding.

Russian Varieties.

Early Red.
Moldavaka.

Japan Varieties.

Chabot.

American Plums.

Hawkeye.
Minnesota.

PEACH.

Gov. Briggs.
Muir.
No. 34.
Pansy Pabor.
Pratt.
Reeds Early Golden.
Schofields Seedling.
Schofields White.
Seedling.
Tong Pa.
Yellow Mistry.

CHERRY.

Russian.

Abbers de Argness.

GRAPE.

Foster Seedling.

THE ARBORETUM.

The following list includes the trees planted out to date.

For the nomenclature I have had to depend largely upon nursery catalogues, though the catalogue names have been compared with and, so far as possible, verified by the names employed in the Illustrated Dictionary of Gardening and Dr. Gray's Field, Forest and Garden Botany.

DECIDUOUS TREES.

Acer campestre—English or cork-barked maple.
——— *Colchicum rubrum* or *luteum*—Red Colchicum maple.
——— *dasycarpum*—White or silver-leaved maple.
——— ——— *Wierii laciniatum*—Weir's cut-leaved silver maple.

Acer Pennsylvanicum — Striped-barked maple.
——— *platonoides* — Norway maple.
——— ——— *Rietenbachi* — Rietenbach's Norway maple.
——— *Pseudo Platanus* — Sycamore maple.
——— ——— *purpureum* — Purple-leaved sycamore maple.
——— *saccharinum* — Sugar or rock maple.
Æsculus flava — Yellow horse-chestnut.
——— *Hippocaslanum* — Common horse-chestnut.
——— ——— *alba flore pleno* — Double white-flowered horse-chestnut.
——— ——— *rubicunda* — Red-flowering horse-chestnut.
——— *Pavia?* — Dwarf horse-chestnut.
Alnus glutinosa — European alder.
——— ——— *laciniata* — Cut-leaved alder.
——— ——— *laciniata imperialis* — Imperial cut-leaved alder.
Betula alba — European white birch.
——— ——— *laciniata* — Cut-leaved birch.
——— ——— *pendula laciniata* — Cut-leaved weeping birch.
——— ——— *pendula elegans.*
——— ——— *purpurea* — Purple-leaved birch.
Catalpa bignonioides.
——— ——— *speciosa.*
——— *Kœmpferi.*
——— *Teas' Japanese hybrid.*
Cerasus avium flore alba plena — Large double-flowering cherry.
Cerasus pumila pendula — Dwarf weeping cherry.
Cersis Canadensis — American Judas tree.
——— *Japonica* — Japan Judas tree.
Cratœgus Oxycantha — English hawthorn.
——— ——— *coccinea flore pleno* — Double scarlet thorn.
——— ——— *flore pleno Paulii* — Paul's double scarlet thorn.
Fagus sylvatica — European beech.
——— ——— *heterophylla* — Fern-leaved beech.
——— ——— *pendula* — Weeping beech.
——— ——— *purpurea* — Purple-leaved beech.
——— ——— *laciniata* — Cut-leaved beech.
Fraxinus Americana — White ash.
——— *excelsior* — European ash.
——— ——— *aurea* — Golden-barked ash.

Fraxinus excelsior aurea pendula — Golden-barked weeping ash.
——— ——— *myrtifolia* — Myrtle-leaved ash.
——— ——— *pendula* — Weeping ash.
——— ——— *variegata* — Variegated-leaved ash.
——— *oxyphylla parvifolia* — Lentiscus-leaved ash.
Gymnocladus Canadensis — Kentucky coffee tree.
Laburnum vulgare — English laburnum.
——— *Alpina* — Scotch laburnum.
Larix Europæa — European larch.
Liquidamber striaciflua — Sweet gum or liquid amber tree.
Liriodendron tulipifera — Tulip tree.
Magnolia acuminata — Cucumber magnolia.
——— *Lennei* — Lenne's magnolia.
——— *purpurea* — Purple magnolia.
——— *Soulangeana* — Soulange's magnolia.
——— *speciosa* — Showy-flowered magnolia.
——— *Umbrella* — Umbrella magnolia.
Also two Chinese sorts, unnamed.
Morus — Mulberry.
——— Kansas weeping.
——— Kansas fine-cut leaved.
Negundo aceroides — Ash-leaved maple or box elder.
Persica vulgaris flore rosea plena — Double-flowering red peach.
Populus alba — Silver-leaved poplar.
——— ——— *Bolleana.*
——— *balsamifera* — Balsam poplar.
——— *Carolina* — Green-leaved, or Carolina poplar.
——— *dilitata* — Lombardy poplar.
Populus grandidentata pendula — Weeping tooth-leaved poplar.
——— *monilifera aurea Van Geertii.*
Prunus sinensis flore pleno ? — Chinese double-flowering cherry.
Pyrus Americana nana — Dwarf mountain ash.
——— *aucuparia* — European mountain ash.
——— ——— *pendula* — Weeping mountain ash.
——— ——— *quercifolia* — Oak-leaved mountain ash.
——— *hybrida* — Hybrid mountain ash.
——— *malus pendula* — "Elise Rathke," new German weeping apple.
——— *spectabilis flore alba pleno* — Chinese double white-flowering crab.

Pyrus spectabilis flore rosea pleno — Chinese double rose-flowering crab.
Quercus alba — White swamp oak.
——— *coccinea* — Scarlet oak.
——— *macrocarpa* — Burr or mossy-cup oak.
——— *Robur* — English oak.
——— ——— *pedunculata concordia* — Golden oak.
Salisburia adiantifolia — Ginkgo tree.
Salix Babylonica — Babylonian or weeping willow.
——— *Caprea pendula* — Kilmarnock weeping willow.
——— *phylicifolia?* — Red-twig willow.
——— *purpurea pendula* — New American willow.
——— *rosmarinifolia* — Rosemary willow.
——— *viminalis* — Osier willow.
——— Comewell willow.
Tilia Americana — American linden or basswood.
——— *Europœa* — European linden.
——— ——— *alba* — Silver-leaved linden.
——— ——— *laciniata* — Fern-leaved linden.
——— ——— *rubra* — Red-twigged European linden.
Ulmus Americana — American white or weeping elm.
——— *campestris* — English elm.
——— ——— *stricta purpurea* — Purple-leaved English elm.
Ulmus Dovœi.
——— *Montana* — Scotch or wych elm.
——— ——— *Camperdown pendula* — Camperdown weeping elm.
——— *suberosa* — English cork-barked elm.
Diospyros Virginiana. — Common persimmon.

EVERGREEN TREES.

Abies balsamea — Common balsam.
——— *Canadensis* — Hemlock spruce.
——— *excelsa* — Norway spruce.
Cupressus Lawsoniana — Lawson's cypress.
Juniperus Virginiana — Red cedar or savin.
Pinus Ausiriaca — Austrian pine.
——— *Strobus* — White pine.
——— *sylvestris* — Scotch pine.

Taxus baccata — English yew.
——— ——— *elegantissima* — Beautiful variegated yew.
——— ——— *erecta* — Erect yew.
Thuja occidentalis — American arbor vitæ.
——— ——— *compacta* — Parson's arbor vitæ.
——— ——— *ericoides* — Heath-leaved American arbor vitæ.
——— ——— *Hoveyi* — Hovey's golden arbor vitæ.
——— ——— *globosa* — Globe-headed arbor vitæ.
——— ——— *pyramidalis* — Pyramidal arbor vitæ.
——— ——— *Siberica* — Siberian arbor vitæ.
——— *orientalis Tartarica* — Tartarian arbor vitæ.

REPORT OF FARM SUPERINTENDENT.*

The early part of this report year was devoted to completion of report for last year, attendance on several farmers' meetings and in the details of feeding experiments in the stable.

About midwinter the care of and reponsibility for the rations supplied and feeding of the dairy experiment animals were transferred to this department. This work has been given the attention which its importance required, and every detail was considered of importance.

The rations were always calculated in advance, according to the German standard, and then proportional reductions were made to all the animals according to weight, after which the rations for certain ones which showed a tendency to lay on flesh were somewhat further reduced.

In compounding these rations it was always necessary to use average analyses and co-efficients of digestion for some or all the articles fed, hence in no case can strict conformity be claimed between the figures and the actual composition of food offered, while that actually consumed will, of course, be found somewhat further off from the given standard.

During the whole period there was a gradual change to less food per given weight and more coarse food in proportion to grain.

From the very first this feeding has been carried on in accord with the laws laid down by German scientists and the experience of American experiments that less feed and a wider ratio best accords with American conditions.

The care of the lysimeters and reading of soil thermometers as well as the meterological record, have taken each a portion of time.

Samples of the drainage waters were collected from each lysimeter for chemical examination, and in order that the record and discussion may go together, no further mention of it will be made here, save that the record of the behavior of the new lysimeters for the previous year is here given.

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*F. E. Emery.

The following articles have been prepared for this report as part of the general outside work on the plats, farm and in the stable:

Grasses and forage crops.
Peas best for forage.
On raising scrub stock.
Comparison of roots and silage.
Variety test of wheat.
Potato experiments, 1890.
After effect of fertilizers in field G, 1889.
Report on lysimeters for 1889.
Meteorology for 1890.
Food fed dairy animals.

GRASSES AND FORAGE CROPS.

The small plats of grass have been kept practically as in 1889. They are valuable as an object lesson for all who are interested in our leading crops, hay and pasturing. There is yet so much to learn in regard to grass, its culture and management, that few of our farmer visitors can afford to leave the Station grounds without looking over these plats, to compare the vigor and appearance of the grasses with which he is acquainted with others growing under like conditions, which may aid him to increase the value of his crops by adopting a larger variety, or by changing his varieties altogether, or making different combinations in seeding.

The special work attempted with these plats the past season has been the collection of botanical specimens for addition to the Station museum, and for exhibition at the fairs and farmers' meetings, to illustrate talks on the subject of grasses and their value; also the collection of samples at different stages of growth for analysis.

There had been nothing done with the large grass plats up to the termination of my connection with the Station, except to cut and weigh the crop as hay. The seeding and weight of crops on these plats are given in the following table. The lower series of A plats were intended to be harvested by half plats as seeded, but the growth was so nearly equal on the several halves, and clover had come in so strongly that it was abandoned. This clover was probably seeded in by a top-dressing of manure made from hay in which the clover had ripened while waiting for the later grass to come to the proper stage for hay:

HAY FROM LARGE GRASS PLATS — SERIES A — UPPER — 1890.

PLAT.	Grasses sown, 1886.	Leading grasses, 1889.	Second crop yield.	Third crop yield.
			Lbs.	Lbs.
A 1, upper	Perennial Rye grass, Alsike Clover, one-half.	Alsike Clover, Perennial Rye grass, Timothy	284	5,680
A 2, upper	Water Meadow grass, Red Top, one-half each.	Red Top Timothy, White Alsike and Red Clovers, Water Meadow and Orchard Meadow Fescues, and a few stools of Reed Canary grass	298	5,960
A 3, upper	Kentucky Blue grass, Meadow Fescue, one-half each.	Meadow Fescue, Timothy, Kentucky Blue, White, Alsike and Red Clovers	248	4,960
A 4, upper	Italian Rye grass, Timothy, one-half each.	Timothy, Clover, Rye grass, Quack, Orchard, and species of Fescue	298	5,960
A 5, upper	Spiked Fescue, Sweet Vernal, one-half each.	Spiked Fescue, White, Alsike and Red Clover, Sweet Vernal, Timothy, Orchard, Oat and Melotus	242	4,840
A 6, upper	Pacey's Rye grass, Various-leaved Fescue grass, one-half each.	Fescue and Orchard grasses	250	5,000
A 7, upper	Orchard grass, Meadow Fescue grass, one-half each.	Orchard and Fescue grasses and Clovers	234	4,680
A 8, upper	Wood Meadow grass, Creeping Bent grass, one-half each.	....	182	3,640
A 9, upper	Yellow Oat grass, Meadow Foxtail grass, one-half each.	Meadow Foxtail and White Clover	102	2,040
A 10, upper	Crested Dogstail grass, Purple Fescue grass, one-half each.	Sheep Fescue and White Clover	154	3,080
A 11, upper	Rough-stalked Meadow grass, Foul Meadow grass, one-half each.	Timothy, Quack, White Clover and Meadow grass.	270	5,400
A 12, upper	Italian Rye, Red Top, Timothy, Tall Fescue, Meadow Foxtail, Perennial Rye, Yellow Oat grass, one pound each.	Meadow grass, very little Timothy, Orchard or Rye grasses, and very little Clover	265	5,300
A 13, upper	Rough-stalked Meadow, Sweet Vernal, Crested Dogstail, Pacey's Rye, Poa pratensis Meadow and Various-leaved Fescues, one pound each.	Fescue, Kentucky Blue and Quack grasses, White, Alsike and Red Clovers	242	4,840

Plat	GRASS SEED SOWN ON PLATS A LOWER IN 1889.	Per plat.	Per acre.	Yield per plat as hay.	Yield hay per acre.
				Lbs.	Lbs.
A 1, W. half, with rye	Tall Oat grass (Avena elatior)	1 lb.	40 lbs.	336	6,720
E. half, with rye	Orchard grass (Dactylis glomerata)	10¾ ozs.	26⅞ lbs.		
A 2, W. half, with rye	Tall Oat grass (Avena elatior)	10¾ ozs.	26⅞ lbs.	314	6,280
E. half, no rye	Orchard grass (Dactylis glomerata)	10¾ ozs.	26⅞ lbs.		
A 3, W. half, with rye	Timothy (Phleum pratense)	6 ozs.	15 lbs.	278	5,560
E. half, no rye	Timothy (Phleum pratense)	4 ozs.	10 lbs.		
A 4, W. half, with rye	Tall Oat and Orchard grasses	8 ozs.	20 lbs. each.	374	7,480
E. half, no rye	Tall Oat and Orchard grasses	5½ ozs.	13¾ lbs. each.		
A 5, W. half, with rye	(Festuca elatior)	10 ozs.	25 lbs.	198	3,960
E. half, no rye	(Festuca elatior)	7 ozs.	17½ lbs.		
A 6, W. half, with rye	Meadow Foxtail grass (Alopecurus pratensis	1½ lb.	60 lbs.	210	4,200
	Kentucky Blue grass (Poa pratensis)	¾ lb.	30 lbs.		
E. half, no rye.	Same as W. half.	1 lb. ½ lb.	40 lbs. 20 lbs.		
A 7, W. half, with rye	Red Top, Timothy, Kentucky Blue	1 oz. each.	2¼ lbs. each.	310	6,200
	Sweet Vernal, Meadow Foxtail, Festuca elatior and Tall Oat grass	2 ozs. each.	5 lbs. each.		
E. half, no rye	Red Top, Timothy and Kentucky Blue	¾ oz.	1⅞ lbs. each.		
	Remainder of same grasses	1½ oz.	3¾ lbs. each.		
A 8, W. half, with rye	Orchard grass	8 ozs.	20 lbs.	315	6,300
	Kentucky Blue grass	6 ozs.	15 lbs.		
E. half, no rye	Orchard grass	5½ ozs.	13¾ lbs.		
	Kentucky Blue grass	4 ozs.	10 lbs.		
A 9, W. half, with rye	Reed Canary grass (Phalaris arundinacea)	1 lb.	40 lbs.	Green 1,546	weight. 30,920
	Sweet Clover (Melilotus alba)	½ lb.	20 lbs.		
E. half, no rye	Reed Canary	10¾ ozs.	26⅞ lbs.		
	Sweet Clover	51-5 ozs.	13¾ lbs.		
A 10, W. half, with rye	Johnson grass (Sorghum halapense)	1 lb.	40 lbs.	1,514	30,280
	Sweet Clover	½ lb.	20 lbs.		
E. half, no rye	Johnson grass	10¾ ozs.	26⅞ lbs.		
	Sweet Clover	5½ ozs.	13¾ lbs.		

The crop on Plats 9 and 10 was all Melilotus. It was too early for the grass and wet weather made it impossible to cure it to hay and retain its leaves.

Other soiling crops grown this season have been Alfalfa, Prickly Comfrey, clover, oats and vetches, oats and peas, Hungarian grass, barley and corn.

Mangolds and silage were fed alternately a month at a time during the spring months, including fifteen days of June. Grass was fed the remainder of June; clover the first ten days of July, and oats and vetches the remainder of July. Oats and peas were fed in August until the sixteenth, when, the severe drought having checked the growth of successive sowings, the crop failed and the stock was returned to silage until corn ripened enough to put in silo. Corn then became the late crop.

There was too little of Alfalfa or Prickly Comfrey for feeding so many animals as were being soiled on similar food to make it worth while to use them, so Alfalfa was made into hay and Prickly Comfrey used for pigs (see Bulletin No. 22). Oats and vetches proved a very satisfactory crop. One acre furnished about 700 pounds of food daily for twenty-one days in July from the time pods began to form, until well along toward maturity. Another acre sown later and affected by the drought yielded one and one-half tons of hay.

The different early sowings of oats and peas came off about together, and with the early oats and vetches. These made 7.7 tons of hay cut when the pods were well formed, and the oats were mostly in the watery stage, and some in milk. Some plats of oats and peas, and the last but one sowing, supplied green food for the stock only sixteen days. The last sowing rusted badly, stopped growing during the drought, and was plowed under for wheat. A strip of 2.2 acres below the plats were sown to Alfalfa in the spring.

It has done well considering the long drought, and promises well in future. The ground was rather stiff, and was prepared by plowing under oats and peas in 1889. The plat was then tilled and sown to rye, which was plowed in in the spring when all other ground on the farm was too wet to work. These crops seemed to have helped free this soil of surplus water.

One acre of mangolds have been grown with intention to obtain the actual cost, and use them as a change of diet from silage for all stock at times during the winter.

The hay crop amounted to 84.59 tons, not counting oats and peas, or oats and vetches, at harvest as stored. This, from very nearly thirty-eight acres, gives a yield of 2.2 tons per acre.

PEAS BEST FOR FORAGE.

Late in the spring there was received from a correspondent the following query: Is there no better pea to grow for forage than the Canada pea? Replied to that we do not now know of any better variety to be grown for that purpose.

Catalogues were examined for varieties producing haulms of good length which would make good green forage and half a dozen selected. Of these, two could not be had in season and the trial was started with the varieties given in the table.

The plats available for this trial had produced a small crop of beans for several years, and was not well suited for a good vigorous growth of vegetation, which reinforced by the drought made the yields far smaller than would have been the case under favorable climatic and soil conditions.

One peck, fifteen pounds, of each variety of peas was mixed with six pounds of oats and drilled in with the Crown drill. Two drill casts of each lot of peas and oats were sown across the first eleven G plats. Plat No. 1 was only a gore, and its yield has been discarded, as have the paths and the remainder of the plats, about one-third, which was sown with a mixture of all the seeds left over from sowing these plats. The whole area sown was .619 acre, on which one bushel of peas and three pecks of oats were sown. This was at the rate of peas 1.6 and oats 1.2 bushels per acre, or 2.8 bushels of seed per acre in all. This forage was harvested August first to fourth, as needed for feeding, about 700 pounds per day.

While these yields are very small, the Canada pea with probably an equal weight of seed, gave over eighteen per cent greater yield than the White Marrowfat, and the other two were so far behind in yield as practically to fall out of the comparison.

WEIGHT OF FORAGE PEAS AND OATS.

PLAT.	South strip Canada Field Pea.		White Marrowfat.		Champion of England.		North. Black Eyed Marrowfat.		Total per plat.	Yield by plats per acre.
	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Lbs.
August 1, 2	26		24		18		34		102	3156
August 2, 3	65	14	60	6	64	12	54		245	7580
4	59	8	55	0	63	2	77	12	255.375	7901
5	50	0	44	0	41	8	49	8	185	5724
6	60	12	39	0	30	4	48	0	178	5507
7	74	14	45	12	35	8	36	6	192.5	5956
8	75	6	61	12	34	4	35	8	206.875	6401
9	72	2	54	2	30	0	34	4	190.5	5894
10	78	4	57	8	49	8	59	0	239.25	7402
11	94	0	44	4	33	14	47	12	189.875	5875
12	644	75	545	75	458	75	475	125	2124.375	....

FLAX GROWING.

The growth of flax for fibre has greatly decreased in the last one or two generations, until now there are many people of middle age to whom the plant is a stranger. Formerly it was commonly grown, and nearly every farm had its tools for the manufacture of the fibre into cloth. The growing of flax has become a lost industry among us. Recently there has been a stir to revive the cultivation of this plant, and the Boyce Fibre Company have sent out some circulars to increase the interest felt and secure fibre and improvements of the same in order to re-establish this industry on a profitable basis.

Here at the Station a considerable plat of land was reserved for flax and hemp, but sufficient seed was not received and the larger plats were sown to Japanese buckwheat and Hungarian grass.

Four small packages of seed were received from the California Experiment Station, and were sown on rather poor ground. The season has been an extremely unfavorable one for many crops. The hard and cloddy soil, with frequent rains late in spring followed by severe drought, was ruinous to this crop, as well as some others.

The following table gives the yields, as well as the yields of the same in California for a rather unfavorable season and of which they report: "These yields, although small, must be accounted fair when the late planting and the condition of the soil are taken into consideration."

Our seeding was done June thrae, and the flax pulled August twelve and fourteen. The Yellow-seeded and White-flowered French were first ripe and pulled on the earlier date.

Rate of Yield per Acre in Pounds.

	California.		New York.	
	Straw.	Seed.	Straw.	Seed.
White-flowered, from France ...	4092	1276	1792	618.2
Royal, from Germany	3689	987	2858.6	493.4
Russian, from Pskoff	3381	884	2563.6	533.2
Yellow-seeded	2713	706	1497.4	499.1

Our crop has been small, but if this could be made the thin end of a wedge to help rebuild an industry which will give employment for moderate pay to a part of our farms and workmen, it will have served a useful purpose.

ON RAISING SCRUB STOCK.

It has appeared for several years as though farmers were losing money in raising common scrub stock in the usual way for prices which prevail for such stock. It does not pay to keep poor stock, nor would it pay to poorly keep good stock. Cold barns and housing in cold yards are equally unprofitable methods. Stock toughened by exposure in raising is stunted at the expense of the owner's pocket. The other extreme of pampering stock, much less often met, may also be too expensive practice to follow. Better stock, better fed and cared for, should be the general aim in order to raise the rate of growth and in that way decrease the cost of production per hundred weight for what will be worth more per hundred weight.

In 1888, with a small stock of unregistered and "native" cattle on this farm, it was decided to raise the calves for that year and pursue a middle course with them to compare cost of growth with market value. No special pains were taken at any time and the calves were treated about as they would be on an ordinary farm, except that they were not exposed to inclement weather and they were fed some grain. In the case of Nettie and Floss it will be seen a fair though not large growth was made on skim milk from the start. The others received new milk longer and the change to skim milk occupied a longer time. The record of food consumed and cost is accurate so far as the milk, grain, silage and roots are concerned, but the hay is only approximately so since the calves were often of necessity placed two in a single box stall and enjoyed their hay in common. This could make but a small difference owing to the small amount of hay eaten, and where one is undercharged the mate is consequently charged as much over its actual consumption, so that when grouped the charges are corrected.

The heifers were sold in November, 1889, because there was not room enough for them with the thoroughbred stock which had been acquired since we began to raise them. The steer was offered to the butcher in January, but through his delay did not go off until March.

The calculation of cost has been on the following valuation of feeding stuffs:

	Per ton.
Skim milk	$5 00
Wheat bran	16 00
Wheat middlings	20 00
Oil meal	26 50
Ground oats	23 00
Corn meal	16 00
Mangolds	2 00
Silage	2 00
Green alfalfa	5 00
Stover	5 00
Hay	8 00
Pasture, per week	15

The particulars in regard to the breeding and ages of these calves are as follows:

Budd. Dropped November 15, 1888. Unregistered Jersey sire and dam. Weight at birth seventy-five pounds. Sucked dam three days. Fed whole and skim milk eighteen days. Began keeping record December 14th.

Nettie. Dropped November 26, 1888. Unregistered Jersey sire and dam. Weight at birth, sixty-six and seven-eighths pounds. Sucked dam four days. Whole and skim milk, seven days. Began feeding oil meal and bran lightly with skim milk. Record of milk began December 14th. Grain fed December 30th.

Floss. Dropped December 16, 1888. Unregistered Jersey sire and dam. Weight at birth, fifty-six and one-eighth pounds. Sucked dam four days. Whole and skim milk two days. All skim milk after six days old.

Uno. Dropped February 23, 1889. Sire registered short horn; scrub dam. Weight at birth, eighty-nine pounds. Sucked dam three days. Whole and skim milk, twelve days. All skim milk after that period.

Emm 2d. Dropped February 27, 1889. Sire and dam unregistered Jerseys. Weight at birth, fifty-six pounds. Sucked dam three days. Whole milk, nineteen days. All skim milk when twenty-nine days old. Weight ninety-seven pounds at thirty-four days' old, April 1st. Died of inflammation of bowels, April 20th.

TABLE SHOWING WEIGHTS, GAINS AND COST AT VARIOUS AGES, AND WHEN SOLD.

DATE.	BUDD.					NETTIE.				
	Days old.	Live weight.	Gain per day from birth.	COST FOR FOOD TO DATE.		Days old.	Live weight.	Gain per day from birth.	COST FOR FOOD TO DATE.	
				Total.	Cents per pound.				Total.	Cents per pound.
		Lbs.	Lbs.				Lbs.	Lbs.		
December 22, 1888	37	139	1.73	*$0.425	....	26	99¼	1.25	*$0.28	....
January 11, 1889	57	170¾	1.68	1.46	0.86	46	124¾	1.26	1.24	0.99
February 4, 1889	81	207½	1.636	2.69	1.30	70	148½	1.17	2.33	1.57
April 1, 1889	137	292½	1.59	7.39	2.53	126	216	1.19	5.93	2.75
October 21, 1889	....	....	....	....	....	330	374	.90	12.75	3.38
November 15, 1889	365	401	.893	16.94	4.64	....	....	....	....	....
November 23, 1889	....	....	....	....	....	363	418	.967	15.26	3.68
January 23, 1890	511	434	.703	23.19	5.34	....	....	....	....	....
March 12, 1890	594	482	.685	29.31	6.085	....	....	....	....	....
Sold for	....	....	....	....	....	....	....	....	13.00	....
Market quotations	....	....	....	15.91	....	....	....	....	10.87	....

* Record began December fourteenth, and cost reckoned from that date only.

TABLE SHOWING WEIGHTS, GAINS AND COST AT VARIOUS AGES AND WHEN SOLD — (*Concluded*).

DATE.	Floss.					Uno.				
	Days old.	Live weight.	Gain per day from birth.	Cost for food to date. Total.	Cost for food to date. Cents per pound.	Days old.	Live weight.	Gain per day from birth.	Cost for food to date. Total.	Cost for food to date. Cents per pound.
		Lbs.	Lbs.				Lbs.	Lbs.		
December 22, 1888	6	61	.812	....	....	....	....	....	....	....
January 11, 1889	26	80¼	.93	$0.72	$0.90	....	....	....	....	....
February 4, 1889	50	113	1.138	1.83	1.62	....	....	....	....	....
April 1, 1889	106	190	1.263	4.61	2.43	37	146	1.54	$3.62	2.48
October 21, 1889	310	304	.80	11.34	3.73	241	361	1.13	9.70	2.69
November 15, 1889	....	....	....	....	....	....	....	....	....	....
November 23, 1889	343	353	.866	14.25	4.04	274	384½	1.08	12.54	3.26
January 23, 1890	....	....	....	....	....	....	....	....	....	....
March 12, 1890	....	....	....	....	....	....	....	....	....	....
Sold for	....	....	....	13.00	....	....	....	....	11.00	....
Market quotations	....	....	....	9.18	....	....	....	....	10.00	....

When these animals were turned off the Buffalo market for good to choice "stockers" (the class into which such stock would go) was two dollars and sixty cents per hundred weight. They were readily sold for breeding at the higher figures given in the table on the reputations of their dams. The steer, Budd, sold March twelve for twelve dollars, was worth for small second quality animals, as per Buffalo market, three dollars per hundred weight, or fourteen dollars and fifty-two cents. He was not of a type suited to beef production, but was quite equal to many animals which are kept and fed thus at a loss.

At the prices given for food these animals were raised at a considerable loss when offered in the common market. They were still a loss at the prices sold, if the coarse feed could have been sold at the prices charged. With a large amount of coarse forage on hand a moderate price may thus be realized for it, and most of the ash and nitrogen retained on the farm as pay for the feeding and care of the stock. Where the excrements are well cared for, *i. e.* not allowed to be leached out and lost in drainage, or to be burned off by fire-fanging, this method of selling forage can be made a source of profitable crop production. But how much better it would be, if, in the first place, such stock be selected as will with good feeding bring a profit of itself, besides leaving quite as mnch fertility to pay for the labor.

The reader's attention is called to the cost of live weight per pound for food consumed; to the increase of this item and how soon it became greater than the market price.

This is a strong argument against feeding late maturing animals or those which do not consume food enough above that needed for support to make a profitable growth.

COMPARISON OF ROOTS AND ENSILAGE.

In this comparison made with two cows it will be noted that the first trial was on a ration containining roots. The second trial was made with the same grain and hay but with silage substituted for the roots.

In the third trial the grain was increased from what was fed during the two preceding trials and the silage was continued. For the fourth trial the increase of grain was maintained, while the silage of the second and third trials was replaced with roots.

By this arrangement of the periods during which roots and silage were fed, the average time from calving was about equal for the time each of these foods were fed.

The grain fed was a mixture of two parts ground oats, two parts old process linseed meal, and one part wheat middlings.

There were ten days or more allowed for each period. Milk was set separately for churning only from the last seven milkings. The cows were weighed at the same time per day on three of the days for which the milk was separately set.

The unregistered Jersey cows, fed for this comparison and to show differences which farmers may expect from cows raised together and fed alike in their own herds, were young and fresh at the time of beginning this feeding. They are here considered together, but are tabulated separately that the difference in daily production of milk and butter may be noted. Probability of this difference occurring in every herd indicates and suggests the necessity for test comparisons in every milking herd.

Both sets of rations are reasonably near the standard. The ratio of rations containing roots was rather narrower than the standard; that of those containing silage was wider than the average. The cost was 2.8 cents less with silage than with roots when both were calculated at the same price per ton.

The average yield of milk was .48 pound more with the silage rations, but the actual yields of butter when averaged were as near equal as we could expect to have obtained from duplicates. The setting of milk in the third trial was different from the other trials and in all probability this difference diminished the yield of butter. (See note.) Adding this to the small difference found in the table and allowing the butter to have been equal in quality and worth twenty-five cents per pound, here is a difference of three and a quarter cents a day per cow. When the saving in ration is added to this increased production of butter, the advantage from using the silage ration is increased to 6.03 cents per day. We believe this difference can be widened in practice by the production of equally as good silage at less than half the price which we have set on it for this calculation.

The cost of these rations is based on the following prices for the following articles of food :

	Per ton.
Ground oats	$20 00
Linseed meal (O. P.)	26 50
Wheat middlings	20 00
Roots	3 00
Rowen (hay)	6 00
Silage	3 00

NOTE.— At the time for making the first trial other experiments which fully filled the cooler were begun in the dairy and this one had to be postponed or set in a cool room. The latter alternative was chosen, and at the first opportunity a comparison was made of the butter yield of equal amounts of milk set in the cooler and on the floor in the room, under conditions and treatment as nearly identical with those of the third trial as possible. February tenth to thirteenth twenty pounds of milk from each of seven milkings were poured together several times and divided equally; one-half was set in the cooler immersed in running water and the other half on the cement floor of the cool room. The time set was twelve hours for evening and twenty-four hours for morning milk. The cream was churned on the eighteenth. The averages and other details are given in the table below:

	Milk set.	Cream skim'ed.	Average temperature of milk.	Average temperature of cooling, medium at setting.	Temp. before churned.	Temp. after churned.	Time churned.	Weight salted butter.
	Lbs.	Lbs. Ozs.	°F.	°F.	°F.	°F.	Min.	Ozs.
Cooler	70.	14 15½	84.7	46.	62.	65.	32	71.75
Cooler room	70.	14 11	84.7	39.7	62.	64.	30	66.

Per cent more from milk set in cooler 8.7.

This calculated on the yields of the third trial would add eleven ounces of butter or 1.59 ounces per cow per day, which would raise the gain from feeding silage as compared with roots to 6.03 cents instead of 2.8 cents per day from feed alone.

The cows are here considered individually and this table may be regarded as a final summary of each of the trials for both cows. But when combined as in the totals and averages there is shown in contrast the difference in weight, food consumed, and daily production of milk and butter. This comparison is from feeding equal weights of roots and silage. The roots were all consumed, but some of the silage was neglected by Belle. The body weights averaged higher with the roots. This was probably due to May's rapid falling off in the early part of lactation, to the increased amount of hay needed, and extra water required, although no account was made of water drunk. Nine and one-sixth pounds (83.3 per cent) more of hay was eaten with roots than with silage. This of course made so much additional cost in the ration where roots and silage are credited an equal value of three dollars per ton. The actual cost is, however, considerably less for and in favor of silage.

ROOTS AGAINST SILAGE. EXPERIMENT WITH BELLE AND MAY.

		DAILY CONSUMPTION.										DAILY PRODUCTION.			
		Weight of cow.	Hay.	Grain.	Roots (Mangolds.)	Protein.	Carbo-hydrates.	Fat.	Nutritive substance	Ratio 1 to	Cost in cents per day.	Yield of milk.	Per cent cream.	Yield of butter.	Butter per 100 lbs. milk.
First trial—Roots...	Belle............	Lbs. 981.	Lbs. 22.17	Lbs. 6.	Lbs. 40.	Lbs. 2.939	Lbs. 14.70	Lbs. .633	Lbs. 18.269	5.5	Lbs. 19.43	Lbs. 17.66	22.65	Lbs. 1.116	Lbs. 6.32
	May	1014.	21.52	6.	40.	2.894	14.349	.623	17.86	5.5	19.24	27.45	19.78	1.616	5.89
Fourth trial—Roots.	Belle............	987.	18.10	8.	40.	2.665	11.110	.704	11.479	4.8	20.47	15.02	21.05	.893	6.18
	May	975.	18.96	10.	40.	3.002	12.331	.803	16.136	5.8	22.96	25.80	19.64	1.643	6.39
Totals..............................		3957.	80.75	30.	160.	11.50	52.49	2.763	66.73	......	82.13	85.93	83.12	5.268	24.76
Averages		989.	20.19	7½.	40.	2.875	13.12	.691	16.69	5.2	20.53	21.48	20.78	1.317	6.127
German standard for 1000		......	......	......	..... Silage	2.5	12.5	0.40	15.4	5.4	......	......	......	......	......
Second trial—Silage	Belle............	974.	9.79	6.	38.69	2.15	11.853	.724	14.717	6.4	15.63	16.25	19.62	1.43	7.03
	May	958.	11.02	6.	40.00	2.218	12.637	.753	15.638	6.5	16.08	26.89	22.67	1.964	7.31
Third trial—Silage..	Belle............	980.	10.50	8.	38.93	2.577	13.031	.826	16.43	6.9	18.19	16.32	23.17	.857	5.39
	May	988.	12.35	10.	40.00	3.021	14.516	.949	18.49	6.6	21.05	28.39	19.18	1.437	5.13
Totals..............................		3900.	41.66	30.	157.62	9.993	52.037	3.252	65.275	......	70.95	87.85	84.64	5.394	24.86
Averages..............................		978.	11.015	7½.	39.4	2.498	13.007	.813	14.32	6.1	17.74	21.96	21.16	1.394	6.215

VARIETY TEST OF WHEAT.

This trial was made on plats E 1-14, which had been two years in straw crops. They had been plowed alike, but harrowed a different number of times both years. The first was with oats reported by Mr. Goff.*

The second crop was with Clawson wheat, which proved to be nearly a failure. Report of it has not been published. The yields stood in no direct relation to the times of cultivation, however, and No. 4, which had at one time been a "weed" plat, and which yielded the least crop of oats, produced a greater weight of cleaned grain than any other plat save No. 14, not cultivated after plowing, except the action of the drill hoes on the furrows. The cultivation before sowing was the same for wheat as it had been for oats, and the same for each individual plat. Nos. 1 and 14 were not harrowed at all, Nos. 2 and 13 were harrowed twice each, and each succeeding plat once more than the last until Nos. 7 and 8 were harrowed six times each. A ditch was dug diagonally across some of these plats in the fall after the wheat had come up, which materially interfered with the wheat on the middle ones. There was, however, a marked difference in the time of ripening on different plats. The grain ripened earliest on No. 4, followed closely by No. 2. Nos. 11, 12, 13 and 14 were next in order in ripening.

With this third straw crop on these plats, grown in 1890, the plats were crossed by the strips of each variety of wheat of which there was seed enough to reach across, in order that every variety should be subjected to as nearly as possible the same soil conditions. This was true of all the varieties except the three from the Canadian Experiment Station, of which one was sown across plats 1–7, and the other two across plats 8--14 and back across 14 and 13.

It seemed desirable to try only a few varieties of wheat from several sections of this country and from Canada. Accordingly, several varieties of winter wheat were selected and sown October third. These winter wheats were from W. L. Eastman, Ovid, N. Y.; Wm. McKane, Geneva, N. Y.; United States Department of Agriculture, and seed grown here at the Station. The California, South Dakota and Canadian Experiment Station wheats were all

*Seventh Annual Report, pp. 178–180.

spring grain, as also was that purchased of D. L. Wellman. These were sown in April.

There were eight varieties received from Professor William Saunders, director of the Canadian Experiment Station, but of five of these there was little more than enough for the trial of large against small seed by Mr. Churchill, and they were all devoted to that use, with the expectation of comparing the yields of individual plants. Only the three of which there was sufficient seed for both trials are included here.

A sample of Clawson wheat received from Mr. Eastman was from the original stock sent out by the United States Department of Agriculture, and was, as Mr. Eastman informed me, seventeen years old. None of the wheat grew, and none germinated in a trial of 100 kernels under favorable conditions.

Fulcaster, from the United States Department of Agriculture, the age of which was unknown, also failed to grow or to germinate. Both of these samples of wheat had a rancid flavor when chewed up. No opportunity has yet been presented of applying this taste test to old or badly-stored wheats as a criterion of their availability for seed.

The following table shows the source of each variety of wheat, the areas occupied, dates sown and harvested, rate of yield of grain and straw harvested, relation of grain to straw and other data :

NAME OF VARIETY.	Of whom obtained.	Date sown.	Weight seed sown.	Date panicled.	First bloom noted.	First ripe seed.	Date harvested.	Area in plat.	Wheat harvested.	Straw harvested.	Rate harvested per acre.	Relation of grain to straw harvested.	Weight struck, half bushel, at harvest.
Winter wheats—		1889.	Lbs.Oz					Sq. ft.	Lbs.Oz	Lbs.Oz	Bush		Lbs.Oz
Clawson	Sta	Oct. 30	......	June 7	June 13	July 14	July 15-16	5687.0	162-13	456-11	20. 8	2.81	28-13
Fulcaster	U. S. D. of A.	Oct. 30	......	June 7	....	July 14	July 16	710.8	37- 5	85- 5	38.11	2.29	31- 4
Landreth	W. L. E.	Oct. 30	3- 8	Later.	June 13	July 14	July 15-16	1654.0	55- 4	175-15	24.25	3.18	28-11
Mediterranean Hybrid	W. McK	Oct. 30	......	June 7	....	July 14	July 16	2844.0	91-14	222- 2	23.45	2.42	29-11
New Light Amber	W. L. E.	Oct. 30	3- 7	June 7	June 13	July 14	July 16	1654.0	64- 5	153- 3	28.23	2.38	30- 1
Spring wheat—		1890.											
Atlanti	Cal. E. S	Apr. 27	......	June 7	....	....	Aug. 22	253.0	0- 4¼	2-10½	0.76	10.00	....
Missoyen	Cal. E. S	Apr. 27	......	June 30	June 3	....	Aug. 1	253.0	4-11	22- 1	13.45	4.77	....
Palestine	Cal. E. S	Apr. 27	0-15	June 25	June 30	....	July 28	356.0	9- 2	38- 3	18.61	4.18	....
Petali	Cal. E. S	Apr. 27	1-00	June 25	June 30	....	July 28	275.0	9- 9	40-14	25.25	4.27	....
Ladoga	Ottawa E. S.	Apr. 26	2- 8	....	....	....	Aug. 6	746.0	4- 2	25-11	4.01	6.23	....
Red Fife	Ottawa E. S.	Apr. 24	2- 8	....	....	....	Aug. 6-13	968.0	8-10	33- 9	6.09	3.89	....
White Fife	Ottawa E. S.	Apr. 26	2- 8	....	....	....	Aug. 12	746.0	7-13	36- 0	7.6	4.61	....
Kubanka	S. Da. E. S	Apr. 21	......	June 30	July 3	....	Aug. 6	663.0	27- 4½	57- 7	29.87	2.11	....
Ladoga	S. Da. E. S	Apr. 21	......	June 30	July 3	....	Aug. 1- 6	711.0	9- 1	58-13	9.26	6.49	....
Pure Scotch Fife	S. Da. E. S	Apr. 21	7-15	June 30	July 3	....	Aug. 6	663.0	17- 1	60- 3	18.68	3.53	....
Saxonka	S. Da. E. S	Apr. 21	2-13	June 30	July 3	....	Aug. 6	613.0	11- 6	57-14	13.47	5.09	....
Wellman's Sask	S. Da. E. S	Apr. 21	1-15	June 30	July 3	....	Aug. 7	663.0	16-10	56- 3	19.28	3.38	....
Saskatchewan	D. L. W	Apr. 21	1- 9	June 30	July 3	....	Aug. 7-13	506.0	13-14	42-15	19.9	3.09	....
Wellman's Sask	D. L. W	Apr. 21	1-12	June 30	July 3	....	Aug. 7	569.0	11- 4	35- 1	14.35	3.12	....

The best record of winter wheats was made by Fulcaster, followed by New Light Amber. The spring wheats ranking best were Kubanka, Petali; Saskatchewan, from D. L. Wellman, and Wellman's, from S. D. Experimental Station, Pure Scotch Fife and Palestine in this order. Atlanti headed and ripened very unevenly. By the middle of September there were many heads which had panicled since the harvest. In this respect this sample resembled spring-sown winter wheat.

POTATO EXPERIMENTS, 1890.

The wet weather all through May made the planting late, and the main crop on B and F plats was not planted until May 30th and 31st. Subsequently some of the seed on B plats rotted, and a very poor stand was left. The stand on the F plats was much better.

The fertilizers were sown June second, under favorable circumstances, and all were evenly applied.

Planting and cultivation.—In order to secure exactness in spacing, these plats were all planted by a line and the seed covered about two inches deep.

Cultivators were run through the rows as often as needed to keep a layer of loose earth on the surface to prevent great losses of moisture.

The last hand work was done July 29th, when the rows were slightly hilled up, but the cultivators were narrowed up and run twice in a row later to prevent evaporation, as from the dry weather the soil was beginning to crack between rows.

What had been an exceedingly wet season up to the middle of June, turned to a very dry one during the time from June 20th to the middle of August. It was during this time the crop of tubers were set and checked both in the number set and in their growth.

Later, the fungous attack reduced the crop actually grown to a low percentage of merchantable tubers.

The proportion of affected tubers is so great, and not uniform for all plats, that it would destroy the whole value of the experiments to disregard the tubers grown which succumbed to disease, so they are given as harvested along with "merchantable" and "small."

This season the difference in amount of seed per acre has been reduced, and the number of different rates of seeding reduced from five to three. These changes should have given, other things equal, a better total crop and difference enough to show plainly the interest of the great majority of farmers in using sufficient seed to carry his crop along against all minor obstacles.

Last year, the "hills" harvested in every row were counted, and the percentage of those missing were calculated. This data allowed the calculation to a complete stand, which was done, and the small amounts of seed thereby shown in a much more creditable light than if actual yields had been used, as the small seed was the kind which failed. This year the count was not made, and actual yields must be used regardless of what the stand was. This prevents any conclusions being drawn from the crop on the B plats, on which too much water rotted the seed.

Some Extracts from Notes Relating to the Various Trials.

June 30. The growth of vines on Plats B 8, 9 and 10, is much larger than on B 11 and 12.

Potatoes on F plats are distinctly showing the difference in seeding.

Whole seeds shows largest tops.

Halves of larger tubers show smallest tops.

Quarters of still larger tubers show smallest tops.

July 9. B plats, showing greater differences from effect of water than anything else.

Some differences appearing where different sizes of tubers were planted, were in favor of the larger ones.

B 10 shows much lighter colored tops than the other B plats, due doubtless to lack of nitrogen in its fertilizer.

F plats.— Different amounts of seed show very plainly in the larger growth of tops where there was heaviest seeding.

Seed from three sources.— Can see no difference in growth of tops between the rows of similar seeding from the various sources of seed.

Fertilizer trial.— F 7 has the poorest stand of plants, appearing like B plats suffering from too much water, and 8 and 9 are somewhat affected.

July 11.— Foliage on F 5 is darker than on any other, while F 6 shows palest foliage of any of the whole block of plats.

While there are no very great differences in growth of vines, those on Plat 7 are smallest, and those on Plats 3, 6, 9, 11 and 12 are most vigorous.

August 14.— Very little difference discernible between growth of vines on B Plats where different amounts of seed were planted. Flea beetles are very numerous, and are doing much damage.

F plats.— The seed from Mr. Peck has produced the most vigorous vines, and these show least difference now for different amounts of seed.

Seed from Mr. Hood has produced least growth of vines, and these show most difference from different amounts of seed.

The Station grown seed has produced a medium growth of vines, and the difference in vines between two largest amounts of seed is trifling; the smallest amount of seed has given much less growth of tops so far..

Vines on Plats 3 and 12, where potatoes rotted last year, are beginning to be attacked by rot again. Plats 5 and 6 continue to show darker and lighter color of foliage than any other plats.

Destroying beetles.— The Colorado beetles were plentiful long before the potatoes were planted, and began their work of destruction on the first appearance of the plants. In anticipation of this attack, a Kendall Paris Green Distributor of ninety-three gallons capacity had been purchased of the Rodbourn Manufacturing Company, Breesport, N. Y. This was started June sixteenth, using London purple at the rate of thirteen and one-half ounces for each tank full of water to poison the beetles. Soft masses of the purple stopped the fine holes of the nozzles until coarser ones were tried and the distribution bettered.

The London purple did not prove satisfactory, in that it failed to kill the beetles, and Paris green was substituted. Eight ounces of Paris green to every tank full of water cleared the vines of Colorado beetles, but did not affect the flea beetles which appeared in swarms. Twelve ounces were tried without effect save to injure vines wherever the machine stopped.

Tansey tea, kerosene emulsions,† and tobacco water‡* were each given a trial in the strengths which have been recommended, but the swarms of flea beetles remained undiminished.

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* First Annual Report State Entomologist, page 65, for Cucumber Flea Beetles.

† New York State Agricultural Experiment Station Report, 1884, page 315.

‡ Suggested by do., page 59.

A new machine brought to the Station for trial by the inventor, under the name of "Ansley's Potato Bug Catcher," was run for a trial in the garden where the beetles had been recently poisoned, and consequently few were gathered by its fans into the trays. But it was noticed that there were many flea beetles collected. The beetles are brushed into a shallow pan, in which a small quantity of kerosene has previously been put, and one horse draws the machine, which covers two rows at a trip. This machine was passed several times over our B, C and D plats, and proved a veritable flea beetle collector, and the only thing we tried which could materially diminish their numbers. To those who object to the use of poison, this machine offer a fairly rapid means of destroying the Colorado beetles, while it adds the flea beetles, as well as lady bugs and everything else the paddles can brush into the pans. It will go over about twice as much ground with the operator walking and guiding it as can be cultivated once in a row with the same horse and driver.

The Kendall Paris Green Distributor will poison about the same area, but the poison seems to have no effect on the flea beetle, and does no direct harm to friendly insects unless some are poisoned by eating poisoned beetles.

DIFFERENT AMOUNTS OF SEED.

B plats.— On each of the tenth acre B plats 8, 9, 10, 11 and 12 were planted three rows each of three different sizes of whole tubers carefully selected of even sizes, so the weight of the eighty-eight tubers of smallest size required for one row was eleven pounds, eighty-eight tubers of medium size required for one row was sixteen and one-half pounds, eighty-eight tubers of largest size required for one row twenty-two pounds. The seeding per acre and result of trial are given below :

SEED, WHOLE TUBERS.

PLATS.	Sixteen and One-half Bushels per Acre.						Twenty-four and Three-quarter Bushels per Acre.						Thirty-three Bushels per Acre.					
	Merch.		Rotten.		Small.		Merch.		Rotten.		Small.		Merch.		Rotten.		Small.	
	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.
B 8	70	2	84	9	22	1	86	1	93	2	17	14	104	7	116	2	14	9
B 9	85	2	91	12	16	1	78	6	115	10	12	9	85	13	132	10	15	12
B 10	91	1	78	7	13	14	98	11	94	2	17	1	106	7	122	12	17	9
B 11	44	9	67	5	8	0	45	13	53	3	10	10	55	0	76	4	15	14
B 12	56	6	81	11	8	4	55	14	119	3	11	1	65	13	122	7	12	9
Totals	347	4	403	12	68	4	364	13	475	4	69	3	417	8	570	3	76	5
Yields per acre, bushels	34.7		40.4		6.8		36.5		47.5		6.9		41.8		57.0		7.6	
Total yields per acre, bushels	81.9						90.9						106.4					

Where so large a part of the tubers were rotten, it is probable there were many grown which were not weighed at all. There was a poor "stand" of plants, many missing "hills," on these plats due to heavy rains early in the season.

F plats.— Nos. 3 to 12, inclusive, have produced several crops of potatoes in succession, and this is the third year this crop has received the same formulas of fertilizers on these plats. Nos. 1 and 2 have been planted to cucurbits and turnips, and were fallowed part of the time. This trial of different amounts of seed covers Plats 2 to 12 inclusive, but there is some doubt as to whether No. 12 was planted and harvested in the same order, hence the yield from that plat is dropped. The rows on Plat 12 were at right angles with those on the other eleven plats. The first eleven of these plats were planted with rows running crosswise to facilitate cultivation and the application of arsenites by horse power. No. 12 is the first of another block with a wide path between it and No. 11. The rows were three feet eight inches apart, and the "hills" were eighteen inches apart in the row. This seed was all carefully selected of uniform size, so the weight for each row of twenty-two "hills" of each different form and amount was a duplicate of all the others of its kind.

These weights were of whole tubers, five and one-half pounds per row; half tubers, three and three-fourths pounds per row; quarter tubers, two and one-half pounds per row.

The order of planting was, beginning on the northwest corner, a row of whole tubers across the north ends of the plats. The second row was of half potatoes of larger size for seed, and the third row was planted with quarters of still larger tubers. The next three rows were a repetition of the order and amounts of seed and of the same kind (White Star), but was grown on different soil. The third three was the same, but was grown on another farm. The last nine of the eighteen rows per plat were duplicates of the first nine. The spaces between plats were left blank and were cultivated. There was a marked difference in the growth of tops early in the season, which gradually became less later. The tops from whole seed obtained a start of the others and made a stronger growth. The following table shows the yields by plats and different amounts and forms of seed:

F PLATS SEED CONSISTED OF

PLAT.	WHOLE TUBERS—THIRTY-THREE BUSHELS PER ACRE.						HALF TUBERS—TWENTY-TWO AND ONE-HALF BUSHELS PER ACRE.						QUARTER TUBERS—FIFTEEN BUSHELS PER ACRE.					
	Merch.		Rotten.		Small.		Merch.		Rotten.		Small.		Merch.		Rotten.		Small.	
	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.
F 2	105	6	14	15	23	15	83	10	11	15	21	14	69	8	12	10	18	3
F 3	84	....	4	3	31	3	89	....	3	12	24	9	64	1	10	2	16	6
F 4	77	6	10	9	24	6	72	5	4	6	16	6	54	9	3	3	13	.....
F 5	80	7	....	5	19	13	64	9	....	8	21	2	54	....	....	....	14	9
F 6	104	12	10	3	24	15	78	6	8	2	13	1	75	13	5	11	9	10
F 7	79	11	11	5	17	3	50	6	6	9	8	6	48	7	5	1	7	13
F 8	82	7	10	14	23	14	66	6	13	3	17	2	66	8	5	14	10	1
F 9	90	5	19	5	25	12	75	15	9	5	16	2	57	1	10	1	8	7
F 10	76	15	27	12	23	....	65	3	17	11	15	6	62	8	11	7	7	11
F 11	86	....	32	....	19	3	66	15	22	14	15	4	70	4	16	6	9	5
F 12	80	2	45	13	17	1	74	11	36	12	8	4	50	6	27	13	10	11
Totals	947	7	187	4	250	5	787	6	135	1	177	8	673	1	108	4	125	12
Yields per acre, bushels	86.13		17.32		22.75		71.58		12.28		16.14		61.18		9.84		11.43	
Total yields per acre, bushels	125.9						100.0						82.45					

Small as is this yield, the large amount of seed pays for itself and enough more for a margin of profit over each of the lots seeded lighter. If the rotten tubers were to be counted as part of the merchantable, then the profit would be increased considerably. This but emphasizes our last last year's conclusions.*

WHICH ELEMENT OF FERTILITY IS DOMINANT FOR POTATOES?

This experiment was expected to show something in favor of either muriate or sulphate of potash as a potato manure, and some difference, if there was any, between nitrate of soda and ammonium sulphate for the same purpose as well as to compare the value of the effect of the elements nitrogen and potash for this crop.

Our this season's crop on the B plats is of no value for this experiment on account of poor stand. The yields on F plats may be fairly compared. Every controllable factor has been kept uniform for all these plats, F 3–12, except that of fertilizers and the rotting of tubers. The plats, fertilizers applied, and crops harvested are given in the table below, in which the crop is shown as merchantable, rotten, and small tubers, and the merchantable, merchantable and rotten combined, and total yields are calculated to yields per acre.

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* Eighth Annual Report, pages 225-234.

Plat.	FERTILIZER.	Amount per acre.	Merch. tubers.		Decayed tubers.		Small tubers.		Merch. tubers per acre.	Merch. and rotten tubers per acre.	Total tubers harvested per acre.
		Lbs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Bushels.	Bushels.	Bushels.
F 3	Dissolved bone black Ammonium sulphate Potassium chloride	400 400 400	237	1	18	1	72	2	79.0	85.0	109.1
F 4	Dissolved bone black Ammonium sulphate Potassium sulphate*	400 400 300	204	4	18	2	53	12	68.1	74.1	92.0
F 5	Dissolved bone black Ammonium sulphate	400 400	199	0	0	13	55	8	66.3	66.6	85.1
F 6	Dissolved bone black Ammonium sulphate Potassium chloride	400 400 600	261	15	24	0	47	10	87.3	95.3	111.2
F 7	Dissolved bone black Ammonium sulphate Potassium sulphate	400 400 450	208	8	22	15	33	6	69.5	77.1	88.3
F 8	Dissolved bone black Potassium sulphate Sodium nitrate	400 300 500	235	5	29	15	51	1	78.4	88.4	105.4
F 9	Dissolved bone black Potassium sulphate Ammonium sulphate	400 300 400	223	5	38	11	50	5	74.4	87.3	104.1
F 10	Dissolved bone black Potassium sulphate	400 300	204	10	56	14	46	1	68.2	87.2	102.5
F 11	Dissolved bone black Potassium sulphate Sodium nitrate	400 300 250	223	3	71	4	43	12	74.4	98.15	106.1
F 12	Dissolved bone black Potassium sulphate Ammonium sulphate	400 300 200	205	3	110	9	36	0	68.4	105.25	117.2

* All the potassium sulphate used in 1890 was sixty per cent. K_2SO_4.

In my last report on this fertilizer experiment the decayed tubers were not included in the table "because of variations which could have been introduced by incorporating the weights of decayed tubers which varied between being only partially involved and almost or entirely consumed." The pounds of decayed tubers from each plat were shown, but they were not included, as so many tubers grown, as given in the table above. This seems the only way to give a fair comparison between these plats this year because of so large a percentage of spoiled tubers which it seems fair to include, and although it is obviously not strictly accurate to use these weights, yet, by showing the yields as near actual production as possible, the results of the fertilizer test will stand more nearly in their true relation.

INFLUENCE OF POTASH AND NITROGEN ON YIELD OF TUBERS IN BUSHELS PER ACRE — F PLATS.

	Potassium Chloride.				No Potash.				Potassium Sulphate.		
	Merchantable.	Merchantable + rotten.	Total, including small.		Merchantable.	Merchantable + rotten.	Total, including small.		Merchantable.	Merchantable + rotten.	Total, including small.
	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.
F 3	79.	85.	109.1	F 5	66.3	66.6	85.1	F 4	68.1	74.1	92.
F 6	87.3	95.3	111.2	....	......	......	......	F 7	69.5	77.1	88.2
Means..........	83.	90.2	110.15	....	66.3	66.6	85.1	....	68.8	75.6	90.1

	Sodium Nitrate.				No Nitrogen.				Ammonium Sulphate.		
	Merchantable.	Merchantable + rotten.	Total, including small.		Merchantable.	Merchantable + rotten.	Total, including small.		Merchantable.	Merchantable + rotten.	Total, including small.
	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.
F 8	78.4	88.4	105.4	F10	68.2	87.2	102.5	F 9	74.4	87.3	104.1
F11	74.4	98.2	112.7	....	......	......	......	F12	68.4	105.3	117.3
Means..........	76.4	93.3	109.1	....	68.2	87.2	102.5	....	71.4	96.3	110.7

An examination of the accompanying table will show that the application of potassium chloride to Plats 3 and 6 increased the crop considerably over that on F 5, on which the same amount of seed and fertilizing elements were applied, but which received no potash. The larger amount on Plat 6 gives an increased yield over Plat 3. This third application of the same fertilizers for potatoes, on the same plats, seems to have increased the yields this season on an average of the two, as compared with the one receiving no nitrogen, by 16.7 merchantable, 23.6 where the weight of decayed tubers are added to the merchantable, and twenty-five bushels per acre where the small tubers are included. In the same way the application of potassium sulphate shows a small increase over the plat without potash. This increase is, however, too small to make this a profitable investment.

Last season there was a smaller yield from each crop of the plats receiving sodium nitrate than from the one receiving no nitrogen. This season these yields have advanced while those receiving ammonium sulphate have not kept up last year's relation, although the mean gain has been 3.2 bushels per acre for merchantable, 9.1 bushels merchantable and decayed, and 8.2 bushels total per acre. These results indicate: First. That for potatoes, potassium chloride is a good, safe fertilizer, even on some clay soils where potash may be said to be present in considerable quantity. Second. That while potassium sulphate helps the crop, it is far less effective than the chloride and not desirable when chloride can be obtained. Third. That the appiications of nitrogen in sodium nitrate and ammonium sulphate have been beneficial on some plats, but always at too great cost for profit. This element for potatoes should be supplied in the clover turf turned under to grow it, or from some other cheaper source.

Changing Seed Potatoes, or Growing Potatoes from Seed Raised at a Distance or on Different Soil.

There is an old custom among our best farmers of changing seed potatoes from one kind of soil to another, in the belief that the prolificacy is thereby increased, and that they secure a better yield from so doing. A trial of this was planned as a part of the potato work for this season, and White Star seed was obtained of Mr. Frank Hood, of Oaks Corners, N. Y., and also of Mr. Chas. E. Peck, of Phelps, N. Y. Both gentlemen raised

White Star potatoes, but of a somewhat different character. Mr. Peck's White Stars were nearly like those grown here at the Station, differing in having rather deeper eyes. The White Stars grown by Mr. Hood have been selected for compactness and shallow eye for several years. These were grown on sandy soil. Mr. Peck considered the soil of his potato field very much like that of our plats. The Station grown seed compared with these has been grown on the Station plats since 1882, and no new seed introduced until this trial began.

The seed from these three sources was planted on the F plats, 1–12, inclusive, in the following order: Three rows of Station seed (except on F 1), first, whole tubers; second, half tubers; third, quarter tubers, as before described under "Different Amounts of Seed;" then three rows were planted with seed from Mr. Hood, and the third three rows with seed from Mr. Peck. These were all repeated in the same order, making eighteen rows in all across each of the twelve plats. On the first plat, F 1, all whole seed was used, and the seeding for every row was of even sized tubers, weighing five and three-quarter pounds per row for every row on the plat.

RESULTS FROM SEED TUBERS GROWN ON DIFFERENT SOILS.

	STATION GROWN SEED.						SEED GROWN BY MR. HOOD.						SEED GROWN BY MR. PECK.					
	Seed, whole-tubers, 33 bushels per acre.		Seed, half-tubers, 22½ bushels per acre.		Seed, quarter-tubers, 15 bushels per acre.		Seed, whole-tubers, 33 bushels per acre.		Seed, half-tubers, 22½ bushels per acre.		Seed, quarter-tubers, 15 bushels per acre.		Seed, whole-tubers, 33 bushels per acre.		Seed, half-tubers, 22½ bushels per acre.		Seed, quarter-tubers, 15 bushels per acre.	
	Rows 1 and 10.		Rows 2 and 11.		Rows 3 and 12.		Rows 4 and 13.		Rows 5 and 14.		Rows 6 and 15.		Rows 7 and 16.		Rows 8 and 17.		Rows 9 and 18.	
	Lbs.	Ozs.	Lbs.	Ozs	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.
Total merchantable	321	1	262	5	225	11	252	12	215	12	162	1	379	10	309	9	286	5
Total rotten	75	15	50	9	40	5	47	8	32	7	26	15	63	13	52	1	41	0
Total small	78	10	55	11	38	4	100	5	64	1	47	5	72	0	58	12	40	3
Grand totals	475	10	368	9	304	4	400	8	312	4	226	5	515	7	420	6	367	8
			1148	7					939	1					1303	5		
Total bushels per acre produced			104	4					85	1					117	5		

To the above may be added the yield from Plat F 1, on which all whole tubers were used for seed, at the rate of twenty-three bushels per acre in rows which were continued on from the other plats. These tubers were carefully selected of even size, so each set of three rows received exactly eleven and one-half pounds of seed. The yield from each lot of seed was:

	Rows.	Merch.		Rotten.		Small.		Totals.	
		Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.
Station grown seed	First three	42	11	16	0	8	8	142	6
	Fourth three..	49	8	17	4	8	7		
Seed grown by Mr. Hood on sandy land	Second three..	31	9	17	10	7	6	110	0
	Fifth three	28	14	15	2	9	7		
Seed grown by Mr. Peck.	Third three ...	58	1	14	4	8	15	148	12
	Sixth three....	48	4	11	2	8	2		
		258	15	91	6	50	13	401	2

This trial is not favorable to the practice of changing seed. There was a gain from one lot over home grown seed, but it was more than offset by the smaller yield or tubers from the seed grown on sandy land.

PLOWING UP TO POTATOES VS. COMMON CULTIVATION.

A correspondent of this Station wished some experiments made in plowing up to the rows once or twice, but it was too late in the season to make a trial on a large scale. There were three twentieth acre plats available, however, and late as it was, June 16th, they were planted with equal amounts of seed put in "hills" one and one-half feet apart in the row, while the rows were forty inches apart.

They were cultivated once in a row July 9th, and six rows on each plat plowed up so as to completely cover the vines. Four rows on each plat were hoed without hilling up.

On July 18th, the potatoes on these plats having made a good growth were all cultivated and three of the rows plowed a second time. In order to make this work complete, all the parts not well covered were hoed up high. These rows looked much like well banked rows of celery when completed.

The number of "hills" in each row were taken at the time both plowings were done. The numbering of rows below begins on west side for C 1 and on the east for C 2 and 3:

Number of row.		July Nine.			July Eighteen.		
		C 1.	C 2.	C 3.	C 1.	C 2.	C 3.
1	Flat culture	14	39	31	30	41	41
2	Flat culture	15	26	32	33	42	40
3	Flat culture	29	43	31	38	43	39
4	Flat culture	30	37	30	39	42	41
5	Plowed up once	39	36	34	41	42	34
6	Plowed up once	39	35	35	42	37	39
7	Plowed up once	40	40	39	40	41	41
8	Plowed up twice	43	41	30	41	36	32
9	Plowed up twice	39	36	36	39	36	36
10	Plowed up twice	41	37	28	42	34	31

An examination of the growth on July 26th, showed the following relative condition :

Plat C 1. Foliage on rows not plowed leading in size.

Plat C 1. Foliage on rows plowed once and twice about equal.

Plat C 2. Foliage on rows not plowed shows much better than on those plowed once, and those plowed twice, much less than on once plowed rows.

Plat C 3. Foliage shows best growth on not plowed rows.

Plat C 3. Second best growth on rows plowed once, and poorest growth on rows plowed twice ; but the differences on this plat are much less than on plat C 2.

On August 14th, the comparisons of growth were recorded thus :

C 1. A little difference here in favor of once and twice plowed.

C 2. A little difference here in favor of not plowed once and twice plowed even.

C 3. Size and appearance about equal for all, but the plants on north end of rows not plowed are rather puny.

The last comparative notes made were on September twelve.

On plat C 1 the rows plowed once and twice were called qual and apparently led those not plowed in growth and vigor.

On plat C 2 there was scarcely if any difference between the growth and appearance of rows plowed or not plowed, and on plat C 3, there was some difference between the plowed rows ; those plowed twice were leading, while those not plowed were behind in stature and amount of foliage.

YIELD OF TUBERS.

PLAT.	Nearly Flat Culture. Four Rows Per Plat.						Plowed up Once. Three Rows Per Plat.						Plowed up Twice. Three Rows Per Plat.					
	Merch.		Rotten.		Small.		Merch.		Rotten.		Small.		Merch.		Rotten.		Small.	
	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.	Lbs.	Ozs.
C 1	22	15	36	1	17	2	21	9	50	0	10	15	30	4	24	1	7	9
C 2	46	6	78	8	19	15	31	5	26	14	10	15	24	15	21	8	6	15
C 3	29	0	64	2	15	5	34	5	22	6	11	6	31	11	27	0	6	4
Total yields	98	5	178	11	52	6	87	3	99	4	33	4	87	14	72	9	20	12
Yields calculated per one-twentieth acre	81	15	148	15	43	10	96	14	110	4	36	15	97	12	80	10	23	1
Total yields			274	8					244	1					201	7		
Yields per acre, bushels			91.5						81.4						67.1			

The growth of foliage indicated that great benefit could be derived from the ploughing up, but these plats were planted too late for any benefit to be derived from the practice of ploughing up, as the plants checked by it at first, although recovered sufficiently to make the greater growth above ground, had not time thereafter to make a corresponding growth of tubers. Had the crop been planted and ploughed up to earlier, there would in all probability have been an opposite result in the amount of crop produced.

AFTER EFFECT OF FERTILIZERS IN FIELD G — 1889.

One-twentieth acre plats were measured off, one on each of the fertilizer plats for grass in 1888, to which no fertilizer was applied this year. The other part of the field was dressed with stable manure at the rate of fifteen loads per acre. The crop was King Philip corn, sown in drills with a wheat drill sowing at the rate of one and one-fourth bushels, but only dropping seed in two rows at the rate of ten quarts per acre. The distance between the drills was three and one-third feet.

The yields from plats a and b were comparatively low, showing the stand of corn was poor, rather than any after effect of fertilizer. Presuming the stand of corn to have been fairly even on the other plats, the yields from the unmanured plats e. and j. (o bore B & W corn), were at the rate of 24,200 and 21,440 pounds per acre. Comparing the yields of the other plats with the mean of these, g and d yielded respectively 500 and 1,300 pounds greater than the mean, but both are less than the yield from e. The plats which have given yields greater than the above mean and also greater than e, are c, f, h, k and l.

Considering the little influence of the application the first year,* these differences seem to be rather more dependent on the stand of corn than anything else, especially as no difference of growth has been noticeable during the whole season. The table appended shows the crop actually harvested, and its rate per acre, with the increased yields above the mean of the unmanured plats wherever an increase occurred.

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* Seventh Annual Report, page 342.

PLAT.	Crop harvested.	Per acre.	Excess of yield over mean of unmanured.
	Pounds.	Pounds.	Pounds.
a	948	18960	....
b	825.5	16510	....
c	1460	29200	6380
d	1206	24120	....
e	1210	24200	....
f	1452	29200	6220
g	1166	23320	....
h	1368	27360	4540
i	1258	25160	2340
j	1072	21440	....
k	1450	29000	6180
l	1420	28400	5580
m	896	17920	....
n	1136	22720	....

REPORT ON LYSIMETERS FOR 1889.

The drainage from the three old lysimeters was running so even in composition that the chemist has made no examination of the water from them the past season. The chief interest centering in this work for this year is the initial behavior of the new lysimeters which have been fitted with apparatus for the determination of the evaporation as well as drainage from the lysimeter. Hence this report is made simply to give the record of what has been done to those of our constituency who are interested in this line of investigation. This new feature in lysimetry seems to be justly regarded as an important step in advance in gaining an insight into the physical forces which are at work in the soil.

The old form of lysimeters can not be depended upon to show any phenomena in common with the surrounding soil. This becomes evident when one considers that because the lysimeter soil is cut off from the subsoil during a period of drouth it becomes excessively dry and then when rain enough to saturate has fallen there is only the depth of the lysimeter to be filled, but it may hold far more than an equal depth of like soil which has been all along drawing on the water table in the subsoil for water.

This dessication invites a wider range of temperature, freer exposure to air and probably other potent causes of change to which the natural soil is not subject. In this new feature we have a method of supplying water at the bottom of a column of soil and to observe not only how much and what the character of the drainage water is, but how much water is required to supply that column in droughty periods, from a constant water table at a given depth.

If this method of supply and measurement of receipts and expenditure of water works well, then, in order to attain more nearly to the actual physical conditions of our soils there must be variation of this water table in harmony with that of the natural soil, or a considerable number of different depths must be studied to enable a fairly accurate generalization to be made as to subjects with which lysimetry deals.

Preparation of the New Lysimeters.

The details of construction, placing, and the principle involved in working these lysimeters was given by one of the inventors.* The samples of soil taken at the time of filling the lysimeters were subjected to moisture determinations, and the following data, including the moisture determinations have been compiled from the records made by Mr. Goff.

Composition of Samples of Soil Taken when Lysimeters were Filled.

	Fresh weight, grams.	Dry weight, grams.	Gravel contained, grams.	Water contained, grams	Per cent of water in soil.
Lysimeter No. 1, three feet deep, filled with soil *in situ:*					
First foot from surface	168.2	138.2	10.0	30.0	18.96
Second foot from surface	237.9	201.3	11.4	36.6	16.16
Third foot from surface	251.5	214.9	34.1	36.6	16.81
Total	657.6	554.4	55.5	103.2	17.12
Per cent of gravel	......	8.4	......	......	.....
Lysimeter No. 2, six feet deep, filled with soil *in situ:*					
First foot from surface	204.8	185.3	12.5	19.5	10.14
Second foot from surface	186.7	159.3	11.0	27.4	15.59
Third foot from surface	215.8	192.0	26.4	23.8	12.57
Fourth foot from surface	186.8	172.4	45.9	14.4	10.20
Fifth foot from surface	230.4	208.9	35.9	21.5	11.05
Sixth foot from surface	206.7	187.3	91.7	19.4	16.87
Total	1231.2	1105.2	223.4	126.0	12.50
Per cent of gravel	......	18.1	......	......	.....

*Seventh Annual Report New York Agricultural Experiment Station, pp. 187-191.

This table may be supplemented by the following notes:

Lysimeter No. 1.—For the first six or eight inches in depth the soil is a tenacious black loam free from gravel. Below that a tenacious yellow clay free from gravel is about a foot thick. Then a stratum was encountered containing a considerable proportion of coarse gravel, with numerous stones four to six inches in diameter.

Lysimeter No. 2.—The soil chosen for this lysimeter (a poor sod at the west end of G plats), was exceedingly hard and dry on the surface. The clay appeared to come to the surface; is extremely tenacious. Very few stones were encountered in the first two feet. In one corner of the excavation, where the ground had been ploughed in spring but not afterward worked, the soil was very perceptibly moister than elsewhere, to the depth of at least two feet. At a depth of two and one-half feet a layer of dark colored gravel mixed with very tough clay was encountered. At the depth of five feet this changed to a tough yellow clay nearly free from stones.

The soil used in filling the other two lysimeters (Nos. 3 and 4) was taken from the surface of the open part of the west garden, between the old apple orchard and railroad cut. The dry clods were picked up early in August, after a month of dry weather, and stored in the barn, where they were crushed and the soil sifted through a sieve of ten meshes to the inch. Sand for the bottoms was thoroughly washed, and was fairly dry when used. At the time of filling (August thirty-one), a sample of the sand for lysimeter No. 4, three feet deep, was dried and found to contain .126 per cent of moisture. A depth of six inches of this sand, weighing 221 pounds, was put in the bottom; then a depth of three feet of the sifted soil was put in. This weighed 988 pounds. A moisture determination in duplicate showed 4.05 per cent of water, viz.:

	Grams.	Grams.	Grams.
First sample	174.4	166.9	7.5 water equal to 4.36 per cent.
Second sample ...	162.2	156.1	6.1 water equal to 3.76 per cent.

Lysimeter No. 3 (six feet deep) was filled September 15th. The sand for the bottom contained less than .04 per cent of water. Of this sand, 221.5 pounds were put in the bottom. Then 2023.75 pounds of the sifted soil was put in to fill up the lysimeter to the surface with a column of six feet of soil. This soil contained .34 per cent of moisture. The two surface-filled lysimeters (Nos. 3 and 4) were covered until November 8, 1888. From that date all precipitation must be added as moisture to help wet down the dry mass.

There was considerable delay in getting the graduated cylindrical reservoirs properly made, and the first connection of the apparatus to supply water to the bottom of the first lysimeter (No. 1) was made by Mr. Goff late in March, 1889. In the meantime this lysimeter had been saturated by the rainfall, and there had been considerable drainage therefrom.

None of the others were saturated until after being connected.

No. 2 was connected April 9, 1889.

No. 3 was connected April 14, 1889.

No. 4 was connected April 11, 1889, but the cock was out of order until April 27, 1889.

The following tabulated record shows the amount of water added at bottom and top of the three unsaturated lysimeters to completely wet them and start drainage. After being wet down the soil in Nos. 3 and 4 settled. They were filled to the surface mark by the addition of some of the same soil used in the original filling. No. 3 received 75.34 pounds and No. 4 received 46.19 pounds.

TABLE I.

	Rainfall in inches.	Rainfall per lysimeter in cu. cent.	No. 1. Drainage.	No. 1. Water added at surface.	No. 1. Water absorbed from reservoir.	No. 2. Drainage.	No. 2. Water added at surface.	No. 2. Water absorbed from reservoir.	No. 3. Drainage.	No. 3. Water added at surface.	No. 3. Water absorbed from reservoir.	No. 4. Drainage.	No. 4. Water added at surface.	No. 4. Water absorbed from reservoir.
			C. c.	C. c.	C. c.	C. c.	C. c.	C. c.	C. c.	C. c.	C. c.	C. c.	C. c.	C. c.
Sept. 15 to Nov. 7, 1888, inclusive	5.50	56529.	......	......	......	......	......	......	......	......	......	......	......	......
Nov. 8, 1888, to March 31, 1889, inclusive	6.806	69952.	......	......	......	......	......	......	......	......	......	......	......	......
April 25	....	......	......	......	......	......	8000.	......	......	8900.	......	......	......	......
April 27	....	......	......	......	......	......	......	......	......	16000.	......	......	......	......
May 1, for April	3.28	33712.	21075.	......	190.	20000.	......	1055.	......	......	18030.	......	......	2200.
May 1	....	......	......	......	......	......	......	......	......	16000.	......	......	16000.	......
May 2	....	......	......	......	......	......	......	......	......	8000.	......	......	8000.	......
May 5	....	......	......	......	......	......	......	......	......	8000.	......	......	8000.	......
May 7	....	......	......	......	......	......	......	......	......	16000.	......	......	8000.	......
May 8	....	......	......	......	......	......	......	......	......	16000.	......	......	16000.	......
May 23	....	......	......	......	......	......	......	......	......	16000.	......	......	......	......
May 24	....	......	......	......	......	......	......	......	......	8000.	......	......	......	......
May 25	....	......	......	......	......	......	......	......	......	16000.	......	......	......	......
May 26	....	......	......	......	......	......	......	......	......	15000.	......	......	......	......
June 1, for May	1.21	12436.	11000.	......	450.	+2500.	......	435.	16700.	......	12138.	9125.	......	1753.

NOTE.—The figures in this table can be read as litres by regarding the decimal point removed three places to the left.

As above noted, No. 1 was saturated and some drainage had been noticed in March before being connected with supply reservoir.

Balance sheet for the other three lysimeters:

No. 2.

		Litres.
Rainfall, September 15, 1888 to May 1, 1889		160.193
Added above, April 25, 1889		8.000
Added or absorbed from below in April, 1889		1.055
Total		169.248
Drainage, last of April		20.000
Approximate amount required for saturation and evaporation to May 1, 1889		149.248

No. 3.

		Litres
Rainfall, November 8, 1888 to June 1, 1889		116.100
Added above		143.900
Added or absorbed from below, April	18.030	
Added or absorbed from below, May	12.138	
		30.168
Total		290.168
Drainage, last of May		16.700
Approximate amount required for saturation and evaporation to June 1, 1889		273.468

No. 4.

		Litres.
Rainfall, November 8, 1888 to June 1, 1889		116.100
Added above		56.000
	Cubic centimeters.	
Added or absorbed below in April	2200	
	1753	
		3.953
Total		166.053
Drainage, May 8 to June 1, 1889		9.625
Approximate amount required for saturation and evaporation to June 1, 1889		156.428

This approximation is not easily divided to show either saturation or evaporation, owing to two things:

The unknown evaporation for the period between filling and complete saturation; and the amount of water still in the lysimeters which in time will slowly drain out.

This last may be illustrated by the rainfall and drainage for April and May. There was considerable rain the last of April:

	Inch
April 25	.85
April 26	.06
April 27	1.21
April 28	.83
April 29	.12

It was passing off as drainage for some time after May 1st. May was a dry month, and the light rainfall scarcely exceeds the drainage, as shown by lysimeter No. 1. But No. 2, being deeper, was more conservative than No. 1 in this month. This one gave off very little drainage, most of which was during the last night of the month, and shows a larger amount of moisture held or evaporated. This will be seen in the amounts set against evaporation to establish equilibrium in the following table:

	APRIL.	MAY.	
	No. 1. Litres.	No. 1. Litres.	No. 2. Litres.
Rainfall	33.712	12.436	12.436
Absorption	1.90	.450	.425
	33.902	12.886	12.861
Drainage	21.075	11.000	2.500
Evaporation	12.827	1.886	10.361

An element which adds to the above difference is the inclusion of considerable drainage which really belongs to the June record. A heavy rainfall after 6 P. M., May 31st, amounted to 2.24 inches. At 7 A. M. before the drainage was turned off and measured, several litres of drainage water had passed off from each lysimeter. This rapid drainage was so unexpected that the receptacles for Nos. 1 and 2 filled and overflowed on the morning of June 1st before the morning inspection and monthly measurements were made at 7 A. M.

The tables following give the rainfall, drainage and evaporation for both the new and old lysimeters for the remainder of the year. The volumes for the new lysimeters are given in litres and those for the old ones are in inches as published heretofore.

The percentage serve as a means of comparison between the two sets for which a different unit has been adopted.

TABLE No. III.—NEW LYSIMETER RECORD, JUNE TO DECEMBER, INCLUSIVE, 1889.

New lysimeters.		June.	July.	August.	September.	October.	November.	December.
		Litres.	Litres.	Litres.	Litres.	Litres.	Litres.	Litres.
No. 1	Rainfall on lysimeter	76.777	46.868	20.299	25,695	34.123	35.356	16.650
	Absorption by lysimeter from reservoir	.198	.085	.042	.027	.008	.010	.012
	Total water supplied	76.975	46.953	20.341	25.722	34.131	35.366	16.662
	Drainage from lysimeter	28.600	19.200	5.300	8.900	6.500	31.550	13.700
	Per cent drainage to rainfall	37.25	40.96	26.11	34.64	....	....	....
No. 2	Rainfall on lysimeter	76.777	46.868	20.299	25.695	34.123	35.356	16.650
	Absorption by lysimeter from reservoir	.113	.180	.070	.115	.096	.030	.036
	Total water supplied	76.890	47.048	20.369	25.810	34.219	35.386	16.686
	Drainage from lysimeter	16.500+	.250	3.300	5.200	12.000	28.200	12.750
	Per cent drainage to rainfall	21.49	.53	16.26	20.24	....	....	....
No. 3	Rainfall on lysimeter	76.777	46.868	20.299	25.695	34.123	35.356	16.650
	Absorption by lysimeter from reservoir	.186	.123	.001	.071	....	.595	.288
	Total water supplied	76.963	46.991	20.300	25.766	34.123	35.951	16.938
	Drainage from lysimeter	33 463	10.500	9.000	4.800	8.000	22.550+	23.400
	Per cent drainage to rainfall	43.58	22.40	44.34	18.69	....	....	....
No. 4	Rainfall on lysimeter	76.777	46.868	20.299	25.695	34.123	35.356	16.650
	Absorption by lysimeter from reservoir	.104	3.798	.560	.248	.386	.013	.010
	Total water supplied	76.881	50.666	20.859	25.943	34.509	35.369	16 660
	Drainage from lysimeter	35 600	14.800	7.000	9 300	15.800	35.500+	19.350
	Per cent drainage to rainfall	46.37	31.60	34.46	36.19	....	....	....

Table No. III.—New Lysimeter Record, June to December, Inclusive, 1889.

New lysimeters.		June.	July.	August.	September.	October.	November.	December.
		Litres.	Litres.	Litres.	Litres.	Litres.	Litres.	Litres.
No. 1	Rainfall	76.777	46.868	20.299	25.695	34.123	35.356	16.650
	Absorption	.198	.085	.042	.027	.008	.010	.012
	Total	76.975	46.953	20.341	25.722	34.131	35.366	16.662
	Drainage	28.600	19.200	5.300	8.900	6.500	31.550	13.700
	Evaporation and retained in lysimeters	48.375	27.753	15.041	16.822	27.631	3.816	2.962
No. 2	Rainfall	76.777	48.868	20.299	25.695	34.123	35.356	16.650
	Absorption	.113	.180	.070	.115	.096	.030	.036
	Total	76.890	47.048	20.369	25.810	34.219	35.386	16.686
	Drainage	16.500+	.250	3.300	5.200	12.000	28.200	12.750
	Evaporation	60.390	46.798	17.069	20.610	22.219	7.186	3.936
No. 3	Rainfall	76.777	46.868	20.299	25.695	34.123	35.356	16.650
	Absorption	.186	.123	.001	.071	.000	.595	.288
	Total	76.963	46.991	20.300	25.766	34.123	35.951	16.938
	Drainage	43.500	10.500	9.000	4.800	8.000	22.550+	23.400
	Evaporation	33.463	36.491	11.300	20.966	26.123	13.401+	6.462
No. 4	Rainfall	76.777	46.868	20.299	25.695	34.123	35.356	16.650
	Absorption	.104	3.798	.560	.248	.386	.013	.010
	Total	76.881	50.666	20.859	25.943	34.509	35.369	16.660
	Drainage	35.600	14.800	7.000	9.300	15.800	35.500+*	19.350
	Evaporation	41.281	35.866	13.859	16.643	18.709	—.131	—2.690

* Loss.

OLD LYSIMETER RECORD.

DATE.	Rainfall.	Drainage. No. 1. Turf.	Drainage. No. 2. Kept bare.	Drainage. No 3. Cultivated three inches.	Per Cent Drainage to Rainfall. No. 1. Turf.	Per Cent Drainage to Rainfall. No. 2. Kept bare.	Per Cent Drainage to Rainfall. No. 3. Cultivated three inches.	Evaporation and Retained. No. 1.	Evaporation and Retained. No. 2.	Evaporation and Retained. No. 3.	Evaporation and Retained. No. 1.	Evaporation and Retained. No. 2.	Evaporation and Retained. No. 3.
1888.	In.	In.	In.	In.				In.	In.	In.	Per ct.	Per ct.	Per ct.
November	2.02	.765	.88+	.83+	37.72	43.56	41.09	1.255	1.14	1.19	62.28	56.44	58.91
December	1.24+	1.55	1.20	1.32	125.00	96.77	106.45	—.30	.04	—.07	......	......	......
1889.													
January	2.99+	1.82	1.15	1.31	39.13	61.53	56.19	1.17	1.84	1.68	......	......	......
February	.25	.05	.025	.05	20.00	10.00	20.00	.20	.225	.20	......	......	......
March	.66+	.48	.32	.18	72.73	48.48	27.27	.18	.34	.48	......	......	......
April	3.28	1.92	1.835	1.13	58.54	55.95	34.45	1.36	1.445	2.15	......	......	......
May	1.21	.07	.97+	.86	5.785	80.17	71.08	1.14	.24	.35	......	......	......
June	7.47	2.32	1.92	2.32	31.58	25.70	31.58	5.15	5.55	5.15	......	......	......
July	4.56	......	1.22	1.37	....	26.75	30.04	4.56	3.34	3.19	......	......	......
August	1.98	.03	.32	.53	1.515	16.16	26.77	1.95	1.66	1.45	......	......	......
September	2.50	......	.40	.81	....	16.00	32.40	2.50	2.10	1.69	......	......	......
October	3.32	.24	1.25	1.25	7.23	37.65	37.65	3.08	2.07	2.07	......	......	......
November	3.44	3.84	2.94	3.19	111.63	85.46	93.02	—.40	.50	.25	......	......	......
December	1.24+	1.61	1.12	1.40	129.84	90.32	112.90	—.37	.12	—.16	......	......	......
Total for 1889	32.90+	12.38	13.47+	14.40	37.63	41.55	43.77	20.52	19.43	18.50	......	......	......
Total for growing season, May to September, inclusive	17.72	2.42	5.03	5.89	13.66	28.39	33.24	15.30	12.69	11.83	......	......	......

	Rainfall in inches.	Rainfall per lysimeter in cubic centimeters.
September 15 to November 7, 1888, inclusive....	5.50	56529.
November 8, 1888, to March 31, 1889, inclusive..	6.806	69952.
April	3.28	33712.
May	1.21	12436.
June	7.47	76777.
July	4.56	46868.
August	1.975	20299.
September	2.50	25695.
October....	3.32	34123.
November	3.44	35356.
December	1.62	16650.

FOODS FED DAIRY ANIMALS.

The following tables give the quantity and chemical composition of the various foods fed the several animals of the dairy herd, and are a continuation of similar tables given on page 158 of the Eighth Annual Report, and continued in Bulletin No. 21, new series.

The detailed discussion of these tables is given elsewhere in this report, and they will be further considered in future bulletins:

HOLSTEIN-FRIESIAN — COPIA 3D.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	114.3	4.1	119.3	3.8	116.4	3.9	350.0
Barley hay	142.6	11.4	......	......	......	......	......	......	......	......	......	......	142.6
Clover and Timothy hay	36.0	12.0	323.7	11.4	......	......	......	......	......	......	......	......	359.7
Timothy hay	76.8	11.8	......	......	......	......	......	......	......	......	......	......	76.8
Barley, oat and pea hay	87.8	11.0	......	......	......	......	......	......	......	......	......	......	87.8
Keutucky Blue Grass hay	......	......	26.7	10.7	190 3	7.0	......	......	......	......	......	......	217.0
Mixed grasses	......	......	......	......	374.5	17.0	......	......	......	......	......	......	374.5
Red clover	......	......	......	......	......	......	294.3	29.4	......	......	......	......	294.3
Oats and vetches	......	......	......	......	......	......	618.6	29.5	......	......	......	......	618.6
Oats and peas	......	......	......	......	......	......	......	......	615.9	38.5	......	......	615.9
Maize ensilage	......	......	682.0	22.0	600.0	20.0	......	......	599.7	40.0	1000.0	40.0	2881.7
Mixed roots	720.0	24.0	......	......	......	......	......	......	......	......	......	......	720.0
Mixed grain, No. 6	93.8	3.1	85.5	2.8	......	......	......	......	......	......	......	......	179.3
Mixed grain, No. 10	......	......	......	......	90.0	3.0	93.0	3.0	93.0	3.0	88.5	3.0	364.5
Sorgum forage	......	......	......	......	......	......	......	......	......	......	200.0	40.0	200.0

Holstein-Friesian — Copia 3d.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	1289.1	42.9	1651.7	53.2	1843.5	61.5	1773.1	57.2	1469.7	47.4	1246.1	41.5	**9273.2**
Water in food	694.6	23.15	567.1	18.30	776.1	25.87	656.0	21.16	966.2	31.17	982.5	32.75	**4642.5**
Dry matter eaten	452.9	15.41	548.5	17.76	479.6	15.96	464.2	14.97	462.1	14.89	421.4	14.08	**2840.2**
Ash	22.1	.74	29.7	.96	28.7	.96	26.7	.86	26.4	.85	23.2	.77	**156.8**
Albuminoids Nx 6.25	61.1	2.04	78.0	2.52	60.8	2.03	61.0	1.97	70.9	2.29	57.8	1.93	**389.6**
Crude fiber	118.0	3.93	135.2	4.36	115.9	3.86	126.1	4.07	106.9	3.45	97.5	3.25	**699.6**
Nitrogen-free extract	235.0	7.83	280.0	9.03	252.6	8.42	232.4	7.50	238.9	7.71	227.0	7.57	**1465.9**
Fat	16.7	.56	25.6	.83	21.6	.72	18.4	.59	19.0	.61	16.3	.54	**117.6**
Invert sugar	17.1	.57	16.2	.52	8.0	.27	17.3	.56	14.0	.45	15.4	.51	**88.0**
Sucrose	41.1	1.37	8.8	.28	8.9	.30	12.3	.40	8.8	.28	10.9	.36	**90.8**
Starch	88.5	2.95	135.4	4.37	139.3	4.64	106.0	3.42	131.6	4.24	135.2	4.51	**736.0**
Albuminoid nitrogen	7.4	.25	8.8	.28	6.6	.22	7.9	.26	7.4	.24	5.3	.18	**43.4**
Amide nitrogen	2.2	.07	3.4	.11	2.1	.07	1.8	.06	4.2	.14	3.9	.13	**17.6**
Increase in live weight and daily gain	4.0	.13	52.0	1.68	45.0	1.50	*9.0	*.29	44.0	1.42	82.0	2.73	....

* Loss.

HOLSTEIN-FRIESIAN — ESEL 2D.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	79.1	2.8	139.5	4.5	147.2	4.9	365.8
Barley hay	115.8	9.3	......	......	......	......	......	......	......	......	......	......	115.8
Clover and Timothy hay	34.1	11.4	252.3	8.9	......	......	......	......	......	......	......	......	286.4
Timothy hay	75.3	11.6	......	......	......	......	......	......	......	......	......	......	75.3
Barley, oat and pea hay	70.5	8.8	......	......	......	......	......	......	......	......	......	......	70.5
Kentucky Blue Grass hay	......	......	25.0	10.0	150.7	5.6	......	......	......	......	......	......	175.7
Mixed grasses	......	......	......	......	367.3	16.7	......	......	......	......	......	......	367.3
Red clover	......	......	......	......	......	......	281.4	28.1	......	......	......	......	281.4
Oats and vetches	......	......	......	......	......	......	511.7	24.4	......	......	......	......	511.7
Oats and peas	......	......	......	......	......	......	......	......	619.8	38.7	......	......	619.8
Maize ensilage	......	......	739.7	23.9	567.4	18.2	......	......	636.3	42.4	1073.5	42.9	3016.9
Mixed roots	706.0	23.5	......	......	......	......	......	......	......	......	......	......	706.0
Mixed grain, No. 6	105.0	3.5	89.6	2.9	......	......	......	......	253.2	8.2	265.5	8.8	713.3
Mixed grain, No. 10	......	......	......	......	90.0	3.0	......	......	......	......	......	......	90.0
Sorghum forage	......	......	......	......	......	......	......	......	......	......	200.0	40.0	200.0
Wheat bran	......	......	......	......	......	......	100.4	3.2	......	......	......	......	100.4

HOLSTEIN-FRIESIAN — ESEL 2D.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	1060.9	35.4	1395.4	45.0	1467.2	48.9	2109.5	68.0	3103.3	100.1	2908.4	96.9	12044.7
Water in food	676.0	22.53	598.0	19.29	751.1	25.04	571.5	18.43	1016.1	32.78	1062.3	35.41	4675.0
Dry matter eaten	429.2	14.36	508.6	16.40	424.3	14.14	401.1	12.94	632.7	20.41	623.9	20.80	3021.3
Ash	27.7	.92	27.7	.89	25.7	.86	24.6	.79	35 6	1.15	34.1	1.14	175.4
Albuminoids Nx 6.25	58.4	1.95	72.2	2.33	56.4	1.88	54.6	1.76	109.4	3.53	101.6	3.39	452.6
Crude fiber	104.5	3.48	120.4	3.88	102.2	3.41	107.1	3.46	130.9	4.22	127.6	4.25	692.7
Nitrogen-free extract	222.8	7.43	263.8	8.51	231.5	7.72	197.9	6.38	324.6	10.47	339.0	11.30	1579.6
Fat	15.8	.53	23.7	.76	19.5	.65	17.1	.55	29.0	.93	28 5	.95	133.6
Invert sugar	17.2	.57	13.2	.42	7.0	.23	14.3	.46	15.5	.50	17.5	.58	84.7
Sucrose	40.1	1.33	7.7	.25	8.3	.28	11.6	.37	8.9	.29	11.5	.38	88.1
Starch	88.3	2.94	133.4	4.30	130.0	4.33	92.3	2.98	182.2	5.88	196.1	6.54	822.3
Albuminoid nitrogen	5.1	.17	8.0	.26	6.1	.20	7.2	.23	12.1	.39	10.6	.35	49.1
Amide nitrogen	2.0	.07	3.3	.11	2.9	.10	1.7	.05	4.7	.15	4.7	.16	19.3
Increase in live weight and daily gain	16.0	.53	58.0	1.87	13.0	.43	*285.0	*9.19	20.0	.64	64.0	2.13	....

*Loss. Calved July 16th. Weight of calf 84 lbs.

HOLSTEIN-FRIESIAN — TOLSMA ARTIS.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average	
	Lbs.	Lbs.	Lbs.	Lbs,	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	185.0	6.6	206.3	6.7	204.2	6.8	595.5
Barley hay	139.2	11.1	......	......	......	......	......	......	......	......	......	......	139.2
Clover and Timothy hay	36.3	12.1	269.3	9.4	......	......	......	......	......	......	......	......	305.6
Timothy hay	75.1	11.6	......	......	......	......	......	......	......	......	......	......	75.1
Barley, oat and pea hay	89.8	11.2	......	......	......	......	......	......	......	......	......	......	89.8
Kentucky Blue Grass hay	......	......	30.3	12.1	220.4	8.2	......	......	......	......	......	......	250.7
Mixed grasses	......	......	......	......	492.0	22.4	......	......	......	......	......	......	492.0
Red clover	......	......	......	......	......	......	314.1	31.4	......	......	......	......	314.1
Oats and vetches	......	......	......	......	......	......	730.6	34.8	......	......	......	......	730.6
Oats and peas	......	......	......	......	......	......	......	......	612.7	38.3	......	......	612.7
Maize ensilage	......	......	765.4	24.7	726.3	24.2	......	......	481.4	32.1	1073.8	43.0	3046.9
Mixed roots	709.2	23.6	......	......	......	......	......	......	......	......	......	......	709.2
Mixed grain No. 6	105.0	3.5	52.2	3.3	229.5	7.5	277.1	8.9	243.7	7.9	200.9	6.7	1108.4
Sorghum forage	......	......	......	......	......	......	......	......	......	......	200.0	40.0	200.0
Wheat bran	......	......	35.0	2.3	......	......	......	......	......	......	......	......	35.0

HOLSTEIN-FRIESIAN — TOLSMA ARTIS.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	1182.2	39.4	1719.5	55.5	3334.7	111.2	4431.7	143.0	3730.4	120.3	2917.6	97.3	**17316.1**
Water in food	685.8	22.86	620.2	20.0	978.7	32.62	771.4	24.88	892.6	28.79	1062.0	35.40	**5010.7**
Dry matter eaten	468.7	15.62	532.0	17.16	689.5	22.98	735.4	23.72	651.5	21.02	616.9	20.56	**3694.0**
Ash	30.4	1.01	28.8	.93	39.3	1.28	41.9	1.35	37.5	1.21	34.5	1.15	**212.4**
Albuminoids Nx 6.25	63.3	2.11	74.2	2.39	101.3	3.38	113.3	3.65	110.8	3.57	9.43	3.14	**557.2**
Crude fiber	118.0	3.93	127.6	4.12	152.7	5.09	178.3	5.75	141.3	4.56	138.8	4.63	**856.7**
Nitrogen-free extract	238.4	7.95	275.1	8.87	358.7	11.96	366.4	11.82	329.0	10.61	320.0	10.67	**1887.6**
Fat	17.2	.57	24.7	.80	33.3	1.11	32.4	1.05	29.3	.95	27.3	.91	**164.2**
Invert sugar	18.0	.60	14.2	.36	10.0	.33	23.0	.74	18.2	.59	19.7	.66	**103.1**
Sucrose	40.7	1.36	9.1	.29	10.0	.33	15.0	.48	9.5	.31	11.4	.38	**95.7**
Starch	71.5	2.38	138.5	4.47	198.3	6.61	197.3	6.36	183.4	5.91	187.6	6.25	**976.6**
Albuminoid nitrogen	7.7	.26	8.2	.26	11.4	.38	15.3	.49	12.2	.39	9.4	.31	**64.2**
Amide nitrogen	2.3	.08	3.5	.11	4.0	.13	2.8	.09	4.8	.16	5.0	.16	**22.4**
Increase in live weight and daily gain	34.0	1.13	*101.0	*3.26	*56.0	*1.87	*34.0	1.10	*36.0	*1.16	47.0	1.57	....

* Loss. Calved May 24th. Weight of calf 86 lbs.

HOLSTEIN-FRIESIAN — NETHERLAND DOWAGER 4TH.

	April.		May.		June.		July.		August.		September.		Total for four months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	52.5	2.2	......	......	......	......	52.5
Barley hay	116.1	9.3	......	......	......	......	......	......	......	......	......	......	116.1
Clover and Timothy hay	37.1	12.4	246.1	8.6	......	......	......	......	......	......	......	......	283.2
Timothy hay	81.4	12.5	......	......	......	......	......	......	......	......	......	......	81.4
Barley, oat and pea hay	79.8	10.0	......	......	......	......	......	......	......	......	......	......	79.8
Kentucky Blue Grass hay	......	......	26.0	10.4	154.4	5.7	......	......	......	......	......	......	180.4
Mixed grasses	......	......	......	......	368.4	16.7	......	......	......	......	......	......	368.4
Red clover	......	......	......	......	......	......	269.7	27.0	......	......	......	......	269.7
Oats and vetches	......	......	......	......	......	......	172.2	9.6	......	......	......	......	172.2
Maize ensilage	......	......	708.4	22.5	597.8	19.9	......	......	......	......	......	......	1306.2
Mixed roots	717.2	23.9	......	......	......	......	......	......	......	......	......	......	717.2
Mixed grain, No. 6	93.8	3.1	77.0	2.5	......	......	......	......	......	......	......	......	170.8
Mixed grain, No. 10	......	......	......	......	41.0	1.4	......	......	......	......	......	......	41.0
Wheat bran	......	......	......	......	......	......	35.3	1.8	......	......	......	......	35.3

Holstein-Friesian — Netherland Dowager 4th.

	April.		May.		June.		July.		August.		September.		Total for four months only.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	1172.9	39.1	1451.7	46.8	1339.3	44.6	1109.4	35.8	......	......	......	......	5073.3
Water in food	687.6	22.92	572.3	18.46	657.7	21.92	324.6	10.47	......	......	......	......	2242.2
Dry matter eaten	437.8	14.59	485.1	15.65	503.9	16.80	205.1	6.62	......	......	......	......	1631.9
Ash	28.3	.94	26.5	.85	24.0	.80	12.9	.41	......	......	......	......	91.7
Albuminoids Nx6.25	58.0	1.93	68.1	2.20	48.5	1.62	27.5	.89	......	......	......	......	202.1
Crude fiber	109.1	3.63	116.3	3.75	101.9	3.40	58.2	1.88	......	......	......	......	385.5
Nitrogen-free extract	225.1	7.50	250.8	8.10	211.1	7.00	97.9	3.16	......	......	......	......	784.9
Fat	15.9	.53	22.5	.73	18.3	.61	8.8	.28	......	......	......	......	64.5
Invert sugar	17.7	.59	12.8	.41	6.7	.22	7.7	.25	......	......	......	......	44.9
Sucrose	40.8	1.36	7.4	.24	6.9	.23	5.0	.16	......	......	......	......	60.1
Starch	83.7	2.79	125.9	4.10	113.4	3.80	42.1	1.36	......	......	......	......	365.1
Albuminoid nitrogen	7.1	.24	7.5	.24	4.9	.16	3.5	.11	......	......	......	......	23.0
Amide nitrogen	2.1	.07	3.1	1.00	2.8	.09	.9	.03	......	......	......	......	8.9
Increase in live weight and daily gain	39.0	1.30	39.0	1.26	*6.0	*.20	*414.0	*13.68	......	......	......	......	....

* Loss, animal sick. Calved July 17th. Weight of calf 99 lbs. Cow died August 5th.

HOLSTEIN-FRIESIAN — GENEVA NETHERLAND.

	APRIL.		MAY.		JUNE.		JULY.		AUGUST.		SEPTEMBER.		Total for two months and ten days.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Sweet milk	......	......	......	......	......	......	145.8	14 6	294.4	14.	......	......	**440.2**
Skim milk	......	......	......	......	......	......	......	......	251.5	16.8	568.0	18.9	**819.5**
Mixed grain, No. 10	......	......	......	......	......	......	......	......	......	......	24.4	.8	**24.4**
Clover and Timothy rowen	......	......	......	......	......	......	......	......	29.6	3.0	85.1	2.8	**114.7**
Linseed meal gruel	......	......	......	......	......	......	......	......	5.2	.5	13.0	.4	**18.2**

Holstein-Friesian — Geneva Netherland.

	April.		May.		June.		July.		August.		September		Total for two months and ten days.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water in food	......	......	......	......	......	......	128.5	12.84	508.7	16.14	580.1	19.34	1217.3
Dry matter eaten	......	......	......	......	......	......	17.3	1.73	66.8	2.15	110.4	3.68	194.5
Ash	......	......	......	......	......	......	.9	.09	4.4	.14	7.3	.24	12.6
Albuminoids Nx6.25	......	......	......	......	......	......	4.9	.49	19.5	.63	28.1	.94	52.5
Crude fiber	......	......	......	......	......	......	......	......	1.8	.06	6.8	.23	8.6
Nitrogen-free, extract	......	......	......	......	......	......	6.3	.63	28.0	.90	50.4	1.68	84.7
Fat	......	......	......	......	......	......	5.3	.53	12.9	.42	6.2	.21	24.4
Milk sugar	......	......	......	......	......	......	6.3	.63	......	......	......	......	....
Albuminoid nitrogen	......	......	......	......	......	......	.8	.08	3.1	.10	4.3	.14	8.2
Amide nitrogen	......	......	......	......	......	......	......	......	0.1	......	.2	......	.2
Increase in live weight and daily gain	......	......	......	......	......	......	......	......	57.0	1.84	51.0	1.70	....

AYRSHIRE — QUEEN DUCHESS.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	109.0	3.5	119.6	3.9	119.2	4.0	347.8
Barley hay	104.6	8.4	......	......	......	......	......	......	......	.....	......	......	104.6
Clover and Timothy hay	29.5	9.8	245.0	8.6	......	......	......	......	......	......	......	......	274.5
Timothy hay	64.0	9.8	......	......	......	......	......	......	......	......	......	......	64.0
Barley, oat and pea hay	68.2	8.5	......	......	......	......	......	......	......	......	......	......	68.2
Kentucky Blue Grass hay	......	......	22.0	8.8	140.9	5.2	......	......	......	......	......	......	162.9
Mixed grasses	......	......	......	......	249.7	11.3	......	......	......	......	......	......	249.7
Red clover	......	......	......	......	......	......	219.3	21.9	......	......	......	......	219.3
Oats and vetches	......	......	......	......	......	......	391.8	18.7	......	......	......	......	391.8
Oats and peas	......	......	......	......	......	......	......	......	485.1	30.3	......	......	485.1
Maize ensilage	......	......	497.0	16.0	378.0	12.6	......	......	472.4	31.5	800.0	32.0	2147.4
Mixed roots	538.1	17.9	......	......	......	......	......	......	......	......	......	......	538.1
Mixed grain, No. 6	67.2	2.2	47.0	1.5	......	......	.....	......	193.0	6.2	172.9	5.8	480.1
Mixed grain, No. 10	......	......	......	......	17.8	0.6	......	......	......	......	......	......	17.8
Sorghum forage	......	......	......	......	......	......	......	......	......	......	160.0	32.0	160.0
Wheat bran	......	......	......	......	......	......	41.4	1.3	......	......	......	......	41.4

AYRSHIRE — QUEEN DUCHESS.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	761.7	25.4	986.1	31.8	915.9	30.5	1175.5	37.9	2142.5	69.1	1988.	66.3	7969.7
Water in food	519.4	17.31	413.6	13.34	497.3	16.58	441.5	14.24	775.3	25.01	798.5	26.62	3445.6
Dry matter eaten	352.1	11.74	397.4	12.82	289.1	9.64	320.0	10.32	494.8	15.96	453.6	15.12	2307.0
Ash	22.8	.76	22.3	.72	17.9	.60	19.5	.63	28.0	.90	24.9	.83	135.4
Albuminoids N x 6.25	46.0	1.53	54.9	1.77	33 2	1.10	40.5	1.31	85.1	2.74	71.9	2.39	331.6
Crude fiber	90.8	3.03	100.2	3.23	77.4	2.58	93.4	3.01	104.1	3.36	96.3	3.21	562.2
Nitrogen-free extract	178.0	5.93	201.0	6.48	147.4	4.91	153.8	4.96	253.0	8.16	238.3	7.94	1171.5
Fat	12.7	.42	18.4	.59	13.2	.44	13.1	.42	22.5	.73	20.5	.68	100.4
Invert sugar	13.8	.46	12.1	.39	5 3	.18	12.8	.41	12.6	.41	13.8	.46	70.4
Sucrose	31.3	1.04	6.4	.21	4.6	.15	8.0	.26	7.0	.23	8.7	.29	66.0
Starch	66.7	2.22	95.1	3.07	75.5	2.52	69.4	2.24	141.5	4.57	140.6	4.69	588.8
Albuminoid nitrogen	5.6	.19	6.2	.20	3.4	.11	5.0	.16	9.2	.30	7.4	.25	36.8
Amide nitrogen	1.7	.06	2 5	.08	1.9	.06	1.4	.05	3.7	.12	3.5	.12	14.7
Increase in live weight and daily gain	13.	.43	36.0	1.16	*6.0	*.20	*126.0	*4.06	*18.0	*.58	5.0	17	....

* Loss. Calved July 24th. Weight of calf 59 lbs.

AYRSHIRE — MANTON BELLF.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	138.9	5.0	149.8	4.8	146.8	4.9	435.5
Barley hay	119.1	9.5	......	......	......	......	......	......	......	......	......	......	119.1
Clover and Timothy hay	29.4	9.8	245.6	8.6	......	......	......	......	......	......	......	......	275.0
Timothy hay	64.3	9.9	......	......	......	......	......	......	......	......	......	......	64.3
Barley, oat and pea hay	76.9	9.6	......	......	......	......	......	......	......	......	......	......	76.9
Kentucky Blue Grass hay	......	......	22.2	8.9	154.3	5.7	......	......	......	......	......	......	176.5
Mixed grasses	......	......	......	......	250.0	11.4	......	......	......	......	......	......	200.0
Red clover	......	......	......	......	......	......	249.7	25.0	......	......	......	......	249.7
Oats and vetches	......	......	......	......	......	......	520.3	24.8	......	......	......	......	520.3
Oats and peas	......	......	......	......	......	......	......	......	569.5	35.6	......	......	569.5
Maize ensilage	......	......	558.0	18.0	540.0	18.0	......	......	539.9	36.0	899.6	36.0	2537.5
Mixed roots	531.4	17.7	......	......	......	......	......	......	......	......	......	......	531.4
Mixed grain, No. 6	84.0	2.8	82.3	2.7	......	......	......	......	......	......	......	......	166.3
Mixed grain, No. 10	......	......	......	......	75.0	2.5	77.5	2.5	77.5	2.5	75.0	2.5	305.0
Sorghum forage	......	......	......	......	......	......	......	......	......	......	180.0	36.0	180.0

AYRSHIRE — MANTON BELLE.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	1017.6	33.9	1260.7	40.7	1165.1	38.8	1313.1	42.4	1032.8	33.3	867.7	28.9	6656.0
Water in food	519.9	17.33	462.1	14.91	625.1	20.84	558.0	18.00	884.9	28.55	880.0	29.60	3938.0
Dry matter eaten	385.2	12.84	446.0	14.39	394.2	13.14	428.4	13.82	451.8	14.57	413.4	13.78	2519.0
Ash	24.0	.80	24.7	.80	23.3	.78	25.0	.81	26.2	.85	23.2	.77	146.4
Albuminoids Nx 6.25	51.9	1.73	64.2	2.07	49.8	1.66	55.8	1.80	67.9	2.19	55.7	1.85	345.3
Crude fiber	99.4	3.31	107.0	3.45	94.1	3.14	118.9	3.84	109.3	3.53	99.9	3.33	628.6
Nitrogen-free extract	193.6	6.45	232.1	7.52	209.2	6.97	212.3	6.85	230.4	7.43	218.4	7.28	1296.0
Fat	14.2	.47	18.9	.61	17.7	.59	16.9	.54	18.5	.60	16.7	.56	102.9
Invert sugar	14.3	.48	12.5	.40	6.4	.21	16.4	.53	14.6	.47	15.7	.52	79.9
Sucrose	31.0	1.03	7.0	.23	7.1	.24	10.8	.35	8.3	.27	10.2	.34	74.4
Starch	75.7	2.52	112.6	3.63	116.6	3.89	103.2	3.33	125.8	4.06	128.9	4.30	662.8
Albuminoid nitrogen	6.3	.21	7.3	.23	5.4	.18	7.1	.23	6.7	.22	5.1	.17	37.9
Amide nitrogen	1.8	.06	2.7	.09	2.6	.09	1.8	.06	4.1	.13	3.9	.13	16.9
Increase in live weight and daily gain	1.0	.03	55.0	1.77	36.0	1.20	15.0	.48	62.0	2.0	53.0	1.77	....

AYRSHIRE — JUNIETTA PEERLESS.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	111.7	4.0	122.6	4.0	119.4	4.0	353.7
Barley hay	89.4	7.1	......	......	......	......	......	......	......	......	......	......	89.4
Clover and Timothy hay	23.8	7.9	194.5	6.8	......	......	......	......	......	......	......	......	218.3
Timothy hay	51.5	7.9	......	......	......	......	......	......	......	......	......	......	51.5
Barley, oat and pea hay	59.2	7.4	......	......	......	......	......	......	......	......	......	......	59.2
Kentucky Blue Grass hay	......	......	17.2	6.9	120.8	4.5	......	......	......	......	......	......	138.0
Mixed grasses	......	......	......	......	250.0	11.4	......	......	......	......	......	......	250.0
Red clover	......	......	......	......	......	......	199.9	20.0	......	......	......	......	199.9
Oats and vetches	......	......	......	......	......	......	412.0	19.6	......	......	......	......	412.0
Oats and peas	......	......	......	......	......	......	......	......	474.1	29.6	......	......	474.1
Maize ensilage	......	......	465.0	15.0	420.0	14.0	......	......	450.0	30.0	750.0	30.0	2085.0
Mixed roots	480.0	16.0	......	......	......	......	......	......	......	......	......	......	480.0
Mixed grain, No. 6	66.3	2.2	68.8	2.2	......	......	......	......	......	......	......	......	135.1
Mixed grain, No. 10	......	......	......	......	60.0	2.0	32.0	1.0	31.0	1.0	31.0	1.0	154.0
Sorghum forage	......	......	......	......	......	......	......	......	......	......	150.0	36.0	150.0

AYRSHIRE — JUNIETTA PEERLESS.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	743.8	24.8	907.4	29.3	949.2	31.6	962.6	31.1	825.	26.6	664.8	22.2	5052.3
Water in food	462.7	15.42	382.2	12.33	530.8	17.69	440.0	14.20	732.7	23.64	736.0	24.53	3284.4
Dry matter eaten	307.5	10.25	363.3	11.72	320.0	10.7	315.6	10.18	344.9	11.13	314.3	10.48	1965.6
Ash	20.0	.67	20.0	.64	19.0	.63	18.6	.60	20.2	.65	17.8	.59	115.6
Albuminoids N x 6.25	41.1	1.37	52.3	1.70	40.7	1.36	38.9	1.26	50.0	1.61	40.4	1.35	263.4
Crude fiber	77.5	2.58	86.2	2.78	76.7	2.56	93.0	3.00	88.2	2.85	81.0	2.70	502.6
Nitrogen-free extract	159.8	5.33	155.9	5.03	169.3	5.64	153.0	4.94	172.7	5.57	164.6	5.50	975.3
Fat	11.2	.37	16.9	.55	13.4	.45	12.4	.40	14.2	.46	12.8	.43	80.9
Invert sugar	12.0	.40	9.9	.32	5.2	.17	12.8	.41	11.8	.38	12.8	.43	64.5
Sucrose	27.4	.91	5.6	.19	5.9	.20	7.6	.25	5.8	.19	7.4	.25	59.7
Starch	61.2	2.04	92.5	2.98	93.9	3.13	70.1	2.26	90.6	2.92	94.3	3.14	502.6
Albuminoid nitrogen	5.0	.17	5.9	.19	4.4	.15	4.9	.16	4.7	.15	3.4	.11	28.3
Amide nitrogen	1.6	.05	2.3	.07	2.1	.07	1.3	.04	3.3	.11	3.1	.10	13.7
Increase in live weight and daily gain	*10.0	*.33	33.0	1.06	26.0	.87	*26.0	*.84	48.0	1.55	38.0	1.27	....

* Loss.

AYRSHIRE — MISS FLOW 5TH.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	136.0	4.9	146.4	4.7	143 7	4.8	**426.1**
Kentucky Blue Grass hay	......	......	32.1	12.8	156.7	5.8	......	......	......	......	......	......	**188.8**
Mixed grasses	......	......	......	......	349.7	15 9	......	......	......	......	......	......	**349.7**
Red clover	......	......	......	......	......	......	269.0	26 9	......	......	......	......	**269.0**
Oats and vetches	......	......	......	......	......	......	563.2	26 8	......	......	......	......	**563.2**
Oats and peas	......	......	......	......	......	......	......	......	567.2	35.4	......	......	**567.2**
Maize ensilage	......	......	633.0	20.4	660.0	22.0	......	......	504.7	33 6	799.9	32.0	**2597.6**
Mixed roots	463.1	15.4	......	......	......	......	......	......	......	......	......	......	**463.1**
Mixed grain, No. 6.	180.0	6.0	246.6	8.0	295.4	9.8	273.5	8.8	274.6	8.9	218 7	7 3	**1488.8**
Sorghum forage	......	......	......	......	......	......	......	......	......	......	160.0	32 0	**160.0**
Alsike and Timothy hay	378.9	12 6	322.9	11.3	......	......	......	......	......	......	......	......	**701.8**

Ayrshire — Miss Flow 5th.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	2017.1	67.2	2400.9	77.4	2511.6	83.7	2450.6	79.1	2246.5	72.5	1762.8	58.8	**13389.5**
Water in food	483.6	16.12	545.3	17.60	815.0	27.17	620.1	20.00	874.1	28.20	806.0	26.87	**4144.1**
Dry matter eaten	538.4	17.95	689.3	22.20	646.8	21.56	621.6	20.05	618.8	19.96	516.3	17.21	**3631.2**
Ash	29.1	.97	35.1	1.13	36.6	1.22	35.1	1.13	34.9	1.13	28.5	.95	**199.3**
Albuminoids Nx6.25	64.8	2.16	92.6	3.00	103.7	3.48	100.0	3.23	109.3	3.53	84.0	2.80	**554.4**
Crude fiber	138.3	4.61	167.9	5.41	128.3	4.28	142.9	4.61	125.5	4.05	107.5	3.58	**810.4**
Nitrogen-free extract	282.0	9.40	362.1	11.70	342.3	11.41	312.3	10.07	317.3	10.23	270.2	9.01	**1886.2**
Fat	21.8	.73	31.1	1.00	31.6	1.05	28.0	.90	28.5	.92	23.5	.78	**164.5**
Invert sugar	7.2	.24	14.0	.45	8.0	.27	17.9	.58	15.2	.49	15.2	.51	**77.5**
Sucrose	34.3	1.13	13.0	.42	9.0	.30	12.0	.39	8.9	.29	9.4	.31	**86.6**
Starch	122.4	4.08	197.5	6.37	197.6	6.59	162.6	5.24	179.7	5.80	150.8	5.02	**1010.6**
Albuminoid nitrogen	8.8	.29	11.3	.33	12.0	.40	12.8	.41	12.1	.39	8.8	.29	**65.8**
Amide nitrogen	2.0	.07	3.3	.11	3.6	.12	2.2	.07	4.4	.14	3.8	.13	**19.3**
Increase in live weight and daily gain	*3.0	*.10	59.0	1.90	13.0	.43	*6.0	*.19	8.0	.26	42.0	1.40	....

* Loss.

AMERICAN HOLDERNESS — NELLIE 6TH.

	APRIL.		MAY.		JUNE.		JULY.		AUGUST.		SEPTEMBER.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	91.5	3.3	84.7	2.7	65.4	2.2	241.6
Barley hay	49.6	4.0	......	......	......	......	......	......	......	......	......	......	49.6
Clover and Timothy hay	21.9	7.3	202 6	7.1	......	......	......	......	......	......	......	......	224.5
Timothy hay	35.8	5.5	......	......	......	......	......	......	......	......	......	......	35.8
Barley, oat and pea hay	45.9	5.7	......	......	......	......	......	......	......	......	......	......	45.9
Kentucky Blue Grass hay	......	......	18.7	7.5	112.3	4.2	......	......	......	......	......	......	131.0
Mixed grasses	......	......	......	......	245.6	11.2	......	......	......	......	......	......	245.6
Red clover	......	......	......	......	......	......	215.7	21.6	......	......	......	......	215.7
Oats and vetches	......	......	......	......	......	......	441.0	21.0	......	......	......	......	441.0
Oats and peas	......	......	......	......	......	......	......	......	476.5	29.8	......	......	476.5
Maize ensilage	......	......	443.6	14.3	460.6	15.4	......	......	349.7	23.3	445.8	17.8	1699.7
Mixed roots	473.0	15.8	......	......	......	......	......	......	......	......	......	......	473.0
Mixed grain, No 6	75.0	2.5	85.0	2.7	......	......	......	......	......	......	35.0	2.9	195.0
Mixed grain, No. 10	......	......	......	......	75.0	2.5	77.5	2.5	77.5	2 5	13 7	2.3	243.7
Sorghum forage	......	......	......	......	......	......	......	......	......	......	121.5	24.3	121.5

AMERICAN HOLDERNESS — NELLIE 6TH.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	592.6	19.7	976.5	31.5	786.2	26.2	836.2	27.0	738.0	23.8	744.1	24.8	4673.6
Water in food	446.4	14.88	370.8	11.96	557.8	18.59	474.5	15.31	655.4	21.44	465.0	15.50	2969.9
Dry matter eaten	254.8	8.49	379.0	12.23	335.7	11.19	351.2	11.33	333.0	10.74	216.4	7.21	1870.1
Ash	16.3	.54	21.0	.68	19.5	.65	20.8	.65	19.1	.62	12.0	.40	108.2
Albuminoids Nx 6.25	36.3	1.21	56.1	1.81	43.8	1.46	46.8	1.51	52.4	1.69	30.7	1.02	266.1
Crude fiber	56.4	1.88	88.8	2.86	47.9	.16	94.1	3.04	75.4	2.43	50.6	1.69	413.2
Nitrogen-free extract	134.3	4.48	194.1	6.26	179.2	5.97	176.5	5.69	172.5	5.57	113.7	3.79	970.3
Fat	9.7	.32	17.8	.58	14.9	.50	13.9	.45	13.7	.44	9.3	.31	79.3
Invert sugar	10.5	.35	10.4	.33	5.2	.17	12.9	.42	10.4	.34	8.8	.29	58.2
Sucrose	26.3	.88	5.9	.19	6.1	.20	9.3	.30	6.8	.22	5.6	.19	60.0
Starch	50.2	1.67	96.8	3.12	102.1	3.40	86.8	2.80	95.1	3.07	65.5	2.18	496.5
Albuminoid nitrogen	4.1	.14	6.4	.21	4.7	.16	6.1	.20	5.4	.18	2.9	.10	29.6
Amide nitrogen	1.4	.05	2.3	.07	2.3	.08	1.4	.05	3.0	.10	1.9	.06	12.3
Increase in live weight and daily gain	20.0	.67	49.0	1.58	39.0	1.30	1.0	.03	32.0	1.03	*162.0	*5.40	....

* Loss. Calved September 13th. Weight of calf 64 lbs.

AMERICAN HOLDERNESS—MAGGIE 6TH.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	101.4	3.6	111.8	3.6	110.3	3.7	323.5
Barley hay	86.9	7.0	......	......	......	......	......	......	......	......	......	......	86.9
Clover and Timothy hay	23.6	7.9	206.9	7.3	......	......	......	......	......	......	......	.....	230.5
Timothy hay	49.9	7.7	......	......	......	......	......	......	......	......	......	......	49.9
Barley, oat and pea hay	54.9	6.9	......	......	......	......	......	.....	......	......	......	......	54.9
Kentucky Blue Grass hay	......	......	19.5	7.8	133.0	4.9	......	......	......	......	......	......	152.5
Mixed grasses	......	......	......	......	231.4	10.5	......	......	......	......	......	......	231.4
Red clover	......	......	......	......	......	......	202.2	20.2	......	......	......	......	202.2
Oats and vetches	......	......	......	......	......	......	411.8	19.6	......	.....	......	......	411.8
Oats and peas	......	......	......	......	......	......	......	......	443.0	27.7	......	......	443.0
Maize ensilage	......	......	492.6	15.9	480.0	16.0	......	......	380.9	25.4	602.3	24.1	1955.8
Mixed roots	478.1	15.9	......	......	......	......	......	......	......	......	......	......	478.1
Mixed grain, No. 6	67.5	2.3	77.5	2.5	......	......	......	......	......	......	......	......	145.0
Mixed grain, No. 10	......	......	......	......	75.0	2.5	77.5	2.5	77.5	2.5	13.7	2.3	176.0
Sorghum forage	......	......	......	......	......	......	......	......	......	......	128.1	25.6	128.1

AMERICAN HOLDERNESS — MAGGIE 6TH.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	694.4	23.1	1024.3	33.0	916.9	30.6	1309.3	42.2	1292.9	41.7	1161.8	38.7	**6399.6**
Water in food	459.7	15.32	406.7	13.12	563.3	18.78	446.0	14.39	658.5	21.24	597.2	19.91	**3131.4**
Dry matter eaten	301.0	10.03	389.8	12.57	356.0	11 87	346.8	11.19	354.7	11.44	257.2	8.57	**2005.5**
Ash	19.5	.65	21.5	.69	20.9	.70	20.1	.65	20.5	.66	14.6	.49	**117.1**
Albuminoids Nx 6.25	40.5	1.35	56.6	1.82	45.8	1.53	46.4	1.50	54.6	1.76	32.0	1.07	**275.9**
Crude fiber	74.9	2.50	92.4	2.98	48.9	1.63	93.0	3 00	82.9	2.67	68.5	2.28	**460.6**
Nitrogen-free extract	154.2	5.14	200 1	6.45	189.8	6.33	174.0	5.61	180.3	5.82	132.0	4.40	**1030.4**
Fat	11.0	.37	18.2	.59	15.9	.53	13.7	.44	14.3	.46	10.4	.35	**83.5**
Invert sugar	11.8	.39	10.6	.34	5 7	.19	12.8	.41	11.0	.35	11.1	.37	**63.0**
Sucrose	27.2	.91	6.1	.20	6.6	.22	9.0	.29	6.9	.22	6.0	.20	**61.8**
Starch	57.7	1.92	99.7	3.22	106.9	3.56	86.6	2.79	100.2	3.23	74.3	2.48	**525.4**
Albuminoid nitrogen	4.4	.15	6.4	.21	5.0	.17	5.9	.19	5.5	.18	2.6	.09	**29.8**
Amide nitrogen	1.7	.06	2.4	.08	2.3	.08	1.5	.05	3.1	.10	2.5	.08	**13.5**
Increase in live weight and daily gain	12.0	.40	71.0	2.29	33.0	1.10	3.0	.10	34.0	1.10	*135.0	*4.5	....

*Loss. Calved September 25th. Weight of calf 76 lbs.

GUERNSEY — ROSETTE FORD.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	109.2	3.9	119.1	3.8	117.2	3.9	345.5
Barley hay	99.8	8.0	......	......	......	......	......	......	......	......	......	......	99.8
Clover and Timothy hay	26.6	8.9	243.6	8.5	......	......	......	......	......	......	......	......	270.2
Timothy hay	57.6	8.9	......	......	......	......	......	......	......	......	......	......	57.6
Barley, oat and pea hay	59.6	7.4	......	......	......	......	......	......	......	......	......	......	59.6
Kentucky Blue Grass hay	......	......	21.7	8.7	150.2	5.6	......	......	......	......	......	......	171.9
Mixed grasses	......	......	......	......	272.8	12.4	......	......	......	......	......	......	272.8
Red clover	......	......	......	......	......	......	219.5	21.9	......	......	......	......	219.5
Oats and vetches	......	......	......	......	......	......	455.1	21.7	......	......	......	......	455.1
Oats and peas	......	......	......	......	......	......	......	......	485.2	30.3	......	......	485.2
Maize ensilage	......	......	495.9	16.0	539.0	18.0	......	......	477.1	31.8	798.2	31.9	2310.2
Mized roots	531.0	17.5	......	......	......	......	......	......	......	......	......	......	531.0
Mixed grain, No. 6	66.0	2.2	62.0	2.0	......	......	......	......	......	......	......	......	128.0
Mixed grain, No. 10	......	......	......	......	60.0	2.0	31.0	1.0	31.0	1.0	30.0	1.0	152.0
Sorghum forage	......	......	......	......	......	......	......	......	......	......	160.0	32.0	160.0

GUERNSEY — ROSETTE FORD.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	802.4	26.7	1042.6	33.6	999.7	33.3	938.2	30.3	739.1	23.8	609.7	20 3	**5131.7**
Water in food	510.4	17.01	414.1	13.36	640.2	21.34	483.0	15.58	762.4	24.6	782.2	26.07	**3592.3**
Dry matter eaten	330.2	11.01	409.1	13.2	381.8	12.73	331.8	10.07	349.9	11.26	323.2	10.77	**2126.0**
Ash	21.5	.72	22.9	.74	22.6	.75	19.5	.63	20.4	.66	18.1	.60	**125.0**
Albuminoids Nx 6.25	43.4	1.45	57.9	1.87	47.3	1.58	40.6	1.31	50.8	1.64	41.2	1.37	**281.2**
Crude fiber	83.9	2.80	101.0	3.26	93.2	3.11	98.1	3.16	89.1	2.88	82.4	2.74	**547.7**
Nitrogen-free extract	168.6	5.62	207.6	6.70	201.5	6.72	160.9	5.19	175.6	5.66	168.7	5.62	**1082.9**
Fat	11.9	.40	18.0	.58	17.1	.57	13.1	.42	14.4	.46	13.1	.44	**87.6**
Invert sugar	13.2	.44	12.2	.39	6.2	.21	13.5	.44	11.8	.38	13.1	.44	**70.0**
Sucrose	30.2	1.01	6.6	.21	6.7	.22	8.1	.26	5.8	.19	7.7	.26	**65.1**
Starch	62.1	2.07	99.9	3.22	110.9	3.70	72.5	2.34	92.1	2.97	96.5	3.22	**534.0**
Albuminoid nitrogen	4.7	.16	5.6	.18	5.0	.17	5.2	.17	4.8	.15	3.4	.11	**28.7**
Amide nitrogen	1.8	.06	2.5	.08	2.5	.08	1.3	.04	3.2	.01	3.2	.10	**14.5**
Increase in live weight and daily gain	*10.0	*.33	45 0	1.45	38.0	1.27	*4.0	*.13	23.0	.74	33.0	1.10	....

* Loss.

GUERNSEY — ORIOLE.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	105.7	3.8	117.2	3.8	110.2	3.7	333.1
Barley hay	75 9	6.1	......	......	......	......	......	......	......	......	......	......	75.9
Clover and Timothy hay	22.2	7.4	191.1	6.7	......	......	......	......	......	......	......	......	213.3
Timothy hay	50.0	7.7	......	......	......	......	......	......	......	......	......	......	50.0
Barley, oat and pea hay	51.2	6.4	......	......	......	......	......	......	......	......	......	......	51.2
Kentucky Blue Grass hay	......	......	16.3	6.5	114.1	4.2	......	......	......	......	......	......	130.4
Mixed grasses	......	......	......	......	248 1	11.3	......	......	......	......	......	......	248.1
Red clover	......	......	......	......	......	......	179.0	17.9	......	......	......	......	179.0
Oats and vetches	......	......	......	......	......	......	370.2	17.6	......	......	......	......	370.2
Oats and peas	......	......	......	......	......	......	......	......	429.3	26.8	......	......	429.3
Maize ensilage	......	......	434.0	14.0	405.0	13.5	......	......	419.5	28.0	697 9	27.9	1955.9
Mixed roots	400.0	13.3	......	......	......	......	......	......	......	......	......	......	400.0
Mixed grain, No. 6	67.6	2.3	69.7	2.2	......	......	......	......	......	......	......	......	137.3
Mixed grain, No. 10	......	......	......	......	67.4	2.2	61.2	2.0	61.7	2.0	60.0	2.0	250.3
Sorghum forage	......	......	......	......	......	......	......	......	......	......	139.9	28.0	139.9

GUERNSEY — ORIOLE.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	691.8	23.1	792.3	22.3	802.6	26.8	866.2	27.9	673.7	21.7	531.3	17.7	**4357.9**
Water in food	388.9	12.96	359.9	11.61	518.3	17.28	399.5	12.89	678.0	21.87	688.9	22.96	**3033.5**
Dry matter eaten	278.0	9.27	351.1	11.33	316.3	10.54	316.6	10.21	349.7	11.28	319.1	10.64	**1930.8**
Ash	17.8	.59	19.4	.48	18.7	.62	18.5	.60	20.3	.65	17.7	.59	**112.4**
Albuminoids Nx 6.25	37.9	1.26	51.1	1.65	41.0	1.37	41.6	1.34	52.5	1.69	43.2	1.44	**267.3**
Crude fiber	69.4	2.31	83.3	2.69	74.2	2.47	87.1	2.81	84.4	2.72	76.5	2.55	**474.9**
Nitrogen-free extract	141.5	4.72	179.9	5.80	168.2	5.60	157.3	5.07	178.5	5.76	169.0	5.63	**994.4**
Fat	10.3	.34	16.5	.53	14.1	.47	12.5	.40	14.3	.46	12.8	.43	**80.5**
Invert sugar	9.4	.31	10.2	.33	5.1	.17	12.0	.39	11.2	.36	12.0	.40	**59.9**
Sucrose	23.1	.77	5.7	.18	6.0	.20	8.0	.26	6.4	.21	7.9	.26	**57.1**
Starch	54.9	1.83	90.7	2.92	94.6	3.15	77.5	2.50	97.9	3.16	99.9	3.33	**515.5**
Albuminoid nitrogen	4.2	.14	6.0	.19	4.4	.15	5.2	.17	5.2	.17	3.9	.13	**28.9**
Amide nitrogen	1.6	.05	2.1	.07	2.1	.07	1.4	.19	5.9	.19	3.0	1.00	**16.1**
Increase in live weight and daily gain	*5.0	*.17	37.0	1.19	32.0	1.07	10.0	.32	50.0	1.61	32.0	1.07	....

* Loss.

JERSEY — GILDERBLOOM.

	April.		May.		June.		July		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	110 9	4.0	121.6	3.9	107.2	3.6	339.7
Barley hay	90.3	7.2	......	......	......	......	......	......	......	......	......	......	90.3
Clover and Timothy hay	24.3	8.1	188.7	6.6	......	......	......	......	......	......	......	......	213.0
Timothy hay	54.1	8.3	......	......	......	......	......	......	......	......	......	......	54.0
Barley, oat and pea hay	58.5	7.3	......	......	......	......	......	......	......	......	......	......	58.5
Kentucky Blue Grass hay	......	......	17.1	6.8	108.4	4.0	......	......	......	......	......	......	125.5
Mixed grasses	......	......	......	......	250.0	11.4	......	......	......	......	......	......	250.0
Red clover	......	......	......	......	......	......	200 0	20.0	......	......	......	......	200.0
Oats and vetches	......	......	......	......	......	......	412.0	19.6	......	......	......	......	412.0
Oats and peas	......	......	......	......	......	......	......	......	469.8	29.4	......	......	469.8
Maize ensilage	......	......	419.0	13.5	366.0	12.2	......	......	443.3	29.6	732.6	29.3	1960.9
Mixed roots	475.0	15.8	......	......	......	......	......	......	......	......	......	......	475.0
Mixed grain, No. 6	67.5	2.3	66.0	2.1	......	......	......	......	......	......	77.5	3.7	211.0
Mixed grain, No. 10	......	......	......	......	35.5	1.2	31.0	1.0	31.0	1.0	......	......	97.5
Sorghum forage	......	......	......	......	......	......	......	......	......	......	149.6	29.9	149.6

Jersey — Gilderbloom.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	746.5	24.9	950.7	30.7	877.4	29.2	1035.6	33.4	949.3	30.6	1477.1	49.2	**6036.6**
Water in food	458.9	15.30	348.2	11.23	486.6	16.22	439.9	14.19	724.0	23.36	724.8	24.16	**3182.4**
Dry matter eaten	310.8	10.36	342.6	11.05	273.3	9.11	314.0	10.13	341.6	11.02	342.1	11.40	**1924.4**
Ash	20.1	.67	19.0	.61	16.4	.55	18.5	.60	20.0	.65	19.0	.63	**113.0**
Albuminoids Nx 6.25	41.5	1.38	49.6	1.60	33.4	1.11	38.6	1.25	49.6	1.60	48.9	1.63	**261.6**
Crude fiber	76.5	2.55	81.9	2.64	40 2	1.34	92.7	2.99	87.4	2 82	80.7	2.69	**459.4**
Nitrogen-free extract	158.2	5.27	174.2	5 62	142.5	4.75	152.2	4.91	171.1	5.52	176 9	5.90	**975.1**
Fat	11.3	.38	16.0	.52	12.7	.42	12.4	.40	14.0	.45	14 9	.50	**81.3**
Invert sugar	12.1	.40	9.6	.31	4.6	.15	12.8	.41	11.7	.38	12.3	.41	**63.1**
Sucrose	27.3	.91	5.4	.17	4.8	.16	7.6	.24	5.7	.18	7.0	.23	**57.8**
Starch	58.7	1.96	86.4	2.79	76.8	2 56	69.5	2.24	89.7	2 89	102.4	3.41	**483.5**
Albuminoid nitrogen	4.6	.15	5.7	.18	3.5	.12	4.9	.16	4.7	.15	4.5	.15	**27.9**
Amide nitrogen	1.8	.07	2.1	.07	1.8	.06	1.3	.04	3.2	.10	3.0	.10	**13.2**
Increase in live weight and daily gain	8.0	.27	17.0	.55	28.0	.93	8.0	.26	24.0	.77	*90.0	*3.0	....

* Loss. Calved September 9th. Weight of calf 48 lbs.

JERSEY — COUNTESS FLAVIA.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	137.7	4.9	148.6	4.8	144.6	4.8	430.9
Barley hay	103.2	8.3	......	......	......	......	......	......	......	......	......	......	103.2
Clover and Timothy hay	27.0	9.0	......	......	......	......	......	......	......	......	......	......	27.0
Timothy hay	58.0	8.9	......	......	......	......	......	......	......	......	......	......	58.0
Barley, oat and pea hay	69.1	8.6	......	......	......	......	......	......	......	......	......	......	69.1
Kentucky Blue Grass hay	......	......	23.3	9.3	151.2	4.8	......	......	......	......	......	......	174.5
Mixed grasses	......	......	......	......	299.4	13 6	......	......	......	......	......	......	299.4
Red clover	......	......	......	......	......	......	209.7	21.0	......	......	......	......	209.7
Oats and vetches	......	......	......	......	......	......	439.5	20.9	......	......	......	......	439.5
Oats and peas	......	......	......	......	......	......	......	......	470.3	29.4	......	......	470.3
Maize ensilage	......	......	569.2	18.4	555.6	18.5	......	......	467.4	31.2	783.6	31.3	2375.8
Mixed roots	477.6	15.9	......	......	......	......	......	......	......	......	......	......	477.6
Mixed grain, No. 6	67.5	2.3	187.5	6.0	270.0	9.0	278.9	9.0	279.0	9.0	245.5	8.2	1328.4
Alsike and Timothy hay	......	......	274.2	9.6	......	......	......	......	......	......	......	......	274.2
Sorghum forage	......	......	......	......	......	......	......	......	......	......	160.0	32.0	160.0

JERSEY — COUNTESS FLAVIA.

	April		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	1059.4	35.3	1968.2	63.5	2272.4	75.7	2465 8	79.5	2424.7	78 2	2180.0	72.7	12370.5
Water in food	468.1	15.60	482.8	15.58	694.9	23.16	494.2	15.94	772.6	24.92	795.8	26.53	3708.4
Dry matter eaten	334.2	11.14	571.3	18.43	581.3	19.38	571.6	18 44	592.7	19.12	537.9	17.93	3189.0
Ash	21.9	.73	28.9	.93	23.1	.77	32.3	1.04	33.5	1.08	29.8	.99	169.5
Albuminoids Nx 6.25	44.7	1.49	73.8	2.38	93.6	3.12	95.1	3 07	105.4	3.40	89.3	29.80	501.9
Crude fiber	87.6	2.92	141.2	4.56	76.3	2.54	126 5	4.08	118.9	3.84	109.4	3.65	659.9
Nitrogen-free extract	168.0	5.60	299.3	9.66	206.6	68.69	288.3	9.30	304.3	9.82	282.0	9.40	1548.5
Fat	12.3	.41	25.6	.83	28.5	.95	26.0	.84	27.4	.88	24.6	.82	144.4
Invert sugar	12.8	.43	11.8	.38	7.4	.25	15.7	.51	14.1	.46	15.3	.51	77.1
Sucrose	27.8	.93	10.8	.35	8.1	.27	10.5	.34	8.3	.27	9.9	.33	75.4
Starch	64.3	2.14	163 3	5.27	176.3	5.88	154.9	5.00	174.6	5.63	168.6	5.62	902.0
Albuminoid nitrogen	4.9	.16	8 1	.26	10.9	.36	12.0	.39	11.7	.38	9.6	.32	57.2
Amide nitrogen	2.0	.07	2.9	.09	3.1	.10	2.2	.07	4.1	.13	3.9	.13	18.2
Increase in live weight and daily gain	*93.0	*3.10	1.0	.03	*3.0	*.10	*20.0	*.61	27.0	.87	24.0	.80	....

* Loss. Calved April 19. Weight of calf 60 lbs.

JERSEY — BARBARA ALLEN.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	111.1	4.0	123.8	4.0	119.8	4.0	354.7
Barley hay	100.7	8.1	......	......	......	......	......	......	......	......	......	......	100.7
Clover and Timothy hay	26.8	8.9	199.0	7 0	......	......	......	......	......	......	......	......	225.8
Timothy hay	57.5	8.8	......	......	......	......	......	......	......	......	......	......	57.5
Barley, oat and pea hay	62.9	7.9	......	......	......	......	......	......	......	......	......	......	62.9
Kentucky Blue Grass hay	......	......	17.5	7.0	121.5	4.5	......	......	......	......	......	......	139.0
Mixed grasses	......	......	......	......	250.0	11.4	......	......	......	......	......	......	250.0
Red clover	......	......	......	......	......	......	199.0	19.9	......	......	......	......	199.0
Oats and vetches	......	......	......	......	......	......	412.0	19.6	......	......	......	......	412.0
Oats and peas	......	......	......	......	......	......	......	......	476.8	29.8	......	......	476.8
Maize ensilage	......	......	419.0	13.5	260.0	13.0	......	......	450.0	30.0	700.7	28.0	1829.7
Mixed roots	475.8	15.9	......	......	......	......	......	......	......	......	......	......	475.8
Mixed grain, No. 6	67.5	2.3	66.0	2.1	60.0	2.0	......	......	......	......	129.0	4.3	322.5
Mixed grain, No. 10	......	......	......	......	......	......	62.0	2.0	62.0	2.0	......	......	124.0
Sorghum forage	......	......	......	......	......	......	......	......	......	......	150.0	30.0	150.0

JERSEY — BARBARA ALLEN.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs	Lbs.	Lbs.
Water drunk	1078.5	35.9	1011.1	32.6	995.4	33.2	1290.2	41.6	1108.2	35.7	1625.3	54.2	**7108.7**
Water in food	462.9	15.43	350.0	11.32	430.6	14.35	443.0	14.29	738.7	23.83	706.3	23.54	**3131.5**
Dry matter eaten	328.3	10.94	351.4	11.34	275.2	9.17	341.1	11.00	373.9	12.06	392.2	13.07	**2062.1**
Ash	19.3	.64	19.6	.63	17.2	.57	19.9	.64	21.7	.70	21.8	.73	**119.5**
Albuminoids Nx 6.25	41.2	1.37	50.9	1.64	35.9	1.20	44.3	1.43	56.1	1.81	60.2	2.01	**288.6**
Crude fiber	85.8	2.86	84.6	2.73	36.1	1.20	94.6	3.05	90.7	2.93	87.5	2.91	**479.3**
Nitrogen-free extract	165.7	5.52	179.2	5.78	144.4	4.81	169.1	5.45	190.4	6.14	204.9	6.83	**1053.7**
Fat	12.0	.40	16.4	.53	12.5	.42	13.4	.43	15.3	.49	17.5	.58	**87.1**
Invert sugar	12.6	.42	100.0	.32	5.0	.17	13.1	.42	12.1	.39	13.1	.44	**65.9**
Sucrose	27.6	.92	5.6	.18	5.5	.18	8.6	.28	6.8	.22	7.8	.26	**62.0**
Starch	63.0	2.10	87.7	2.83	78.6	2.62	82.3	2.65	103.7	3.34	119.8	3.99	**535.1**
Albuminoid nitrogen	4.8	.16	5.9	.19	4.0	.13	5.6	.18	5.5	.18	6.0	.20	**31.8**
Amide nitrogen	1.9	.06	2.0	.06	1.7	.06	1.5	.05	3.4	.11	3.2	.11	**13.7**
Increase in live weight and daily gain	3.0	.10	30.0	.97	33.0	1.10	22.0	.71	*99.0	*3.30	9.0	.29	....

* Loss. Calved August 29th. Weight of calf 54 lbs.

SHORT-HORN — BETSEY 10TH.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	41.0	1.5	60.5	2.0	83.4	2.8	184.9
Kentucky Blue Grass hay	......	......	......	......	49.0	2.0	......	......	......	......	......	......	49.0
Alsike and Timothy hay	44.3	1.5	83.0	2.7	8.6	2.9	......	......	......	.....	......	......	135.9
Mixed grasses	......	......	......	......	103.1	4.7	......	......	......	......	......	......	103.1
Red clover	......	......	......	......	......	......	97.4	9 7	......	......	......	......	97.4
Oats and vetches	......	......	......	......	......	......	203.9	9.7	......	......	......	......	203.9
Oats and peas	......	......	......	......	......	......	......	......	258.7	16.2	......	......	258.7
Maize ensilage	.....	......	......	......	......	......	......	....	236.6	15.8	476.0	19.0	712.6
Mixed grain, No. 6	......	......	......	......	9.0	3.0	......	......	......	......	......	......	9.0
Mixed grain, No. 10	......	......	......	......	81.0	3.0	92.1	3.0	93.0	3.0	90.0	3.0	356.1
Sorghum forage	......	......	......	......	......	......	......	......	......	......	100.0	20.0	100.0
Skim milk	......	......	......	......	370.0	16.1	558.0	18.0	......	......	.....	......	928.0
Sweet milk	600.0	20.0	620.0	20.0	230.0	14.4	......	......	......	......	......	......	1450.0
Ground oats	25.2	0.8	68 2	2.2	......	......	......	......	......	......	......	......	93.4

SHORT-HORN — BETSEY 10TH.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	......	......	168.0	7.6	240.3	8.0	304.0	9.8	1020.0	32.9	1572.4	52.40	3304.7
Water in food	539.6	17.99	567.8	18.31	637.3	21.24	727.2	23.46	401.3	12.95	480.4	16.01	3353.6
Dry matter eaten	129.8	4.33	203.4	6.56	213.3	7.10	265.2	8.55	247.5	7.98	269.0	8 97	1328.2
Ash	6.9	.23	9.6	.31	13.6	.45	16.2	.52	14 0	.45	15.0	.50	75.3
Albuminoids Nx 6 25	27.6	.92	34.4	1.11	45.4	1.51	51.4	1.66	40.6	1.31	39.6	1.32	239.0
Crude fiber	13.6	.45	32.9	1.06	28.1	.94	46.6	1.50	50.7	1.64	58.0	1.93	229.9
Nitrogen-free extract	57.6	1.92	97.8	3.18	108.7	3.62	138.8	4.45	132.3	4.27	145.8	4.86	681.0
Fat	24.7	.82	28.5	.92	17.5	.58	12.2	.39	10.0	.32	10.9	.36	103.8
Invert sugar	2.1	.07	3.5	.11	2.3	.08	6.4	.21	6.8	.22	9.2	.31	30.3
Sucrose	26.9	.90	29.5	.95	32.1	1.07	33.4	1.08	5.6	.18	7.2	.24	134.7
Starch	15.2	.51	41.8	1.35	49.0	1.63	62.9	2.03	78.7	2.54	90.3	3.01	337.9
Albuminoid nitrogen	4.2	.14	5.1	.16	6.5	.22	7.3	.24	4.4	.14	4.0	.13	31.5
Amide nitrogen	.2	.01	.6	.02	.7	.02	.9	.03	2.1	.07	2.3	.08	6.8
Increase in live weight and daily gain	55.0	1.83	78.0	2.52	51.0	1.70	36.0	1.16	45.0	1.45	59.0	1.97	....

SHORT-HORN — LADY SPENCER.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	Total eaten.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Mixed hay	......	......	......	......	......	......	46.2	1.6	59.9	1.9	82.3	2.7	188.4
Kentucky Blue Grass hay	......	......	......	......	56.5	2.4	......	......	......	......	......	......	56.5
Alsike and Timothy hay	34.1	1.1	77.6	2.5	8.4	2.8	......	......	......	......	......	......	120.1
Mixed grasses	......	......	......	......	103.1	4.7	......	......	......	......	......	......	103.1
Red clover	......	......	......	......	......	......	94.2	9.4	......	......	......	......	94.2
Oats and vetches	......	......	......	......	......	......	206.5	9.8	......	......	......	......	206.5
Oats and peas	......	......	......	......	......	......	......	......	256.5	16.0	......	......	256.5
Maize ensilage	......	......	......	......	......	......	......	......	233.5	15.6	473.3	18.9	706.8
Mixed grain, No. 6	......	......	......	......	9.0	3.0	......	......	......	......	......	......	9.0
Mixed grain, No. 10	......	......	......	......	80.6	3.0	88.6	2.9	92.0	3.0	90.0	3.0	351.2
Sorghum forage	......	......	......	......	......	......	......	......	......	......	100.0	20.0	100.0
Skim milk	......	......	......	......	370.0	16.1	558.0	18.0	......	......	......	......	928.0
Sweet milk	600.0	20.0	620.0	20.0	230.0	14.4	......	......	......	......	......	......	1450.0
Ground oats	25.2	0.8	68.5	2.2	......	......	......	......	......	......	......	......	93.7

SHORT-HORN — LADY SPENCER.

	April.		May.		June.		July.		August.		September.		Total for six months.
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	......	......	172.0	7.8	240.3	8.0	304.0	9.8	1015.0	32.7	1955.7	65.2	3687.0
Water in food	537.9	17.93	567.0	18.29	548.4	18.28	726.8	23.44	397.0	12.81	478.1	15.94	3255.2
Dry matter eaten	121.4	4.05	199.1	6.42	219.4	7.31	266.7	8.60	244.9	7.90	267.5	8.92	1319.0
Ash	6.3	.21	9.4	.30	14.1	.47	16.3	.53	13.9	.45	14.9	.40	74.9
Albuminoids Nx 6.25	16.5	.55	34.2	1.10	45.9	1.53	50.9	1.64	40.2	1.30	39.6	1.32	227.3
Crude fiber	11.1	.37	31.3	1.01	30.2	1.00	47.7	1.54	50.1	1.62	57.6	1.92	228.0
Nitrogen-free extract	53.5	1.78	95.9	30.90	111.3	3.71	138.0	4.45	130.9	4.22	145.1	4.84	674.7
Fat	24.3	.81	28.4	.92	17.8	.59	12.2	.39	10.0	.32	10.8	.36	103.5
Invert sugar	1.7	.06	3.3	.11	2.9	.10	6.6	.21	6.7	.22	9.2	.31	30.4
Sucrose	26.8	.89	29.4	.95	32.2	1.07	33.3	1.07	5.5	.18	7.2	.24	134.4
Starch	14.0	.47	41.0	1.32	49.9	1.66	61.8	1.99	77.9	2.51	89.9	3.00	334.5
Albuminoid nitrogen	4.1	.14	5.1	.16	6.5	.22	7.2	.23	4.4	.14	4.0	.13	31.3
Amide nitrogen	.2	.....	.6	.02	.8	.03	.9	.03	2.0	.07	2.3	.08	6.8
Increase in live weight and daily gain	56.0	1.87	86.0	2.77	60.0	2.00	39.0	1.26	40.0	1.29	43.0	1.43	....

HOLSTEIN-FRIESIAN — AVERAGE.

	April.	May.	June.	July.	August.	September.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	1176.3	1554.6	1996.2	2355.9	2767.8	2357.4
Water in food	686.0	589.4	790.9	580.9	958.3	1035.6
Dry matter eaten	449.9	519.1	524.1	451.4	582.0	554.4
Ash	27.1	28.2	29.4	26.5	33.2	30.6
Albuminoids, Nx 6.25	60.2	73.1	66.7	64.1	97.0	84.6
Crude fiber	112.4	124.9	118.2	117.4	126.3	121.3
Nitrogen, free extract	230.4	267.4	263.5	223.7	297.5	295.3
Fat	16.4	24.1	23.2	19.2	25.8	24.0
Invert sugar	17.5	14.1	7.9	15.6	15.9	17.6
Sucrose	40.7	8.2	8.5	11.0	9.1	11.3
Starch	83.0	133.3	145.2	109.4	165.7	173.0
Albuminoid nitrogen	6.8	8.1	7.3	8.5	10.6	8.4
Amide nitrogen	2.2	3.3	3.0	1.8	4.5	4.5
Live weight	1187.0	1199.0	1196.0	1010.0	1075.0	1137.0

AYRSHIRE — AVERAGE.

	April.	May.	June.	July.	August.	September.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	1134.9	1388.8	1385.4	1225.4	1559.4	1320.6
Water in food	496.4	450.8	617.1	514.9	816.8	807.1
Dry matter eaten	395.8	474.0	412.5	421.4	477.6	424.4
Ash	24.0	25.5	24.2	24.6	27.3	23.6
Albuminoids Nx 6.25	50.9	66.0	56.8	58.8	78.1	63.0
Crude fiber	101.5	115.3	94.1	112.1	106.8	96.2
Nitrogen-free extract	203.3	237.8	217.0	207.9	243.3	222.8
Fat	12.5	21.3	19.0	17.6	20.9	18.4
Invert sugar	11.8	12.1	6.2	15.0	13.5	14.4
Sucrose	31.0	8.0	6.7	9.6	7.5	8.9
Starch	81.5	124.4	120.9	101.3	134.4	128.7
Albuminoid nitrogen	6.4	7.7	6.3	7.5	8.2	6.2
Amide nitrogen	1.8	2.7	2.5	1.7	3.9	3.6
Live weight	821.0	866.0	884.0	848.0	873.0	907.0

AMERICAN HOLDERNESS — AVERAGE.

	April.	May.	June.	July.	August.	September.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	643.5	1000.4	851.5	1072.7	1015.4	952.4
Water in food	453.1	388.8	560.6	460.3	657.0	531.1
Dry matter eaten	277.9	384.4	345.9	349.0	343.8	236.8
Ash	17.9	21.3	20.2	20.2	19.8	13.3
Albuminoids Nx 6.25	38.4	56 3	44.8	46.6	53.5	31.3
Crude fiber	65.6	90.6	48.4	93.5	79.2	59.5
Nitrogen-free extract	144.2	197.1	184.5	175.2	176.4	122.8
Fat	10.3	18.0	15.4	13.8	14.0	9.8
Invert sugar	11.2	10.5	5.4	14.8	10.7	10.0
Sucrose	26.8	6.0	6.3	9.1	6.8	5.8
Starch	53.9	98.3	104.5	86.7	97.7	69.9
Albuminoid nitrogen	4.3	6.4	4.8	6.0	5.5	2.7
Amide nitrogen	1.6	2.3	2.3	1.4	3.0	2.2
Live weight	784.0	844.0	880.0	882.0	915.0	766.0

GUERNSEY — AVERAGE.

	April.	May.	June.	July.	August.	September.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	747.1	917.4	901.1	902.2	706.4	570.5
Water in food	449.6	387.9	579.8	441.2	720.2	735.6
Dry matter eaten	304.1	380.1	349.0	324.2	349.8	321.1
Ash	19.7	21.2	20.7	19.0	20.4	17.9
Albuminoids Nx 6.25	40.7	54.5	44.1	41.1	51.6	42.2
Crude fiber	76.6	92.2	83.7	92.6	86.8	79.5
Nitrogen-free extract	155.0	193.7	184.8	159.1	177.0	168.8
Fat	11.1	17.2	15.6	12.8	14.3	13.0
Invert sugar	11.3	11.2	5.7	12.8	11.5	12.5
Sucrose	26.7	6.1	6.4	8.0	6.1	7.8
Starch	58.5	95.3	102 7	75.0	95.0	98.2
Albuminoid nitrogen	4.5	5.8	4.7	5.2	5.0	3.7
Amide nitrogen	1.7	2.3	2.3	1.4	4.5	3.1
Live weight	764.0	805.0	840.0	843.0	879.0	912.0

JERSEY — AVERAGE.

	April.	May.	June.	July.	August.	September.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	961.5	1310.0	1381.7	1597.2	1494.1	1760.8
Water in food	463.3	393.7	537.4	459.0	745.1	742.3
Dry matter eaten	324.4	421.8	376.6	408.9	436.1	424.0
Ash	20.4	22.5	18.9	23.6	25.1	23.5
Albuminoids Nx 6.25	42.5	58.1	54.3	59.3	70.3	66.1
Crude fiber	83.3	102.6	50.9	104.6	99.0	82.5
Nitrogen-free extract	163.9	217.5	164.5	203.2	221.9	221.2
Fat	11.9	19.4	17.9	17.3	18.9	19.0
Invert sugar	12.5	10.5	5.7	13.8	12.6	13.6
Sucrose	27.6	7.3	6.2	8.9	6.9	8.3
Starch	62.0	112.5	110.5	102.2	122.7	130.2
Albuminoid nitrogen	4.7	6.6	6.1	7.5	7.3	6.7
Amide nitrogen	1.9	2.7	2.2	1.7	3.6	3.3
Live weight	749.0	765.0	784.0	787.0	807.0	752.0

SHORT-HORN — AVERAGE.

	April.	May.	June.	July.	August.	September.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	....	170.0	240.3	304.0	101.7	175.4
Water in food	538.8	567.4	592.8	727.0	399.2	479.2
Dry matter eaten	125.6	201.3	216.3	216.0	246.2	268.3
Ash	6.6	9.5	13.8	16.3	13.9	14.9
Albuminoids Nx 6.25	22.0	34.3	45.6	51.2	40.4	39.6
Crude fiber	12.4	32.1	29.1	47.2	50.4	57.8
Nitrogen-free extract	55.5	96.8	109.9	138.4	131.6	145.5
Fat	24.5	28.4	17.6	12.2	9.9	10.8
Invert sugar	1.9	3.4	2.6	6.5	6.7	9.2
Sucrose	26.8	29.5	32.2	33.4	5.5	7.2
Starch	14.6	41.4	49.5	62.4	78.3	90.1
Albuminoid nitrogen	4.1	5.1	6.5	7.3	4.9	4.0
Amide nitrogen	.2	.6	.8	.9	2.1	2.3
Live weight	293.0	375.0	430.0	468.0	510.0	561.0

GENERAL AVERAGE.

	April.	May.	June.	July.	August.	September.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Water drunk	932.7	1056.9	1126.0	1242.9	1274.1	1189.5
Water in food	514.5	462.8	613.1	530.5	716.1	721.8
Dry matter eaten	312.9	396.8	370.7	361.8	405.9	371.5
Ash	19.3	21.4	21.2	21.7	23.3	20.6
Albuminoids Nx 6.25	42.4	57.0	52.0	53.5	65.1	54.5
Crude fiber	75.3	92.9	70.7	94.6	91.4	82.8
Nitrogen-free extract	158.7	201.7	187.4	184.6	207.9	196.1
Fat	14.4	21.4	18.1	15.5	17.3	15.8
Invert sugar	11.0	10.3	5.6	13.1	11.8	12.9
Sucrose	29.9	10.8	11.0	13.3	7.0	8.2
Starch	58.9	100.9	105.5	89.5	115.6	115.0
Albuminoid nitrogen	5.1	6.6	5.9	7.0	6.9	5.3
Amide nitrogen	1.6	2.3	2.2	1.5	3.6	3.2
Live weight	766.0	809.0	836.0	806.0	843.0	839.0

METEOROLOGY FOR 1890.

The early part of this report year, as well as the whole winter was very mild. The frequent rains and lack of frost in the ground for so much of the winter was injurious to cultivators of the soil. This was most noticeable in the heavy condition of the land in the spring. It required very much more work to reduce the soil to a condition suitable for seed than usual. That part of this condition is chargeable to the heavy spring rains is probably true, but the lack of deep frost and long period during which the soil was kept full of water must have been the predominant influence.

The months of May and June this year were the ones during which the heaviest rainfall occurred. Planting was greatly retarded by wet weather, and it was not until very late that some clay fields could be prepared for seed.

Following the wet season came a drought which, in its effects on crops, was quite as harmful to some crops as the wet spring had been to others.

During September there was a change of observers of the meteorological instruments, and to Mr. R. D. Newton is due the credit of continuing *all* the readings for the remainder of the year, as he had been some time taking those of the barometer and wind records.

The soil thermometers were set in their usual positions a few days late and read at regular intervals, as they have been in previous years. The record is included in the tables at the end of this report, as usual.

This record of the temperature of the soil at 7 A. M., 12 M. and 6 P. M., is comparable with itself in the different years it has been taken, but they give us no correct idea of the average temperature of the soil, nor of the extremes.

The writer conceives of many points of interest which might be turned to practical value if continuous record of soil temperature along with its hygrometric condition and color, etc., could be studied along with the seasonal growth of plants.

Some simple rules from such studies, formulated for the purpose and generally known, might save much replanting of spring crops as a first practical result.

EXTREMES AND RANGE OF TEMPERATURE FOR 1890, WITH MONTHLY MEANS FOR FIVE YEARS.

Degrees Fahrenheit.

MONTHS.	Maximum.	Minimum.	Mean of maximum.	Mean of minimum.	Greatest range.	Mean monthly temperature. 1890.	Mean monthly temperature. 1889.	Mean monthly temperature. 1888.	Mean monthly temperature. 1887.	Mean monthly temperature. 1886.	Mean monthly temperature. 1885.
January	67.0	9.0	40.7	22.3	58.0	32.20	29.10	17.80	21.60	20.58	21.05
February	64.5	9.5	40.3	21.5	55.0	31.00	19.83	24.38	25.42	23.22	14.23
March	62.0	2.0	34.9	22.6	60.0	29.63	35.27	25.98	27.65	32.37	21.15
April	78.8	23.0	54.9	33.4	55.8	46.63	46.90	43.28	43.85	50.40	43.78
May	72.8	30.0	61.6	42.9	42.8	55.03	57.82	56.40	65.80	58.45	58.03
June	87.5	44.8	76.0	58.1	42.7	69.37	65.50	70.45	69.22	67.95	66.93
July	94.5	46.5	80.0	58.9	48.0	73.13	72.40	71.16	78.00	71.47	72.91
August	96.2	46.0	77.6	57.7	50.2	68.47	68.33	70.48	68.92	69.70	65.98
September	83.6	35.5	69.1	51.0	48.1	61.03	61.30	59.84	59.55	63.60	60.65
October	72.8	32.0	56.4	42.2	40.8	49.27	43.73	44.37	46.11	51.07	49.04
November	65.4	18.0	45.5	29.6	47.4	38.27	40.18	39.28	37.30	37.17	39.90
December	46.2	3.0	30.0	12.7	43.2	22.60	35.67	29.73	28.35	22.85	28.89
Mean yearly temperature	......	......	......	......	......	48.05	48.00	46.10	47.65	47.40	45.21

DAYS ON WHICH PRECIPITATION WAS APPRECIABLE.

YEARS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October	November.	December.	Total.
1882.	......	......	......	......	......	9	12	10	6	7	7	4	55
1883.	13	13	12	11	16	12	13	9	10	10	5	11	135
1884.	11	14	16	11	15	10	12	6	7	13	8	10	137
1885.	12	7	8	13	13	12	9	20	6	12	15	12	139
1886.	12	11	11	10	7	7	12	6	11	9	11	13	120
1887.	12	15	10	9	7	9	10	7	5	15	9	9	117
1888.	14	6	9	9	16	13	7	11	9	19	12	6	131
1889.	7	10	5	9	9	15	9	10	7	13	12	12	118
1890	14	9	14	6	14	8	5	16	11	16	13	8	134
Average of previous years	11.6	10.9	10.1	10.3	12.1	10.9	10.5	9.9	7.6	12.3	9.9	9.6	125.7
1890 + or —	+2	—2	+4	—4	+2	—3	—6	+6	+3	+4	+3	—2	+8

PRECIPITATION BY MONTHS SINCE 1882.

YEARS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1882	....	...	....	....	....	3.69	2.42	2.37	1.25	0 62	1.22	0.55	......
1883	0.48	1.44	0.88	1.58	4.45	4.12	2.98	3.47	2.12	2.10	1.54	0.73	25.89
1884	1.83	2.01	2.54	0.83	2.49	2.01	2.33	1.44	3.17	1.67	1.01	0.97	22.30
1885	1.07	0.61	0.12	1.26	1.58	2.49	4.64	5.02	2.11	2.88	1 36	0.76	23.90
1886	1.13	0.95	1.13	4.13	1.92	2.92	4.41	2.86	2.31	1.39	3.48	1.24	27.87
1887	0.18	2.97	0.48	1.37	0.46	2.01	6.37	3.03	0.75	1.74	1.58	1.35	22.29
1888	0.78	1.04	1.43	3.09	2.79	3.88	0.99+	4.02	2.73	3.47	2.02	1.24+	27.48
1889	2.99+	0.25	0.66+	3.28	1.21	7.47	4.57	1.98	2.50	3.32	3.44	1.62	32.28
1890	2.16	1.45	2.16	2.20	5.49	5.26	1.07	4.34	5.81	4.54	2.40	....	36.88

WIND RECORD.

The record of all the wind strong enough to turn a vane has been recorded accurately as to the direction and time. For a considerable part of the summer the distance traveled was taken, but has not been included here, chiefly because the apparatus has not been accurately tested to obtain the factor for distance of movement per revolution.

WIND RECORD FROM NOVEMBER, 1889, TO FEBRUARY, 1890.

DATE.	November				December				January				February			
	Northerly, N.W. to N.E.	Easterly, N.E. to S.E.	Southerly, S.E. to S.W.	Westerly, S.W. to N.W.	Northerly, N.W. to N.E.	Easterly, N.E. to S.E.	Southerly, S.E. to S.W.	Westerly, S.W. to N.W.	Northerly, N.W. to N.E.	Easterly, N.E. to S.E.	Southerly, S.E. to S.W.	Westerly, S.W. to N.W.	Northerly, N.W. to N.E.	Easterly, N.E. to S.E.	Southerly, S.E. to S.W.	Westerly, S.W. to N.W.
	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.
1	...	3.5	1.7	7.0	....	3.0	15.3	......	....	6.5	16.0	......	4.3	2.5	......	......
2	.3	8 0	1.0	.....	6.5	......	......	5.5	....	....	.....	23.5	....	...	21.5	......
3	....	7.0	5.5	11.0	17.0	......	......	......	....	3.0	.3	16.5	....	3.7	......	11.3
4	....	....	4.5	13.3	....	11.0	2.0	......	....	16.0	3.5	......	....	....	12 5	11.0
5	....	....	....	24.0	....	......	6 5	16.0	....	....	19.0	......	5.5	....	......	15.5
6	....	....	....	24.0	....	......	2 5	11.0	....	....	......	21.0	....	6.5	1.5	2.5
7	...	....	15.3	7.3	....	4.0	1.5	3.0	1.5	....	......	6.0	....	5.0	14.0	4.5
8	....	....	...	16.3	....	2.0	12 0	3.0	....	....	......	20.0	1.3	....	......	22.0
9	.....	6.7	6.5	......	...	1.5	...	9.0	2.5	1.5	......	1.3	1.0	.7	.7	1.3
10	.3	....	....	2.5	....	9.0	12.0	1.0	3.5	2.0	......	......	....	3.0	1.7	......
11	....	....	2.7	4.0	....	......	......	24.0	1 0	...	10.0	7.5	...	....	17.3	6.5
12	....	2.3	3 5	1.0	...	......	......	11.0	.3	6.0	6 7	......	....	....	6.3	15.0
13	....	1.3	21 3	......	5.0	6.0	......	12.0	....	....	......	18 0	....	1.3	18.5	......
14	....	3.5	1.3	8.5	4.0	......	1.5	3 0	....	16.5	6.0	......	....	2.3	4.7	16.3
15	3.0	....	....	21 0	....	......	5.5	4.0	.5	.5	3.5	10.0	1.3	....	......	13.5
16	....	....	....	21.5	....	7.0	14.5	......	.3	....	......	15.7	2.5	1.0	6.0	......
17	...	8.0	...	......	....	14.0	4.5	......	....	....	......	4.0	2.7	....	......	......
18	2.5	.3	....	......	....	5.5	7.5	7.0	....	...	.5	......	....	....	......	17.0
19	4.3	1.0	2.0	......	....	4.0	.5	4.5	....	...	17.5	2.3	2.0	14.0	3.5	4.0
20	....	1.0	11.0	......	1.5	...	4.7	16.0	....	....	......	24.0	....	....	......	24.0
21	....	1.5	4.5	.5	....	7.5	3.5	2.0	....	....	2.0	22 0	2.0	...	......	13.3
22	....	...	1.0	18.0	....	......	......	24 0	....	2.0	4.5	10.7	....	1.0	4.0	6.0
23	....	3.0	3.0	12.5	....	3.5	2.3	......	....	....	5.0	18.0	...	1.3	18.0	......
24	....	....	5.5	8.5	....	5.5	5.0	12.0	....	....	12.0	8.0	....	....	14.0	.5
25	....	....	...	20.0	....	.5	8.0	11.0	....	....	4.0	8.7	....	....	1.5	8.7
26	....	17 0	....	2.0	....	......	......	24.0	2.0	.5	......	6.3	....	7.0	......	9.5
27	....	7.0	....	6.0	.5	2.5	......	12.0	8.0	....	......	13.0	....	16.5	5.0	......
28	....	...	8.0	13.5	1.0	10.5	......	......	....	....	.5	3.3	....	...	6.5	17.5
29	....	....	....	24.0	....	.....	6 0	16.0	....	...	4.0	3.7	...	....	......	......
30	....	....	3.5	5.5	3.5	2.0	......	6.0	....	...	13 7	......	...	....	......	......
31	....	....	....	......	....	7.5	11.5	......	1.0	....	6.0	14.0	....	....	......	......
Total hours of movement	10.4	71.1	91 8	271.9	39.0	106 5	106.8	237.0	20.6	54.5	134.7	277.5	22 6	65.8	157.2	219.9
Per cent of time in each direction	2.3	15.7	20.6	**60,8**	7.9	21.8	21.8	**48.4**	4.2	11.2	27.6	**56.9**	4.9	14.1	33.8	**47.2**

Wind Record from March to June, 1890.

Date.	March.				April.				May.				June.			
	Northerly, N.W. to N.E.	Easterly, N.E. to S.E.	Southerly, S.E. to S.W.	Westerly, S.W. to N.W.	Northerly, N.W. to N.E.	Easterly, N.E. to S.E.	Southerly, S.E. to S.W.	Westerly, S.W. to N.W.	Northerly, N.W. to N.E.	Easterly, N.E. to S.E.	Southerly, S.E. to S.W.	Westerly, S.W. to N.W.	Northerly, N.W. to N.E.	Easterly, N.E. to S.E.	Southerly, S.E. to S.W.	Westerly, S.W. to N.W.
	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.
1	2.5	....	....	15.0	2.0	....	....	12.0	2.5	3.5	1.5	12.0	3.5	....	....	19.0
2	5.0	....	....	2.0	....	2.0	9.0	3.0	....	2.3	21.0	....	4.0	2.0	6.5	....
3	....	....	.5	4.5	....	3.0	14.5	....	....	....	9.5	3.5	.3	3.5	4.3	4.0
4	....	1.0	6.3	16.0	6.0	....	....	8.5	2.0	2.0	....	13.5	....	....	4.0	12.5
5	2.0	....	....	10.5	3.0	....	10.0	8.0	4.7	3.5	....	12.3	3.0	2.0	6.5	2.3
6	4.0	....	....	12.5	3.0	4.0	....	6.0	.5	....	....	17.0	....	....	9.5	8.0
7	.5	....	....	4.5	3.0	....	....	5.0	6.0	....	....	10.5	....	....	....	24.0
8	1.0	....	....	14.0	....	14.5	8.5	....	....	....	7.0	12.0	....	....	....	15.0
9	....	1.5	19.0	....	....	....	3.3	20.0	6.5	....	2.0	4.3	3.3	3.5	1.5	1.3
10	....	2.5	19.0	....	2.5	....	....	19.5	16.0	....	....	7.0	....	....	2.7	3.3
11	....	....	23.0	....	....	3.0	10.5	5.0	5.5	2.5	2.0	....	.5	....	5.0	1.0
12	2.5	....	6.5	....	....	....	.7	20.0	5.5	1.0	2.5	3.0	2.0	....	2.0	1.5
13	....	....	5.0	8.7	4.5	....	3.5	6.0	....	....	....	10.5	....	....	....	15.5
14	....	2.0	2.0	13.0	2.0	....	....	21.0	2.3	2.0	5.5	2.5	2.3	....	.5	....
15	....	....	.3	23.3	8.0	....	2.0	6.0	.7	....	3.5	7.5	9.0	....	....	7.0
16	....	....	....	24.0	2.0	....	6 0	9.5	....	....	6.0	8.5	....	6.5	8.0	....
17	....	....	....	24.0	15.0	....	....	8.0	....	5.0	....	11.0	....	7.0	12.0	....
18	....	....	....	8.0	6.5	....	....	12.0	....	....	20.0	....	.5	....	4.5	15.0
19	....	.5	2.0	1.0	2.5	....	....	16.5	8.0	....	....	9.0	3.0	....	....	21.0
20	....	8.0	11.0	....	2.0	....	3.0	10.5	....	3.5	.5	17.5	10.0	....	....	1.8
21	....	....	....	21.0	....	....	.5	20.0	....	14.0	1.0	....	1.5	10.5	5.5	....
22	5.0	....	....	13.0	....	.5	10.0	5.5	....	....	16.0	3.5	.5	6.8	6.8	.2
23	....	....	....	23.0	5.5	....	5.5	3.5	1.0	3.0	6.0	3.0	.8	1.8	4.0	6.3
24	.5	13.0	4.0	4.0	15.0	....	....	5.5	....	16.7	2.3	....	.2	....	4.0	5.0
25	....	....	13.0	10.0	10.0	4.5	2.5	....	....	1.5	22.0	....	....	....	3.5	15.5
26	....	....	....	24.0	....	9.0	14.0	....	1.5	....	9.0	10.5	2.5	....	....	21.5
27	2.5	14.0	....	6.5	....	....	....	19.5	.7	1.0	....	15.0	11.0	....	....	10.0
28	1.0	2.5	....	19.5	5.0	1.0	12.0	....	2.5	....	....	10.7	....	....	....	22.0
29	....	....	....	24.0	....	5.0	....	18.0	2.7	.7	1.3	....	....	5.7	.3	3.5
30	....	....	1.5	22.0	2.0	2.0	....	10 0	....	....	4.7	1.5	3.8	1.5	5.5	.2
31	4.0	2.0	1.0	9.0	....	....	....	....	4.5	....	....	14.0	....	....	....	....
Total hours of movement	31.5	47.0	114.1	357.0	99.5	48.5	102.8	278.5	73.1	62.2	143.3	219.8	61.7	50.8	96.6	236.4
Per cent of time in each direction	5.7	8.6	20.8	**64.9**	18.8	9.2	19.4	**52.6**	14.7	12 5	28.7	**44.1**	13.84	11.40	21.66	**53.10**

WIND RECORD FROM JULY TO OCTOBER, 1890.

DATE.	July. Northerly, N.W. to N.E.	July. Easterly, N.E. to S.E.	July. Southerly, S.E. to S.W.	July. Westerly, S.W. to N.W.	August. Northerly, N.W. to N.E.	August. Easterly, N.E. to S.E.	August. Southerly, S.E. to S.W.	August. Westerly, S.W. to N.W.	September. Northerly, N.W. to N.E.	September. Easterly, N.E. to S.E.	September. Southerly, S.E. to S.W.	September. Westerly, S.W. to N.W.	October. Northerly, N.W. to N.E.	October. Easterly, N.E. to S.E.	October. Southerly, S.E. to S.W.	October. Westerly, S.W. to N.W.
	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.
1		4.5+			1.5	.5		19.0				24 0		4.0		
2			23.0	1.0							2.5	7.0		4.5	1.5	
3			12.5	7.0	2.0	4.8	12.0			7.5	1.0	2.0		9.0	3.0	
4	3.0		2.0	8.0			14.8	3.0	3.5	1.0	8.0				4.5	7.0
5				24.0							11.0	6.5				24.0
6		3.5	5.0	7.0	4.0			13.5	1.5	.5	1.0	4.0				4.5
7		6.0	4.5	1.5	6.0	2.5				2.0	4.5	1.0		2.0		1.0
8	.2	1.5	3.0	9.8	6.0	2.5				2.0	16.0					17.0
9	3.5			19 5		2.0	22.0		10.0		3.5	8.0				5.0
10				24.0			3.0	16.0	14.0	1.5		1.0			5.0	
11	1.0			18.0	6.0			18.0		20.5	1.0	2.0			2.0	17.5
12	6.0	4.0	4.0		11.0			12.0			20.0					14.0
13	3.0	6.5	2.8	4.0	7.0		1.5	4.0			11.0	1.0			3.5	
14			24.0			6.0	1.5	.5			3 0	13.5			20.0	
15		9.0	7.0	4.0	2.0		2.0	16.0			13.0					24.0
16	.5		2.5	10.8	9.0	1 0	4.0				10.0	4.0		2.5	.5	1.0
17	1.5	.7	3.3	6.0		5.0	15.5	2.5	21.0						13.0	9.0
18	8.0		2.5	11.0	6.2			13.0	6.0			18.0				24.0
19	1.0			20.0	6.0	2.5	5.5				10.0	6.0			3.0	1.0
20	6.0			13.5	8.5		4.0	2.2		3.0	8.0	7.0	23.0			1.0
21	7 5			8.0	3.5	7.0	3.2	1.8				24.0	13.5			
22	6.5	2.7	1.8				6.0	17.0			4.0	6 5	5.0		2.0	
23		5.0	19.0		20.0			4.0			1.0	10.5			19.0	
24		4.0	4.+		4.0			12.0				22.0			15.0	
25			24.0				3.0	9 0	2.0		5.0	3.0	15.0			
26			18.0	3.5		1.5	5.8				11.0		9.0			
27			3.0	11.0		1.0	3.5	8.8	11.0				20.0			
28	5 0		5.0	2.0				24.0	9.0				3.0			18.0
29		6.0	12.5				4.2	7.0	9.0						10.0	5.0
30		3.5	7.0	4.5	.5		5.0	15.5		3.0				2.0	4.0	16.0
31			10.0	11.8				24.0								4.0
Total hours of movement	53.7	56.9	200.4	229.9	103.2	36.3	116.5	242.8	87.0	41.0	144.5	171.0	88.5	24.0	106 0	193 0
Per cent of time in each direction	9 93	10.52	**37.05**	**42.50**	20.68	7.28	23.35	**48.68**	19.62	9.24	32.58	**38.56**	21.51	5.83	25.76	**46.90**

SUMMARY OF DIRECTION OF WIND FOR 1889–90.

	Northerly, N.W. to N.E.	Easterly, N.E. to S.E.	Southerly, S.E. to S.W.	Westerly, S.W. to N.W.
	Hours.	Hours.	Hours.	Hours.
November	10.4	71.1	91.8	271.9
December	39.0	106.5	106.8	237.0
January	20.6	54.5	134.7	277.5
February	22.6	65.8	157.2	219.9
March	31.5	47.0	114.1	357.0
April	99.5	48.5	102.8	278.5
May	73.1	62.2	143.3	219.8
June	61.7	50.8	96.6	236.4
July	53.7	56.9	200.4	229.9
August	103.2	36.3	116 5	242.8
September	87.0	41.0	144.5	171.0
October	88.5	24.0	106.0	193.0
Total hours	690.8	574.6	1514.7	2934.7
Per cent of time from each direction	12.1	10.1	26.5	51.3

It will be noted that the prevailing wind has been almost steadily west to southwest since this record began.

SUNSHINE RECORD.

This record of sunshine has been continued uniform with the first method adopted by Dr. Babcock, and a summary follows the record for 1890, showing a comparison of the sunshine for each year it has been recorded by the Negretti and Zambra instrument. The past season the photographic sunshine record was carried on beside this, but it is omitted from the report. Rather more sunshine was recorded by the latter instrument than is given in the table.

SUNSHINE RECORD FOR 1890 BY NEGRETTI AND ZAMBRA INSTRUMENTS.

DATE.	JANUARY.												FEBRUARY.											
	Before 9 A. M.		9 to 12.		12 to 3.		After 3 P. M.		Total hours.		Hours, sunrise to sunset.		Before 9 A. M.		9 to 12.		12 to 3.		After 3 P. M.		Total hours.		Hours, sunrise to sunset.	
	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.
1	0	00	0	00	0	00	0	00	0	00	9	08	0	00	0	00	0	00	0	00	0	00	10	00
2	0	00	0	00	0	00	0	00	0	00	9	09	0	00	0	45	0	30	0	00	1	15	10	02
3	0	30	0	00	0	00	0	00	1	00	9	10	0	00	0	00	0	00	0	00	0	00	10	04
4	1	00	0	30	2	45	0	00	6	45	9	11	0	00	0	00	0	00	0	00	0	00	10	07
5	0	00	3	00	0	00	0	00	0	00	9	12	0	15	1	30	1	45	0	15	3	45	10	09
6	0	00	0	00	0	00	0	00	0	00	9	14	0	00	0	30	1	00	1	45	3	15	10	12
7	0	00	0	00	0	25	0	10	0	35	9	15	0	00	0	00	0	00	0	00	0	00	10	14
8	0	00	0	00	0	00	0	00	0	00	9	16	0	00	0	00	0	00	0	00	0	00	10	17
9	0	00	0	00	0	00	0	00	0	00	9	17	0	00	0	00	1	15	0	15	1	30	10	19
10	0	00	0	00	0	00	0	00	0	00	9	18	0	40	2	00	3	00	2	15	7	55	10	21
11	0	00	0	00	1	00	0	00	1	00	9	19	0	30	3	00	3	00	1	55	8	25	10	24
12	0	00	0	00	0	00	0	00	0	00	9	22	0	45	0	45	0	00	0	00	1	30	10	27
13	0	00	1	30	1	50	0	20	3	40	9	23	1	10	2	20	2	50	2	10	8	30	10	29
14	0	00	2	50	3	00	1	30	7	20	9	24	0	00	0	00	0	05	0	00	0	05	10	31
15	0	00	0	00	0	00	0	00	0	00	9	26	0	45	2	00	1	45	0	30	5	00	10	35
16	0	00	1	15	0	00	0	00	1	15	9	27	2	20	3	00	2	00	0	15	7	35	10	37
17	0	00	1	15	0	45	0	00	2	00	9	29	0	00	0	00	0	45	0	45	1	30	10	41
18	1	05	1	00	0	20	0	00	2	25	9	30	0	00	0	00	0	00	0	00	0	00	10	43
19	0	00	0	30	1	00	0	00	1	30	9	33	0	40	1	00	0	45	0	00	2	25	10	46
20	0	00	0	00	1	30	0	30	2	00	9	35	0	00	2	00	0	30	0	00	2	30	10	49
21	0	20	2	45	1	00	0	00	4	05	9	36	0	00	0	00	0	00	0	00	0	00	10	52
22	0	00	1	30	2	45	1	45	6	00	9	38	0	00	0	30	2	00	0	15	2	45	10	55
23	0	00	0	00	0	00	0	00	0	00	9	41	0	00	3	00	2	00	0	00	5	00	10	58
24	0	00	0	00	0	00	0	00	0	00	9	42	0	00	1	00	0	05	0	25	1	30	11	01
25	0	00	0	00	0	00	0	00	0	00	9	44	0	00	0	00	0	45	0	00	0	45	11	04
26	0	00	0	00	0	00	0	00	0	00	9	46	0	30	0	00	0	00	0	00	0	30	11	06
27	0	00	0	00	0	00	0	00	0	00	9	49	0	00	0	00	0	00	0	00	0	00	11	10
28	1	00	0	00	2	20	1	45	5	05	9	51	0	00	0	00	0	30	0	00	0	30	11	12
29	0	30	0	00	0	00	0	00	0	30	9	53	..	..	..	..	..	..	..	..	..	..	..	..
30	0	00	0	00	0	00	0	00	0	00	9	56	..	..	..	..	..	..	..	..	..	..	..	..
31	0	00	0	00	0	00	0	00	0	00	9	58	..	..	..	..	..	..	..	..	..	..	..	..
Total hours	4	25	16	05	18	40	6	00	45	10	294	12	7	35	23	20	24	30	10	45	66	10	296	05
Per cent of possible	9.0		17.3		20.0		10.1		15.4		...	..	13.2		27.8		29.1		15.3		22.3		...	..

SUNSHINE RECORD — (*Continued*).

DATE.	March. Before 9 A. M.	March. 9 to 12.	March. 12 to 3.	March. After 3 P. M.	March. Total hours.	March. Hours, sunrise to sunset.	April. Before 9 A. M.	April. 9 to 12.	April. 12 to 3.	April. After 3 P. M.	April. Total hours.	April. Hours, sunrise to sunset.
	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.
1	0 05	0 25	0 00	0 00	0 30	11 15	2 15	3 00	3 00	2 30	10 45	12 42
2	0 00	0 00	0 00	2 00	2 00	11 17	2 15	2 30	3 00	2 20	10 05	12 46
3	0 00	1 00	0 30	0 15	1 45	11 20	2 40	3 00	3 00	0 30	9 10	12 48
4	1 45	0 45	0 30	0 00	3 00	11 23	0 00	1 00	1 45	0 30	3 15	12 51
5	2 00	2 15	1 45	0 00	6 00	11 25	2 50	3 00	3 00	2 40	11 30	12 54
6	0 00	0 00	0 00	0 30	0 30	11 28	2 50	2 35	0 20	0 00	5 45	12 56
7	0 20	1 45	2 45	2 30	7 20	11 31	0 00	0 00	0 20	3 00	3 20	12 59
8	2 15	3 00	3 00	1 30	9 45	11 33	0 00	0 00	0 15	2 15	2 30	13 02
9	2 40	3 00	3 00	2 45	11 25	11 36	0 00	0 00	0 15	0 00	0 15	13 04
10	0 00	0 45	0 15	0 00	1 00	11 39	0 00	0 00	0 00	0 45	0 45	13 08
11	0 00	0 00	0 00	0 00	0 00	11 42	1 15	3 00	2 30	1 45	8 30	13 11
12	0 00	0 00	0 00	0 00	0 00	11 45	2 45	3 00	3 00	2 30	11 15	13 13
13	0 00	0 00	0 00	0 00	0 00	11 48	0 10	1 45	2 10	2 45	6 50	13 16
14	0 00	0 00	0 00	0 45	0 45	11 51	1 15	0 00	0 00	0 00	1 15	13 19
15	2 00	1 35	0 00	0 00	3 35	11 53	1 00	3 00	3 00	3 00	10 00	13 21
16	0 15	1 00	2 00	0 15	3 30	11 56	3 00	3 00	3 00	3 15	12 15	13 24
17	2 15	0 15	0 00	0 00	2 30	12 00	3 00	3 00	2 40	0 35	9 15	13 27
18	0 30	0 00	0 45	0 00	1 15	12 03	2 40	3 00	3 00	3 20	12 00	13 30
19	0 00	0 00	0 00	0 00	0 00	12 05	2 30	3 00	3 00	3 20	11 50	13 33
20	1 45	0 10	0 15	0 00	2 10	12 08	3 20	3 00	3 00	3 15	12 35	13 35
21	0 00	0 00	1 45	1 30	3 15	12 11	3 10	2 45	3 00	2 45	11 40	13 38
22	0 00	0 00	0 00	0 00	0 00	12 14	1 15	3 00	2 45	0 30	7 30	13 40
23	0 00	2 20	2 00	0 10	4 30	12 16	0 10	0 00	0 00	0 00	0 10	13 43
24	2 45	2 45	2 30	1 20	9 20	12 19	0 00	0 00	0 00	0 00	0 00	13 45
25	0 00	0 00	0 00	0 15	0 15	12 22	3 00	3 00	3 00	2 40	11 40	13 48
26	0 00	0 00	0 00	0 00	0 00	12 25	0 00	0 00	0 00	0 00	0 00	13 50
27	1 45	2 00	0 15	0 45	4 45	12 27	0 00	0 00	0 00	0 00	0 00	13 54
28	0 00	0 00	0 00	0 00	0 00	12 30	3 10	3 00	3 00	3 00	12 10	13 56
29	0 00	0 00	0 00	0 45	0 45	12 33	2 20	2 20	0 00	0 00	4 40	13 59
30	0 45	0 00	3 00	2 15	6 00	12 36	0 30	3 00	3 00	1 40	8 10	14 01
31	2 40	1 30	0 30	0 30	5 10	12 39	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
Total hours	23 45	24 30	24 45	18 00	91 00	370 10	47 20	57 55	55 00	48 50	209 05	401 13
Per cent of possible	27.1	26.3	26.6	18.7	24.6	... ..	47.1	64.3	61.1	44.0	52.1	... ..

SUNSHINE RECORD — (*Continued*).

DATE.	May.												June.											
	Before 9 A. M.		9 to 12.		12 to 3.		After 3 P. M.		Total hours.		Hours, sunrise to sunset.		Before 9 A. M.		9 to 12		12 to 3.		After 3 P. M.		Total hours.		Hours, sunrise to sunset.	
	Hrs.	m	Hrs.	m.	Hrs	m.	Hrs.	m.	Hrs	m	Hrs.	m.	Hrs	m.	Hrs.	m	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.
1	0	00	0	00	0	00	0	30	0	30	14	06	3	00	3	00	3	00	4	15	13	15	15	05
2	3	20	3	00	3	00	3	00	12	20	14	08	3	15	3	00	3	00	3	30	12	45	15	06
3	3	15	3	00	3	00	1	45	10	00	14	11	2	30	2	30	3	00	1	30	9	30	15	08
4	0	00	0	00	0	00	0	00	0	00	14	13	0	00	0	15	2	30	2	30	5	15	15	09
5	0	00	0	45	1	20	1	50	3	55	14	15	1	30	3	00	2	15	2	00	8	45	15	09
6	0	00	0	00	0	00	0	00	0	00	14	17	0	30	0	50	0	00	2	00	3	20	15	10
7	0	00	0	00	0	00	1	30	1	30	14	20	0	00	1	15	0	00	0	00	1	15	15	11
8	3	20	3	00	3	00	3	20	12	40	14	22	3	40	3	00	3	00	3	30	13	10	15	12
9	0	00	0	00	0	00	0	00	0	00	14	25	3	40	3	00	3	00	3	00	12	40	15	13
10	3	30	3	00	3	00	3	30	13	00	14	27	3	30	2	40	0	00	0	00	6	10	15	14
11	0	00	0	00	0	00	0	00	0	00	14	29	2	45	2	00	0	30	0	00	5	15	15	15
12	3	30	2	15	2	50	1	50	10	25	14	31	2	20	1.	50	0	00	1	00	5	10	15	15
13	0	00	0	00	0	00	0	00	0	00	14	33	0	00	0	00	0	00	0	00	0	00	15	16
14	0	00	0	00	0	00	0	00	0	00	14	35	0	10	0	00	0	00	0	50	1	00	15	16
15	0	00	1	30	0	45	1	45	4	00	14	37	0	00	0	00	1	45	2	00	3	45	15	16
16	0	00	0	00	2	00	2	00	4	00	14	39	0	00	0	00	1	15	2	15	3	30	15	17
17	1	15	2	00	3	00	3	00	9	45	14	41	3	30	3	00	1	20	0	45	8	35	15	17
18	2	45	3	00	1	15	0	15	7	15	14	43	3	10	3	00	3	00	4	00	12	10	15	18
19	0	00	0	00	0	00	0	00	0	00	14	45	3	45	3	00	2	15	3	15	13	15	15	17
20	0	00	0	00	0	00	0	00	0	00	14	47	3	50	2	45	2	00	0	45	9	20	15	17
21	4	00	2	45	1	20	0	10	8	15	14	49	0	00	0	00	0	00	0	00	0	00	15	17
22	0	00	0	00	2	45	2	30	5	15	14	51	0	00	0	00	1	30	0	15	1	45	15	17
23	0	00	0	00	0	00	0	30	0	30	14	52	1	30	2	45	3	00	3	30	10	45	15	17
24	3	45	2	15	0	00	0	30	6	30	14	54	2	30	3	00	1	00	0	00	6	30	15	17
25	2	15	2	30	1	20	0	15	6	30	14	56	3	40	3	00	3	00	3	40	13	20	15	17
26	0	00	0	00	0	00	0	00	0	00	14	57	2	45	3	00	3	00	4	00	12	45	15	16
27	2	20	2	45	0	45	1	25	7	15	14	58	4	00	3	00	3	00	3	40	13	40	15	16
28	3	00	3	00	3	00	2	30	11	30	15	00	0	00	0	00	0	00	0	00	0	00	15	15
29	1	00	2	40	0	00	0	00	3	40	15	01	3	15	3	00	3	00	3	30	12	45	15	15
30	0	00	0	00	0	00	0	10	0	10	15	03	3	45	3	00	3	00	2	30	12	15	15	15
31	2	10	3	00	0	00	3	30	11	40	15	04	..	..	..	..	..	..	..	..	..	..	..	..
Total hours	39	25	40	25	35	30	34	45	150	05	453	29	61	30	58	50	52	20	58	10	230	50	457	03
Per cent of possible	29.2		43.5		38.2		26.4		33 1		...	.	44.5		65.4		58.1		42.0		50.5		...	..

SUNSHINE RECORD — (*Continued*).

DATE.	July. Before 9 A. M.	July. 9 to 12.	July. 12 to 3.	July. After 3 P. M.	July. Total hours.	July. Hours, sunrise to sunset.	August. Before 9 A. M.	August. 9 to 12.	August. 12 to 3.	August. After 3 P. M.	August. Total hours.	August. Hours, sunrise to sunset.
	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.
1	0 05	0 45	1 15	0 10	2 15	15 13	0 30	3 00	2 50	3 30	9 50	14 26
2	0 15	2 30	2 15	1 15	6 15	15 12	2 30	3 00	3 00	2 50	11 00	14 24
3	0 00	1 20	3 00	1 30	4 50	15 12	2 30	2 30	1 20	0 00	6 20	14 22
4	3 45	3 00	3 00	2 30	12 15	15 11	2 15	2 50	2 10	2 30	9 45	14 20
5	1 30	2 45	3 00	3 30	10 45	15 10	0 00	1 45	0 00	0 00	1 45	14 17
6	3 30	3 00	2 50	2 10	11 30	15 09	3 25	3 00	2 20	1 45	10 30	14 15
7	2 45	3 00	3 00	1 15	10 00	15 08	3 00	3 00	3 00	1 30	10 30	14 13
8	2 00	3 00	3 00	2 45	10 45	15 07	2 00	3 00	3 00	2 50	10 50	14 11
9	3 00	2 00	3 00	3 45	11 45	15 06	0 00	2 10	1 00	1 00	4 10	14 08
10	3 15	2 00	3 00	3 30	11 45	15 05	1 00	1 15	1 00	1 15	4 30	14 06
11	3 50	3 00	3 00	3 40	13 30	15 04	0 00	1 30	3 00	3 25	7 55	14 03
12	3 35	3 00	3 00	0 05	9 40	15 03	3 30	3 00	3 00	3 20	12 50	14 01
13	0 00	1 40	2 30	3 15	7 25	15 01	3 15	3 00	3 00	3 15	12 30	13 59
14	2 45	2 50	2 30	2 30	10 35	14 59	0 00	0 00	0 15	1 15	1 30	13 55
15	2 15	2 00	1 30	3 30	9 15	14 58	2 45	3 00	3 00	3 00	11 45	13 53
16	2 35	3 00	3 00	3 30	12 05	14 56	3 15	3 00	1 45	3 25	11 25	13 50
17	2 00	0 15	0 30	2 00	4 15	14 55	0 15	0 20	0 00	0 00	0 35	13 48
18	2 25	3 00	3 00	3 15	11 40	14 54	2 45	3 00	3 00	3 15	12 00	13 45
19	2 45	3 00	3 00	2 30	11 15	14 52	0 00	0 00	0 00	0 00	0 00	13 43
20	2 10	2 45	2 40	3 30	10 05	14 50	2 10	0 40	1 10	2 45	6 45	13 40
21	3 30	2 00	3 00	3 30	12 00	14 48	0 00	0 00	0 00	0 00	0 00	13 38
22	3 30	3 00	3 00	3 15	12 45	14 46	0 30	1 45	0 15	0 00	2 30	13 35
23	1 45	2 15	2 50	2 00	8 50	14 45	0 00	2 00	1 15	2 15	5 30	13 33
24	0 10	0 00	0 00	0 00	0 10	14 43	3 00	1 15	2 15	3 00	9 30	13 30
25	1 00	0 45	3 00	0 30	5 15	14 41	0 30	2 30	3 00	2 00	8 00	13 27
26	2 00	2 45	2 45	3 30	11 00	14 39	0 00	0 00	0 00	0 00	0 00	13 25
27	3 00	2 15	2 45	3 15	11 15	14 37	0 00	0 00	0 00	0 00	0 00	13 22
28	3 00	2 00	2 00	1 00	8 00	14 35	0 15	2 45	3 00	2 00	8 00	13 19
29	3 00	2 00	3 00	2 00	10 00	14 33	0 00	0 00	0 00	0 00	0 00	13 16
30	2 50	2 40	0 00	0 00	5 00	14 31	0 00	0 00	0 00	0 00	0 00	13 13
31	0 20	1 30	1 45	1 00	4 35	14 28	0 00	0 05	2 00	2 30	4 35	13 10
Total hours	70 30	67 00	76 05	70 05	283 40	462 11	39 20	53 20	49 35	52 15	194 30	428 47
Per cent of possible	59.2	72.0	81.8	49.7	61.4	... ..	33.1	57.3	53.3	42.6	45.4	... ..

SUNSHINE RECORD — (*Continued*).

DATE.	September. Before 9 A. M.		9 to 12.		12 to 3.		After 3 P. M.		Total hours.		Hours, sunrise to sunset.		October. Before 9 A. M.		9 to 12.		12 to 3.		After 3 P. M.		Total hours.		Hours, sunrise to sunset.	
	Hrs.	m.	Hrs.	m.	Hrs.	m	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.	Hrs.	m.
1	2	30	3	00	3	00	2	30	11	00	13	08	1	00	3	00	3	00	1	30	8	30	11	43
2	2	30	3	00	3	00	2	15	10	45	13	05	0	00	0	00	0	00	0	00	0	00	11	40
3	2	15	3	00	3	00	2	00	10	15	13	02	0	00	1	00	3	00	2	00	6	00	11	38
4	2	10	2	30	3	00	1	45	9	25	13	00	2	00	0	00	0	00	0	00	2	00	11	35
5	0	00	1	15	0	30	0	00	1	45	12	57	0	00	0	00	0	00	0	00	0	00	11	32
6	0	00	0	10	1	20	0	10	1	40	12	54	0	00	0	00	0	00	0	00	0	00	11	30
7	1	30	1	45	2	50	2	00	8	05	12	51	0	00	0	00	0	00	0	00	0	00	11	27
8	0	30	1	15	0	45	0	00	2	30	12	49	2	00	3	00	3	00	2	00	10	00	11	24
9	0	00	0	15	0	05	0	00	0	20	12	46	1	00	3	00	2	45	1	00	7	45	11	21
10	0	00	0	00	0	00	0	00	0	00	12	43	0	30	0	30	0	00	0	00	1	00	11	18
11	0	00	0	00	0	00	0	00	0	00	12	40	0	00	0	00	0	00	0	00	0	00	11	15
12	0	00	0	45	0	30	0	05	1	20	12	38	0	00	0	00	0	00	0	00	0	00	11	13
13	0	00	0	35	2	25	0	00	3	00	12	35	0	00	0	30	1	00	0	00	2	30	11	10
14	1	30	3	00	2	45	0	30	7	45	12	32	0	00	0	00	0	00	0	00	0	00	11	07
15	0	05	2	25	3	00	1	30	7	00	12	28	0	00	0	00	0	00	0	00	0	00	11	04
16	0	00	0	35	2	30	1	45	4	50	12	26	0	45	3	00	3	00	2	00	8	45	11	01
17	0	00	0	00	0	00	0	00	0	00	12	23	0	00	0	00	0	00	0	00	0	00	10	58
18	1	30	3	00	3	00	2	00	9	30	12	20	0	30	2	30	3	00	0	30	6	30	10	55
19	1	00	3	00	3	00	1	30	8	30	12	17	0	00	0	00	0	00	0	00	0	00	10	52
20	1	30	1	00	1	00	0	30	4	00	12	14	0	00	0	00	0	00	0	00	0	00	10	50
21	0	00	0	00	2	30	1	40	4	10	12	12	0	00	1	30	1	00	0	30	3	00	10	47
22	0	00	0	00	1	30	1	30	3	00	12	09	0	30	1	30	3	00	0	00	5	00	10	45
23	2	00	2	30	2	30	1	30	8	30	12	06	0	00	0	00	0	00	0	00	0	00	10	42
24	0	00	2	00	3	00	2	00	7	00	12	03	0	00	0	00	0	00	0	00	0	00	10	36
25	1	30	1	30	0	30	1	00	4	30	12	01	0	00	0	00	0	00	0	00	0	00	10	37
26	0	00	0	00	0	00	0	00	0	00	11	58	0	00	0	30	0	00	0	30	1	00	10	34
27	0	00	0	00	0	00	0	00	0	00	11	55	0	00	0	00	0	00	0	00	0	00	10	32
28	2	00	3	00	3	00	1	45	9	45	11	51	1	00	0	50	0	00	0	30	2	20	10	29
29	1	30	3	00	3	00	2	00	9	30	11	49	0	00	0	00	0	00	0	30	0	30	10	26
30	1	30	3	00	3	00	1	30	9	00	11	46	0	30	3	00	3	00	0	45	7	15	10	24
31	..	..	..	..	..	..	..	..	..	..	..	..	0	00	1	00	3	00	1	30	5	30	10	21
Total hours	25	30	45	30	54	40	31	25	157	05	373	38	9	45	25	50	28	45	13	15	77	35	311	49
Per cent of possible	25.5		50.6		60.7		33.2		42.0		...	..	11.3		27.8		30.9		18.6		22.7		...	..

SUNSHINE RECORD — (*Concluded*).

DATE.	November. Before 9 A. M.	November. 9 to 12.	November. 12 to 3.	November. After 3 P. M.	November. Total hours.	November. Hours, sunrise to sunset.	December. Before 9 A. M.	December. 9 to 12.	December. 12 to 3.	December. After 3 P. M.	December. Total hours.	December. Hours, sunrise to sunset.
	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m.	Hrs. m	Hrs m.	Hrs. m.	Hrs. m.	Hrs m.	Hrs m.	Hrs. m.	Hrs. m
1	1 00	3 00	2 00	0 00	6 00	10 19	0 00	0 00	0 30	0 00	0 30	9 17
2	0 00	0 00	0 00	0 00	0 00	10 16	0 00	1 00	0 00	0 00	1 00	9 16
3	0 00	0 00	0 00	0 30	0 30	10 14	0 00	0 00	0 00	0 00	0 00	9 15
4	0 00	0 00	3 00	0 00	3 00	10 12	0 00	1 45	0 00	0 00	1 45	9 14
5	0 30	3 00	3 00	1 30	8 00	10 10	0 00	0 00	0 00	0 00	0 00	9 13
6	0 50	3 00	2 15	0 00	6 05	10 08	0 00	0 00	0 00	0 00	0 00	9 11
7	0 00	0 30	1 30	0 00	2 00	10 05	0 00	0 00	0 00	0 00	0 00	9 10
8	0 00	0 00	0 00	0 00	0 00	10 02	0 00	0 00	0 00	0 00	0 00	9 10
9	0 00	0 00	0 00	0 00	0 00	10 00	0 00	0 00	0 00	0 00	0 00	9 09
10	0 00	0 00	0 00	0 00	0 00	9 57	0 00	0 00	0 00	0 00	0 00	9 08
11	0 00	0 00	0 00	0 00	0 00	9 55	0 00	0 00	0 00	0 00	0 00	9 07
12	0 00	0 00	1 30	1 30	3 00	9 53	0 00	0 00	0 00	0 00	0 00	9 06
13	0 00	2 00	3 00	0 35	5 35	9 50	0 00	1 00	1 30	0 00	2 30	9 06
14	0 00	2 10	3 00	0 30	5 40	9 48	0 00	0 00	0 00	0 00	0 00	9 06
15	0 00	1 30	1 00	0 00	2 30	9 46	0 00	0 00	0 00	0 00	0 00	9 06
16	0 00	0 00	0 00	0 00	0 00	9 44	0 00	0 00	0 00	0 00	0 00	9 05
17	0 00	2 00	1 00	0 15	3 15	9 42	0 00	2 00	0 00	0 00	2 00	9 05
18	0 00	0 00	0 00	0 00	0 00	9 39	0 00	0 00	0 00	0 00	0 00	9 05
19	0 00	1 00	1 45	0 00	2 45	9 38	0 30	0 00	3 00	0 45	4 15	9 04
20	0 00	0 00	0 00	0 00	0 00	9 36	0 30	3 00	3 00	0 45	7 15	9 04
21	0 00	1 00	3 00	0 00	4 00	9 34	0 00	3 00	0 00	0 00	3 00	9 04
22	0 00	1 00	2 00	0 00	3 00	9 32	0 00	0 00	0 00	0 00	0 00	9 04
23	0 00	0 00	2 00	0 00	2 00	9 30	0 00	0 00	0 00	0 00	0 00	9 04
24	0 00	0 00	0 00	0 00	0 00	9 29	0 00	1 00	0 00	0 00	1 00	9 05
25	0 00	0 00	0 00	0 00	0 00	9 27	0 00	0 00	2 00	0 00	2 00	9 05
26	0 00	2 00	0 00	0 00	2 00	9 25	0 00	1 30	0 00	0 00	1 30	9 05
27	0 00	0 00	1 00	0 00	1 00	9 24	0 00	0 00	0 00	0 00	0 00	9 06
28	0 00	3 00	1 00	0 00	4 00	9 23	0 00	1 30	3 00	0 00	4 30	9 06
29	0 00	0 00	0 00	0 00	0 00	9 20	0 00	3 00	0 00	0 00	3 00	9 07
30	0 00	0 00	0 00	0 00	0 00	9 19	0 00	0 00	0 00	0 00	0 00	9 07
31	.. ..	.. ..	.. ..	.. ..	.. ..	... ..	0 00	0 00	0 00	0 00	0 00	9 08
Total hours	2 20	25 10	32 00	4 50	64 20	293 17	1 00	18 45	13 00	1 30	34 15	283 01
Per cent of possible	3.6	28.0	35.6	9.7	21.9	... ..	1.9	20.2	14.0	3.2	12.1	.. ..

MONTHLY SUMMARY OF SUNSHINE RECORD, MAY 1, 1885, TO JANUARY 1, 1891.

		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1885..	Hours	......	......	.....	.....	165.2	237.5	284.75	163.5	206.75	134.5	53.20	50.00
	Per cent of possible	......	......	......	......	36 4	52.0	53.8	38.1	55.3	39.3	18.1	17.6
1886..	Hours	43.25	80.00	83.25	144 75	235 75	252.25	243.25	240.25	200.3	142.75	102.00	68.5
	Per cent of possible	14.30	26.7	22.3	36.3	51 9	54.2	52.6	56.0	51.7	41.8	34.8	24.2
1887..	Hours	44.0	61.50	110.75	159.00	265.00	217.75	267.5	235.75	......	......	......	....
	Per cent of possible	14.5	18.2	29.7	39.9	58 4	47.6	57.9	55.0	......	......	......	....
1888..	Hours	......	......	......	.....	......	207 42	270.67	200.83	157.08	......	......	....
	Per cent of possible	......	......	......	......	......	45.7	58.9	46.8	42.04	......	......	....
1889..	Hours	65.83	84.58	124.42	164 75	185.17	158.58	255.25	234.25	152.0	106.83	65.33	62.25
	Per cent of possible	22.4	28 6	33.6	41.0	40.8	34.7	55.2	54.6	40.7	31.3	22.3	22 0
1890..	Hours	45.17	66.17	97.0	209.17	150 17	230.83	283.67	194.5	157.17	77.58	64 33	34.25
	Per cent of possible	15.4	22.3	24.6	52.1	33.1	50.5	61.4	45.4	42.0	22.7	21.9	12.1

READINGS OF THE

1890	January.			February.			March.			April.			May.			June.		
	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.
1	34.7	41.5	43.8	28.5	27.0	22.0	25.0	24.0	19.0	26.5	33.0	32 0	46.0	41.2	38.0	62.0	.....	69.5
2	50.7	62 7	46.0	29.8	36.8	36.0	12.0	14.8	10.0	28.0	40.8	45.0	35.2	49.8	52.3	60.0	68.0	66.5
3	32.3	33.6	30.5	39.0	48.0	41.0	16.5	21.5	23.0	33.5	58.5	59.8	50.0	70.5	68.0	58.0	73.0	73.3
4	24.3	35.0	34.0	27.5	39.7	50.0	21.0	34.0	35.5	51.6	62.0	54.5	56.0	60.0	47.0	64.5	78.5	80.0
5	39.5	48.5	54.7	51.0	35.0	27.5	14.3	20.0	16.6	31.0	38.0	38.5	43.8	57.8	66.5	65.5	85.0	82.5
6	52.0	61.0	43.2	17.0	20.8	15.0	7.0	10.0	8.0	32.3	54.5	49.0	44.0	45.0	42.0	66.0	73.0	71.0
7	32.2	33 8	29.0	13.0	24.5	22.5	10.0	17.0	13.0	44.2	39.0	44.0	39.8	47.0	44.5	63.0	62.0	54.0
8	28.0	36.5	32.0	36.0	33.0	25.5	5.7	23.5	20.0	34.5	39.0	47.0	40.3	58.7	47.5	51.0	62.5	67.5
9	16.0	20.0	17.0	24.0	17.8	15.0	12.5	31.8	28.0	46.8	54.5	54 0	43.2	66.0	60.5	64.7	74.5	67.7
10	19.0	21.8	15.2	14.7	24.0	22.0	25.5	40.8	37.5	35.8	39.0	36.0	44.0	40.6	39.7	62.0	77.0	71.0
11	21.2	38.3	40.5	16.0	33.0	35.0	35.0	39.3	43.0	30.8	38.5	42.8	42.0	50.0	50.0	.....	.....	65.0
12	33.5	31.2	35.0	35.0	33.8	31.0	49.2	51.5	61.3	42.6	66.7	74.0	43.0	64.0	55.7	67.0	71.5	63.0
13	59 0	50.0	33.0	22.2	38.6	37.0	39.5	38.0	40.0	60.0	72.7	65.5	47.4	64 5	61.0	62.0	71.0	67.0
14	24.0	28.0	30.0	39.0	41.5	45.0	34.0	42.7	39.0	51.0	66.5	42.0	52.0	52.5	51.0	62.5	68.0	62.5
15	33.0	36.8	43.0	34.0	34.0	25.5	27.2	34.0	24 5	36.8	43.0	42.6	48.0	61.8	65.0	58.0	66.8	69.0
16	32 8	25 5	19.5	13.0	29.0	34 0	18.0	19.8	17.0	33.7	52.6	49.0	48.0	53.0	55.8	66.0	74.0	74.0
17	12.5	23 0	21.0	31.0	34.2	32.0	25.2	30.0	31.7	40.0	59.8	56.0	46.0	56.2	58.2	67.0	77.7	.....
18	17.0	31.0	22.5	28.7	27.0	37.0	34.0	36.2	31.0	33.0	33.0	36.7	44.0	57.0	60.9	66.0	75.2	71.0
19	30.0	38.0	39.0	14.0	18.0	16.0	26.0	29.0	31.0	29.0	40.2	43.0	59.8	54.0	54.0	63.8	68.0	64.5
20	43 0	54 2	34.0	35.5	28.0	19.7	29.5	39.0	38.6	37.0	50.0	49.8	46.2	47.5	50.0	59.7	72.5	69.8
21	28 5	30 0	30.5	11.0	17.0	16.0	41.5	49.0	46.0	41.5	60.5	59 5	47.0	59.5	58.0	59.0	61.0	62.5
22	12.5	15.0	12.0	10.5	26.0	26.0	37.0	42.0	37.0	50.0	65.5	65.2	52.8	58.5	63.0	61.5	66.2	73.0
23	17 0	20.3	29.5	24.0	36.0	36.0	28.0	28.5	25.6	47.7	64.0	63.0	54.8	57.5	62.0	69.8	78.0	77.0
24	22.0	23.0	23.0	37.0	49.0	45.5	20.0	31.5	32.0	43.0	39.8	43.2	55.5	71.8	71.0	63.8	83.0	78.4
25	21.2	31.0	39.0	41.0	43.8	48.0	36.6	44.0	42.0	38.0	47.0	44.0	64.8	68.0	61.0	73.5	80.6	78.0
26	36.0	39.0	38.0	51.0	42.0	34.0	38.5	40.0	34.0	37.5	40.0	38.7	58.0	62.8	63.7	70.0	77.0	77.2
27	31.4	28.0	29.0	31.0	37.0	43.0	30.5	36.0	36.0	46.2	43.0	40.0	57.0	67.0	62.0	61.0	69.0	69.8
28	12.0	18.0	16.0	43.0	47.5	48.0	30.8	32.0	40.0	42.5	53.0	51.0	49.0	60.4	57.8	66.5	73.0	70.8
29	26.0	45.0	41.0	......	......	......	26.0	26.0	29.0	46.0	64.0	56.8	56.5	67.0	61.8	68.8	81.0	80.0
30	35.0	37.0	36.8	......	......	......	26.2	30.0	29.0	42.5	57.8	59.0	56.0	59.0	57.6	69.6	84.0	82.0
31	38.7	43.0	45.5	......	......	......	24.0	37.0	35.0	.....	.....	.....	51.0	71.5	69.5	.....	.....	.....

Standard Air Thermometer.

July.			August.			September.			October.			November.			December.		
7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.	7 A. M.	12 M.	6 P. M.
68.0	84.0	77.0	68.8	85.0	77.8	54.2	67.5	65.0	48.0	66.0	66.8	37.0	38.0	38.0	20.0	17.0	14.5
72.0	80.6	74.0	67.7	85.0	82.0	53.0	74 5	69.2	58.0	65.5	63.5	41.6	41.6	42.5	11.0	12.5	6.0
69.0	76.5	71.5	74.0	93.8	82.2	56.2	78:3	70.0	60.0	70.6	62.0	33.6	36.0	39.0	11.5	20.5	32.0
57.0	67.0	67.0	76.6	90.7	88.8	59.0	81.0	78.0	59.0	66.0	60.5	28.0	37.0	33.0	20.0	31.1	23.2
67.2	76.0	69.7	75.0	86.2	69.0	69.8	81.0	72.8	56.5	61.5	56.2	31.2	50.8	47.0	23.5	28.0	26.4
60.2	74.8	74.0	67.0	78.0	74.0	67.0	73.0	73.7	50.0	54.4	50.2	45.0	59.0	45.5	25.0	33.8	32.0
67.0	86.2	84.8	66.5	76.0	71.2	68.5	79.0	79.2	55.0	56.4	52.5	46.0	56.0	60.5	21.0	19.0	16.2
76.4	79.8	79.8	63.0	83.3	80.6	70.5	81.3	72.0	47.0	56.5	49.5	43.0	43.2	39.5	11.5	20.0	16.2
63.0	63.7	60.0	68.0	81.6	77.8	58.8	64.8	61.0	41.2	58.0	49.0	47.0	51.0	59.0	14.6	29.0	29.0
57.0	66.0	67.5	61.5	64.8	63.5	55.8	59.0	57.0	51.2	62.0	59.0	37.2	34.2	32.0	26.5	33.0	34.4
63.0	76.0	72.0	55.0	66.5	66.0	59.6	62.5	64.0	49.2	54.0	51.0	32.0	34.2	34.0	33.0	36.0	33.0
63.8	81.0	73.0	62.2	74.0	70.2	66.0	75.0	72.0	44.0	49.0	42.0	34.0	39.0	36.5	15.5	14.0	12.0
68.0	75.4	79.0	59.0	78.0	76.7	67.0	75.5	63.0	36.2	52.0	49.0	30.0	52.0	44.0	5.0	19.0	25.0
67.2	84.0	85.2	64.4	75.5	70.3	48.0	62.0	51.0	52.0	56 8	51.0	46.2	52.5	44.0	27.0	31.0	32.5
76.0	76.0	79.2	64.0	72.5	68.8	54.8	69.0	69.0	47.0	49.5	55.0	39 9	47.7	46.1	31.0	27.2	20.7
70.5	81.0	77 0	59.0	76.0	76.0	60.0	67.0	62.2	50.0	58 0	52.5	37.2	44.0	37.6	14.0	26.0	32.2
64.0	74.5	77.0	72.0	83.8	68.2	58.0	58.0	57.0	47.5	50.0	50.2	45.0	46.6	45.0	25.5	29.0	28.0
60.0	66.2	66.0	61.0	67.0	62.0	54.5	66.7	64.0	44.9	58.6	52.5	39.5	42.0	46.0	26.0	27.2	29.0
58.5	63.0	61.7	58.0	67.0	67.0	55.5	72.0	71.0	48.0	49.0	48.5	43.0	43.0	37.0	13.2	16.5	10.6
55 5	61.0	62.2	59.5	66.7	67.0	53.2	55.0	53.0	47.0	47.7	45.8	31.1	33.7	33.0	8.0	22.8	26.0
60.0	63.8	68.0	62.0	70.2	65.2	49.0	57.0	54.5	44.2	49.2	41.8	26.5	39.8	39.6	36.5	40.0	36.5
60.0	74.5	74.5	59.2	67.2	60.0	49.0	64.0	62.0	33.8	51.2	48.9	34.2	37.0	34.0	33.0	34.0	33.0
63.0	77.0	75.2	51.0	56.0	56.0	54.0	63.5	58.7	45.6	48.4	42.0	28.9	36.0	23.0	41.0	39.8	30.0
66.0	68.0	64.0	54.0	63.0	61.0	45.0	52.0	45.0	38.5	42.4	43.0	22.0	33.0	37.0	18.0	24.8	22.5
65.0	73.0	76.0	53.5	68.0	68.0	38.5	59.2	58.0	42.0	47.0	43.0	45.1	47.0	34.0	10.0	14.7	6.0
69.0	78.0	75.7	68.0	72.0	73.5	52.6	56.0	54.2	43.0	45.0	42.7	26.5	27.5	23.6	12.4	11.6	14.0
66.0	80.0	77.0	61.0	73.2	65.2	48.0	46.0	47.0	40.2	40.8	38.0	20.0	21.6	21.6	20.5	28.0	25.9
65.7	82.5	82.4	61.0	66.0	66.3	42.0	50.5	44.7	35.2	40.9	39.2	19.0	26.2	27.2	7.0	7.0	8.5
70.0	84.0	83.8	57.0	74.5	64.7	41.2	57.0	52.0	36.1	42.2	39.6	37.5	41.0	37.2	22.0	30.8	16.5
76.0	91.0	75.0	57.0	59.0	56.5	42.5	64.5	59.0	38.0	47.0	38.0	33.4	44.7	30.0	5.0	18.5	26.0
79.8	94.0	82.0	51.2	56.0	57.6	......	......	......	33.0	45.8	36.5	......	......	......	16.0	22.5	32.5

READINGS OF MAXIMUM AND MINIMUM THERMOMETERS AT 7 A. M.

1890.	January Max.	January Min.	February Max.	February Min.	March Max.	March Min.	April Max.	April Min.	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.	September Max.	September Min.	October Max.	October Min.	November Max.	November Min.	Dec'mb'r Max.	Dec'mb'r Min.
1.....	34.8	12.5	48.0	28.0	51.0	24.5	38.8	23.0	69.0	45.0	73.0	51.4	85.8	65.0	95.0	67.0	62.0	49.8	68.0	41.0	46.9	33.0	46.2	19.0
2.....	52.0	33.0	29.8	17.0	25.5	11.0	35.5	23.4	46 0	30.0	74.5	53.0	85.2	67.3	96 0	58.0	72.6	48.0	72.8	47.0	48.8	35.6	23.5	8.6
3.....	63.5	32.0	39.3	28.0	16.5	8 0	50.2	28.4	55.0	35.2	70.0	49.0	81.7	66.0	90.0	67.0	77.5	52.2	67.2	57.5	47.0	33.0	11.7	4.0
4.....	35.3	24.0	52.5	32.0	25.8	15.0	65.0	35.0	80.7	49.5	80 0	58.0	80.0	53.4	96.2	72.5	81.0	57.0	68.0	48.0	38.0	26.0	36.0	14.8
5.....	40.0	24 0	64.5	25.0	37 4	13.3	67.0	29.5	61 7	41.6	85.3	62.0	80.0	62.5	92.5	72.8	83.5	59 0	69.8	55.6	41.2	27.0	32.0	18.0
6.....	67.0	39.0	50.6	16.5	21.7	6.0	...	....	70.0	43.0	87.5	61.5	71.0	49.0	86.5	61.2	82.6	65.5	64.0	49.0	49.9	30.5	32.0	15.0
7.....	61.8	32.0	21.5	10.0	10.6	4.0	58.0	33.0	46.0	36.0	76.0	58.2	77.2	60.0	80.3	59.0	76.7	65.0	55.0	49.5	62.2	39.0	36.0	20.0
8.....	36.5	27.0	36.0	10.0	13.5	2.0	46.0	31.0	50.5	34.0	76.4	44.8	90.2	62.0	79.6	57.8	83.6	68.0	60 0	46.0	65.4	42.0	24.0	10.5
9.....	37.0	15.5	34.6	23.5	19.5	12.0	49.0	33.6	50 5	34.2	69.3	50.8	94.5	62.4	85.2	63.0	81 7	57.0	58.0	33.5	47.0	36 0	20.0	9.0
10.....	22.0	13.6	34 7	9.8	28.0	22.0	63.0	34.7	67.5	42.0	76.0	54.0	65.2	49.3	85 0	67.0	65.8	55.0	69.7	41.0	59.0	36.5	31.0	14.0
11.....	22.0	14.5	28.0	9 5	38.0	34.8	40.0	29.0	44.0	35.8	68 5	61.0	68.6	52.0	68 0	53.0	59.6	55.0	64.9	48.5	49.2	28.0	37.5	25.5
12. ...	56.2	32.0	37.6	14.5	49.2	34 7	46.0	30.0	51.3	33.0	80 0	64.0	78.7	53.4	69.6	54.0	65.8	59.0	58.2	43.0	55.5	30.7	37.5	15.5
13.....	59.0	32.0	35.0	22.0	62.0	46.5	78.8	42.5	66.4	42.8	72.7	58.0	85.0	63.5	74.8	53.5	80.0	65.0	49.5	35 0	42.2	29.0	17.5	3.0
14.....	33.0	22.0	47.5	34 7.	41.0	33.0	76 0	49.0	66.4	42 5	73.5	60.0	82.0	62.7	82.0	59.4	80.0	46.0	56.0	46.0	54.8	29.6	34.0	4.0
15....	36.0	29.5	47 0	34.0	42 6	26.0	68 0	35.8	54.5	44.0	69.5	56.5	85.5	66.4	77.2	60.4	64.2	47.2	57.2	44.6	53 8	34.7	37.5	26.4
16. ..	43.3	32.0	47.0	12.5	36.0	17.3	45.3	27.5	70 6	46.8	71 3	57.0	88.3	64.0	77.0	53.0	72.5	54.0	64.0	43.0	52.8	36.6	29.6	10.0
17.....	33.5	12.0	37.0	31.0	26.0	16.6	56.8	27.0	58.5	37.2	75.0	61.4	82.4	55.0	80.0	59.0	74.0	57.0	60.0	47.0	45.0	33.3	32.8	10.0
18.....	21.0	11.8	41.0	28.0	34 5	25.0	62.0	33.0	59.0	35.0	80.0	64.0	79.6	56.6	85.0	57.0	59.2	51.5	58.0	42.0	53.0	38.0	30.0	24.5
19.....	33.0	16.0	37.0	13.5	37.0	25.0	40.6	23.0	65.2	44.0	80.0	58.0	70.0	55.0	69.0	50.4	70.7	52.0	60.5	43.2	49.5	38.6	37.5	12.5
20.....	43 0	30.0	35.5	10 0	33.0	25.4	44.8	28.6	61.5	46.0	70.2	50.0	65.5	53.0	70.8	57.4	78.0	52.5	49.5	46.0	45.0	30.2	17.0	3.0
21.....	57.6	28.0	32.0	9.5	43.2	28.8	53.0	31 8	50.1	39.0	73.6	58.7	64.6	47.8	71.4	55.6	55.2	47.5	48.2	43.0	36.2	24.5	37.2	5 0
22.....	57.5	12.0	18.0	10.0	54.0	36 5	63.2	42.0	61.5	46.2	62.6	57.3	....	....	73.8	56.0	60.5	43.0	51.9	32.2	48.0	25.5	43.0	32.5
23.....	17.0	10.5	29 5	10.0	43.0	27.0	69 8	42.0	65.5	51 2	73.5	61.0	77.0	47.0	72.2	50.2	68.5	47.3	53.5	33.0	39.0	28.0	43.0	50.0
24.....	30.0	16.0	41.0	23.0	30.0	16.7	66.0	42.0	64.0	47.5	82.5	60.0	82.0	46.5	59.2	46.0	67.5	41.5	48.5	37.5	32.0	18.0	41.5	17.5
25.....	25.0	12.0	54.0	36.5	36.6	31.0	45.6	32.5	72.8	55.0	84.5	68.7	71.0	63.5	65.0	49.0	60.0	35.5	44.2	38.0	45.1	20.5	21.5	9.0
26.....	40.5	20.0	51.5	37.0	45.5	34.5	48.7	32.5	69.7	56.0	83.2	65.0	79.5	65.0	72.0	52.0	63.8	39.0	48.0	40.4	47.0	21.0	15.4	4.0
27.....	42.0	31.0	51.8	29.5	40.0	30.0	46.0	38.0	68.0	54.0	78.0	54.0	8[illegible].0	60.0	75.8	59.5	58.8	47.0	46.0	39.5	29.5	19.2	20.4	9.0
28.....	32.0	11.0	47.0	36.0	38.4	28.6	49.8	37.5	....	....	72.0	60.0	82.0	59.3	72.0	58.5	49.8	37.5	46.0	34.7	22 2	17.0	30.0	6.0
29.....	26.0	9.0	....	....	40.2	25.2	55.0	37.0	68 0	45.0	75.2	53.7	86.3	65.0	70.0	53.0	57.8	36.5	40.0	32.5	37.5	18.0	22.0	3.5
30. ..	48.0	24.0	....	....	31.0	18.7	65.0	37.0	68.6	54.0	85.6	68.2	86.8	64.2	75.0	55.8	61.0	38.4	43.0	35.5	42.0	29.5	31.5	4.0
31.....	39.0	34.0	....	....	32.6	20.6	....	....	66.0	42.0	....	....	91.5	70.0	60.0	50.0	....	....	47.5	32.0	....	....	22.5	4.5
Av'ge.	40.1	22.3	40.3	21.5	34.9	22.6	54.9	33.4	61.6	42.9	76.0	58.1	80.0	58.9	77.6	57.7	69.1	51.0	56.4	42.2	45.5	29.6	30.0	12.7

READING OF SOIL THERMOMETERS.

1890.	Surface.			One Inch.			Two Inches.			Three Inches.			Six Inches.			Nine Inches.			Eighteen Inch's		
	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M	7 A.M	12 M	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M	12 M.	6 P.M.
April 1	....	....	....	....	...	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.....
2	....	....	....	....	....	....	...	....	....	....	....	....	....	....	....	....	....	....	....	....	.....
3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.....
4	....	....	....	....	57.5	55.5	....	56.0	55.6	....	53.0	55.3	....	47.5	57.5	....	44.5	47.5	....	46.0	46.5
5	....	....	....	37.0	47.5	47.0	38.0	48.7	44.0	39.6	45.3	46.5	41.5	42.5	48.0	42.5	41.7	47.5	47.5	47.2	46.5
6	....	....	....	34.5	50.2	48.0	35.0	49.0	48.0	37.0	45.5	48.0	38.5	41.5	45.5	40.0	40 2	43.2	46.5	46.0	46.2
7	....	...	....	43.5	43.3	47.5	43.2	44.0	47.8	43.2	43.8	47.5	43.0	43.0	45.0	42.5	42.5	43.5	47.0	47.0	47.0
8	....	....	....	36.0	39.0	44.5	36.3	39.0	44.5	37.8	39.2	43.7	39.2	39.5	42.0	40.5	40.0	41.0	47.0	46.5	46.2
9	....	....	....	44.0	49.5	47.5	44.0	49.5	45.5	43.7	47.2	48.0	43.0	44.8	50.5	42.0	43.0	49.5	46.5	46.8	50.5
10	....	....	....	38.0	42.6	41.0	38.5	42.5	40.5	40.0	42.0	42.0	41.5	41.7	42.0	42.2	41.5	42.0	47.5	47.5	47.0
11	...	....	....	34.5	47.0	46.7	35.0	45.8	47.5	36.5	43.0	48.0	38.0	40.3	45.3	39.0	39.5	42.6	46.5	46.2	46.0
12	....	....	....	39.0	54.0	60.5	39.0	54.3	60 3	39.5	48.0	57.2	40.0	43.5	51.2	40.5	41.6	46.5	46.5	46.5	47.0
13	....	....	....	50.5	66 0	64.8	50.0	64.5	65.3	49.2	58.6	63.5	47.2	51.8	57.6	46.5	48.0	57.6	49.0	49.3	50.0
14	....	....	....	51.0	60.8	50.0	51.0	60.0	50.7	51.2	46.5	52.2	51.0	52.8	52.0	49.8	50 2	50.5	52.0	52.0	52.0
15	....	...	....	42.5	56.0	55.0	42.7	54.5	55.0	44.0	50.5	55.5	45.5	47.0	52.2	46.0	46.0	49.2	51.5	51.2	51.0
16	....	73.0	52.0	37 8	56.5	56.7	38.0	55.5	57.3	39 7	49.2	56.5	42.0	46.0	52.5	44.0	44.5	48.6	51.0	50.5	50.5
17	47.0	86.0	56.0	40.6	59.0	57.0	41.0	56.8	57.5	42.0	52.0	46.7	43.7	47.5	53 0	45.0	45.5	49.5	51.0	50.7	51.7
18	40.0	84.0	44.0	42.0	56.5	51.3	42.2	54.0	52.0	43.6	50.5	53.0	44.8	47.0	51.0	45.5	45.6	48.5	51.5	51.0	51.0
19	38.0	79.0	48.0	37.5	54.7	53.3	37.5	51.6	53.5	39.0	47.6	53.2	41.0	44.0	50.0	43.0	43.2	47.2	50.5	50.2	49.8
20	42.0	88.0	54.0	39.0	57.5	57.6	39.5	53.7	57.6	40.5	49.5	56.7	42.4	45.6	52.3	43.5	44.0	48.5	50.5	50.0	50.2
21	47.0	89.0	60.0	41.5	59.0	59.5	41.7	56.0	59.5	42.0	52.0	58.2	43.5	47.5	54.0	44.5	45.5	50.0	50.8	50.5	50.7
22	50.0	90.0	63.0	47.0	64.5	62.0	46.6	61.0	62.5	47.0	46.0	61.6	47.2	50.7	57.4	47.2	48.0	52.6	51.7	51.6	52.0
23	50.0	62.0	58.0	47 0	55.2	55.5	47.2	54.0	55 0	48.0	54.5	54.0	48.8	52.3	52.0	49.0	48.7	50.0	53.0	53.0	52.7
24	48.0	52.0	51.0	48.5	51.3	52.5	49.0	51.5	52.6	50.0	51.0	53.0	50.3	50.0	51.5	50.0	49.0	50 0	53.2	53.0	53.0
25	37.0	88.0	51.0	42.0	60.0	55.5	42.5	55.5	57.0	43.6	52.3	57.2	45.2	48.5	54.2	46.5	47.0	51.0	53.6	52.5	52.5
26	42.0	44.0	40.0	42.5	45.0	42.0	42 4	44.0	43.0	44.0	46.0	44.0	45.5	46.0	45.0	46.7	46.0	45.5	53.0	52.0	52.0
27	46.0	48.0	44.0	44.2	47.5	44.2	44.0	47.5	44.5	44.0	47.0	45.2	43.7	45.5	45.5	44.0	45.0	45.2	51.0	50.6	50.5
28	44.0	74.0	53.0	41.0	60.0	56.5	41.0	55.6	57.0	41.6	52.0	57.0	42.8	47.0	53.5	43.5	45.0	50.0	50.5	50.3	50.7
29	45.0	61.0	52.0	45.3	57.5	52.0	43.3	55.2	51.0	44.0	52.0	51.7	45.2	48.5	50.0	46.0	47.0	48.7	51.6	51.6	51.7
30	45.8	73.0	60.0	45.5	59 5	59.5	45.5	56.0	59.5	46.3	53.2	59.0	47.0	49.5	55.6	47.0	47.5	52.0	52.0	52.0	52.5

READING OF SOIL THERMOMETERS — (*Continued*).

1890.	Surface.			One Inch.			Two Inches.			Three Inches.			Six Inches.			Nine Inches.			Eighteen Inch's		
	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M	7 A.M.	12 M.	6 P.M.
May 1	49.0	49.2	44.0	49.0	48.5	46.8	49.5	48.4	47.0	50.3	49.0	48.2	50.7	49.5	48.5	50.5	49.4	48.5	53.7	53.7	54.5
2	40.0	60.0	50.0	38.0	51.8	51.7	38 5	49.0	51.5	39 4	47.6	51.8	41.4	45.4	50.0	43.8	44.5	48.0	51.3	51.7	51.7
3	48.0	76.0	65.0	44.5	63.0	63.5	43.3	59.0	63.5	44.0	44.5	60.8	44 7	49.3	56.8	45 5	47.0	52.5	52.0	52.0	52.5
4	57.0	62.0	54.0	55.5	58.2	55.5	55.5	58.0	56.0	55.0	56.3	56.5	54.0	51 3	55.5	52.3	52.5	53.5	54.5	54.5	55.0
5	49.0	74.0	65.0	48.7	60.5	63.7	48.8	58.5	63.5	49.3	55.5	60.8	50.0	52.0	57.5	50.0	50.5	54.0	55.0	54.8	55.0
6	50 0	54.0	48.0	49.5	53.5	49.7	50.0	54.5	50.3	52.0	53.5	51.5	52.6	52.5	52.6	52 5	51.5	51.5	55.5	55.5	55.5
7	48.0	60.5	50.0	44.0	56.5	52.5	44.5	52.5	53.2	45.0	52.3	54.0	46.6	49.5	52.5	48.0	48 5	50.0	55 0	54.5	54.5
8	46.0	70.0	53 5	43 0	57.6	56.0	43.0	55.5	55.9	43.5	53.0	56.0	45.5	49.3	53.6	47.0	48.0	51.5	54.5	54.0	54.0
9	46.0	74.0	56.0	44.5	61.0	55.5	44.2	54.5	55.5	45.0	54.5	55.3	46.3	50.0	52.5	47.5	48.5	50.5	54.3	54.0	54.5
10	50.0	49.5	46.0	50 5	49.5	46.5	50 0	49.5	46.7	50.7	50.0	47.7	50.5	50.0	48.6	51.0	50.0	48.5	54.5	55.0	54.5
11	48.0	72.0	56.0	43.0	59.5	58.0	44.0	57.6	58.0	44.0	54.0	58.0	45.3	49.5	55.0	46.2	48.0	52.0	53.7	53.5	54.0
12	48.0	74.0	61 5	44.0	61.7	61.5	44.2	58.5	61.7	45.6	54.3	60.0	46 5	50 5	57.0	48.0	48.7	53.5	54.5	54.3	54.5
13	50.5	63.5	60.5	49.0	58.5	59.5	49.7	57.0	59.5	50.8	51.6	58.0	51.5	52.0	55.2	51.5	61.2	53.0	55.6	55.5	55.5
14	54.0	57.5	54.0	53.5	55.7	51.0	53.6	55.5	54.5	54.0	55.0	55.2	53.5	53.5	54.5	53.0	52.5	53.4	56.5	56 5	56.5
15	50.0	66.0	62.0	49.0	60,3	61.7	49.0	59.0	60.7	49.8	61.8	59.0	50.5	53.5	57.4	51.0	51 7	54 6	56.3	56.1	56.5
16	53.7	58.0	58.0	51.0	56.0	58.5	51.5	56 0	58.5	51.5	55.0	58.2	52.0	53.5	56 0	52 0	52.6	54 0	57.0	57.0	57.0
17	48.0	67.0	54.0	45.5	55.0	55.5	45.5	55.2	55.5	47.0	52.8	56.0	49.0	50.5	54.3	50.5	50.2	52.5	56 5	56.5	56.2
18	50.0	64.0	57.5	46.5	59.5	58.0	46.0	58.0	57.5	45 8	54.5	56.5	47.0	50.8	54.0	48.5	49.5	52.2	56.0	55.5	55.5
19	58 0	58.0	58 0	56.5	57.0	57.2	56.5	57.0	57.2	55.8	57.2	57.2	54.0	55.0	56 0	52.0	53.5	54.5	56.5	57.5	56.9
20	50.0	56.0	53.0	50.0	53.2	51.5	49.5	52.8	51.5	51.9	52.0	53.0	52.5	51.5	51.5	51.5	50.5	51.0	57.0	57.0	57.0
21	52.5	75.0	59.5	47.5	64 5	59.5	47.2	63.5	59 5	46.8	58.8	59 2	48.5	53.2	57.5	49.5	51.0	51.6	56 3	56.0	56.4
22	54.5	63.0	62.0	53.2	58.5	61.5	53.0	57.8	61.5	53.0	56.5	59 8	53.0	54.2	58.0	53.0	53.0	55.5	57.2	57.2	57.5
23	53.5	60.5	62.0	53.0	56.0	59.5	52.8	55.5	59.5	53.2	54.2	58.0	53.5	53.4	55.5	53.4	53.0	54.0	58.0	57.6	57.5
24	60.0	79.0	68.5	54.0	76.0	67.5	54.0	69.5	66.7	52.5	63.0	65.0	52.5	58.8	61.5	53.0	54.5	58.0	58.0	56.9	58.2
25	64.0	78.0	62.0	61.0	69.0	64.5	60.7	69.0	62.5	59.4	64.6	63.5	58.0	60 5	62.0	56 7	58.0	59 5	59.5	59.5	60.5
26	59.5	70.0	64.0	57.5	63.7	62.5	57.5	63.0	62 5	57.4	59.5	62.6	57.2	58.1	61.0	56.7	56.8	58.7	60.2	60 1	60.0
27	60.5	75.0	66.0	57.0	71.5	65.3	57.5	71.0	65.7	57 5	67.2	65.4	57.5	62.0	63.0	57.0	58.5	60.5	60.5	60.5	61.0
28	51.0	77.0	62.2	52.3	67.7	64.5	52.3	69.0	65 0	53.0	63.2	65.3	55.0	58.5	63.0	56.0	56.5	60.3	61.0	61.0	61.0
29	60.0	78.5	66.0	55.7	74.0	65.5	55.0	71.8	65 0	54 3	66.2	64.6	55.0	60.0	61.5	56.0	57.2	60.0	61.3	61.0	61.0
30	59.0	67.0	60.0	57.5	61.0	60 7	57.5	60.2	61 0	57.6	58.0	60.0	57.7	58.0	60.0	57.6	57.3	58.4	61.7	61.5	61.6
31	59 5	88.0	70.0	54.5	74.5	71.5	53.5	74.5	72.0	53.5	66.6	70.6	54.0	60.0	66.2	55.0	57.0	62.0	61.0	61.0	61.0

READING OF SOIL THERMOMETERS — (*Continued*).

1890.	Surface.			One Inch.			Two Inches.			Three Inches.			Six Inches.			Nine Inches.			Eighteen Inch's		
	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.
June 1	64.0	......	71.0	59.0	......	72.5	58.3	......	73.5	57.0	......	72.3	57.7	......	68.3	58.0	......	64.0	62.5	......	63.0
2	64.0	92 0	71.0	59.5	78.5	73.0	59.0	79.0	74.0	55.5	71.0	73.7	59.2	64.2	69.5	59.5	61.0	63.5	63.5	63.5	63.8
3	65.0	82.5	75.5	59.5	72.0	73.2	59.0	71.5	73.5	58.5	66.5	72 0	59.5	62.5	68.2	60.0	60.5	64.3	64.5	64.0	64.2
4	66.0	82.0	76.0	64.5	72.2	74.5	64.5	71.5	75.0	64.2	67.5	74.0	63.7	64.5	70.0	62 5	62.5	66.0	65.5	65.0	65.3
5	69.0	89.5	82.0	65.5	79.5	79.6	65.2	79.5	80.0	65.0	74.0	78.0	64.5	68.2	74.3	64.0	65.0	69.0	66.0	66.2	66.8
6	67.5	76.0	71.0	65.7	73.0	70.5	65.5	71.5	70.5	65.8	69.7	70.0	66.0	67.5	68.2	65.7	64.5	65.5	68.0	68.0	68.0
7	64.0	70.0	58 5	62.0	68.0	60.5	62.0	67.5	61.0	62.6	68.6	62.5	63.3	64.5	63.5	63.5	63.2	63.2	67 5	67.2	67.0
8	60.0	82.0	67.0	54.7	70.7	67.7	55.0	72.5	68.4	54.5	68 5	68.5	56.5	61.5	66.0	58.5	59.5	63.5	66.0	65.2	65.0
9	65.0	86.0	72.0	58.5	75.0	72.7	58.5	76.5	72.0	58.0	69.5	71.5	59.0	63.5	69.0	60.0	61.0	65.6	65.5	65 5	65.7
10	68.0	84.0	71.5	61.5	78.5	71.0	61.6	78.5	71.0	60.0	72.2	71.0	61.8	66.2	68.5	62.0	63.5	66.0	66.5	63.3	66.5
11	.....	76.0	70.0	......	80.0	69.5	......	79.8	70.0	......	75.0	71.2	......	68.5	70.0	......	65.0	67.4	.....	67.0	67.4
12	68.0	76.0	68.0	65.0	72.7	68.0	64.8	72.4	68.0	65.0	69.6	68.0	65.0	66.0	67.0	64.5	64.5	65.5	67.5	67.5	67.5
13	68.0	74.0	72.0	63.0	72.2	71.5	63.0	72.5	70.5	63.0	70.0	70.0	63.2	66.3	68.2	63.2	64.0	66.0	67.5	67.5	67.5
14	66.0	78.0	68.0	63.5	71.5	68.0	63.5	70.5	68.5	63.8	67.7	66.7	64 0	65.0	67.0	64.0	64.0	65.5	68.0	68.0	67.5
15	64.0	75.5	70.0	62.0	71.0	70.5	62.0	70.5	70.7	61.3	68.0	71.0	61.8	65.0	68.5	62.8	63 0	66.0	67.5	67.5	67.5
16	68.0	78.0	74.0	65.0	71.5	73.5	64.5	71.0	73.5	63.5	68.8	72.8	63.3	66.0	70.0	63.3	64 5	67.0	67.5	67.5	68.0
17	70.0	90.0	......	66.0	79.5	......	65.5	80.0	......	64.6	74.0	......	64.5	68.5	......	64.5	65.8	......	68.5	68.5	......
18	68.0	84.0	72.0	66.0	78.5	74.5	66.2	80.5	75.5	66.0	74.6	75.5	66.0	69.4	73.0	66.0	66.5	69.5	69.0	69.2	69.4
19	68.0	82.0	70.0	64.5	79.5	72.5	64.5	79.3	73.0	63,2	74.0	73.5	64.0	68.4	71.6	65.0	66.0	69.0	70.0	69.5	69.4
20	67.5	85.0	74.0	61.5	78.0	74.0	61.5	79.0	73.5	61 0	74.3	73.2	61.5	67.0	71.0	64.0	64.7	68.1	69.5	69.0	69.1
21	62.0	64.0	65.5	61.5	63.5	64.2	61.5	63.1	64.0	62.0	62.5	63.3	64.0	62.5	64.0	64.5	64.0	63.5	69.5	69.0	68.5
22	66.0	71.5	73.5	62.5	68.0	71.2	62.2	67.6	71.2	62.0	66.2	70.3	62.0	64.2	68 0	62.2	62.0	65.5	68.0	67.7	68 0
23	72.0	92.0	79.5	57.5	79.0	78.0	67.0	80.0	79.0	65.7	75.0	78.5	65 0	69.0	74.5	64.5	66.0	70.4	68.3	68.5	69.0
24	73.0	96.0	79.0	66.5	82.5	77.0	67.0	83.0	77.5	66.0	77.0	76.5	66.5	71.0	73.8	66.5	68.0	70.7	70.5	70.2	70 0
25	75.0	100.0	79.5	70.0	86.5	81.3	70.5	87.7	82.5	69.0	80.6	82.0	69.5	73.0	78.0	68.0	69.5	73.8	71.0	71.0	71.2
26	73.0	100.0	80.5	69.0	85.5	82.0	69.5	87.5	83.5	69.0	80.5	83.0	69 0	73 4	78.5	69.0	70.0	74.2	72.3	72.0	72.0
27	67.5	94.0	74.0	64.5	83.0	78.0	65.3	83.5	77 0	65.0	77.0	79.3	67.0	70.9	76.5	68.0	68.5	73.0	72.8	72.3	72.2
28	69.5	82.5	75.0	67.0	73.0	72.5	66.5	72.3	72.5	67.0	70.0	72.0	67.6	68 5	70.5	68.0	68.0	69.0	72.5	72.2	71.8
29	73.0	105.0	81.5	65.5	85.6	82.7	66.5	86.5	85.0	65.2	78.5	82.8	66.7	71.0	78.0	66.4	68.0	73.0	71.5	71.5	72.0
30	72.5	102.0	84.0	67.5	86.0	83.5	68.0	86.8	84.4	67.3	79.6	83.0	68.0	72.7	78.6	67.5	69.5	74.0	72.5	72.4	72.5

READING OF SOIL THERMOMETERS — (*Continued*).

1890.	Surface.			One Inch.			Two Inches.			Three Inches.			Six Inches.			Nine Inches.			Eighteen Inch's		
	7 A M	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A M.	12 M.	6 P.M.	7 A M	12 M.	6 P.M.
July 1	72.0	98.0	78.0	69.5	82.5	77.5	69.5	88.0	78.5	70.0	77.0	78.0	70.0	72.5	75.5	70.0	70.2	72.5	73.3	73.0	73.0
2	72.0	98.0	80.0	70.0	81.6	78.0	70.0	80.0	78.2	70.0	77.0	77.8	70.0	72.5	75.5	69.5	70.0	72.5	73.0	73.0	73.0
3	72.0	90.0	83.0	69.5	79.5	78.5	69.5	81.0	79.2	69.6	76.0	79.0	69.5	71.5	76.0	69.0	69.6	73.0	73.0	72.8	73.0
4	63.0	85.0	72.0	63.0	74.8	75.0	63.0	75.7	76.0	64.0	70.6	76.3	66.0	67.5	73.5	67.0	67.0	70.5	73.0	72.5	72.0
5	72.0	86.0	76.2	68.5	83.5	77.0	68.5	83.5	77.5	68.8	78.6	77.5	69.0	72.5	75.0	69.2	70.0	72.5	73.1	73.0	73.0
6	63.5	95.0	78.0	60.5	81.2	78.0	61.0	81.5	78.7	60.6	74.8	78.0	63.5	68.8	74.5	65.5	66.5	71.0	72.0	71.4	71.5
7	70.0	103.0	83.0	66.8	85.0	82.5	67.0	86.8	83.5	67.0	79.7	82.5	67.5	72.5	78.5	68.0	69.0	74.3	72.0	72.0	72.6
8	76.0	.....	82.0	71.5	......	85.0	71.2	......	86.5	70.8	......	85.0	70.5	......	80.6	70.0	......	76.0	73.5	......	73.7
9	67.0	76.0	66.5	65.5	76.0	69.0	67.0	76.0	70.4	68.0	74.5	72.0	70.0	71.3	72.2	70.5	70.0	71.5	74.5	73.9	73.5
10	58.5	78.0	70.0	59.5	72.5	73.0	60.0	74.5	74.5	63.0	70.0	74.5	65.0	65.5	72.0	72.5	65.5	69.5	72.5	72.0	71.6
11	62.0	88.0	75.0	61.0	80.5	77.5	61.0	82.5	79.0	61.0	75.3	79.0	63.6	69.0	75.4	65.2	66.5	71.5	71.5	71.4	71.5
12	66.0	94.0	76.5	62.5	82.5	77.5	63.5	83.0	79.0	63.6	76.0	78.5	65.2	69.5	75.5	66.5	67.0	72.0	72.0	71.7	72.0
13	70.5	84.5	75.0	68.5	77.0	79.7	68.4	78.0	80.0	68.8	74.0	79.0	69.0	70.2	75.5	68.6	68.6	71.8	72.5	72.5	72.5
14	70.0	89.5	84.0	67.0	84.5	82.5	67.0	84.0	83.0	67.3	78.0	81.5	68.0	72.0	77.5	68.2	69.0	73.3	72.6	72.5	72.7
15	72.0	81.0	81.0	72.0	81.0	80.0	72.0	81.5	80.3	71.6	80.3	80.2	71.1	80.0	77.2	70.5	72.0	74.0	73.5	73.5	74.0
16	70.0	87.0	78.0	68.5	82.4	79.0	69.0	85.0	81.0	69.0	79.0	81.2	69.7	83.5	78.3	70.0	71.0	74.7	74.0	74.0	74.0
17	68.0	74.0	75.5	65.0	72.5	75.0	65.3	73.0	75.5	66.0	71.2	74.3	67.8	69.8	72.0	69.0	69.0	70.2	74.3	74.0	73.5
18	64.5	77.0	72.0	63.5	77.0	75.0	63.5	78.0	76.2	65.4	73.3	77.0	67.0	69.2	74.5	67.7	67.7	71.5	73.0	72.6	72.6
19	64.0	92.0	78.3	63.0	78.5	73.3	63.0	78.6	74.5	64.0	73.3	75.0	65.5	68.7	73.0	66.6	67.0	70.3	72.6	72.3	72.0
20	61.5	86.5	68.0	61.5	76.0	73.0	61.5	76.3	74.0	61.8	71.7	74.3	64.5	67.6	72.0	65.5	66.0	69.3	72.0	71.5	71.5
21	71.5	98.0	72.0	61.7	77.3	76.5	60.6	76.5	77.5	69.3	72.0	77.0	62.2	67.0	73.5	64.0	65.0	70.0	71.1	70.5	70.6
22	70.0	114.0	75.5	61.5	79.6	75.5	61.0	79.5	77.0	61.0	73.8	76.8	62.0	68.0	74.0	64.5	65.5	70.5	71.0	70.5	71.0
23	68.0	96.0	77.0	62.5	76.0	74.5	62.7	77.4	76.4	62.7	73.0	73.0	65.2	68.4	73.6	66.0	66.5	70.3	71.5	71.0	71.0
24	66.0	69.0	64.0	65.5	67.0	65.5	65.3	67.0	66.5	66.0	67.0	67.3	67.0	66.7	67.5	67.0	66.5	67.0	71.5	71.0	71.0
25	65.0	78.0	73.5	64.0	71.5	72.5	64.0	70.5	73.0	64.5	68.5	73.4	65.0	66.2	70.3	64.8	65.0	68.0	70.2	70.0	70.0
26	70.0	88.0	76.0	67.0	80.5	79.0	67.0	80.0	80.0	67.0	75.0	79.0	66.7	70.0	75.2	66.5	67.5	71.5	71.0	71.7	71.0
27	70.0	93.0	79.0	65.5	82.5	80.7	65.5	81.0	81.5	65.5	76.7	80.5	66.5	71.0	76.5	67.0	68.0	72.5	72.0	71.5	72.0
28	68.0	96.0	84.0	66.0	82.8	82.5	66.0	81.5	83.0	66.2	76.5	81.5	67.3	71.0	77.5	67.8	68.5	73.3	72.5	72.0	72.5
29	75.5	96.0	84.0	69.5	84.3	83.0	69.5	84.0	84.0	69.5	79.8	83.0	70.0	73.8	79.2	70.0	77.0	75.0	73.5	73.0	73.6
30	78.0	106.0	76.0	71.0	89.0	77.0	70.6	87.5	77.8	70.2	82.0	78.5	70.5	75.0	77.3	70.5	71.7	74.6	74.0	74.0	74.0
31	77.0	111.0	85.0	73.0	88.0	84.0	73.0	87.5	85.0	72.2	82.0	84.0	71.5	75.5	80.4	71.0	72.2	76.0	74.2	74.0	74.0

READING OF SOIL THERMOMETERS — (*Continued*).

1890.	Surface.			One Inch.			Two Inches.			Three Inches.			Six Inches.			Nine Inches.			Eighteen Inch's		
	7 A.M.	12 M.	6 P.M.	7 A M.	12 M.	6 P.M.	7 A.M	12 M.	6 P M	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M	12 M.	6 P M	7 A M	12 M.	6 P.M.
August 1	73.0	107.0	83.0	71.5	90.0	85.7	71.6	87.5	70.0	72.4	82.0	86.2	72.7	76.0	82.5	72.3	72.8	77.8	75.0	74.8	75.0
2	76.5	110.0	86.0	69.0	87.5	86.3	68.7	85.5	87.0	69.5	81.0	86.2	70.8	75.0	82.0	70.5	72.0	77.4	75.5	75.0	75.3
3	78.0	106.5	86.0	72.5	90.5	84.5	72.5	89.5	86.0	73.0	84.5	85.5	73.3	78.0	82.5	73.0	74.4	82.5	76.0	76.0	76.3
4	80.0	106.0	88.0	75.2	90.5	86.5	75.5	89.0	87.5	75.2	84.5	86.0	75.2	79.0	82.5	74.5	75.3	78.4	76.7	76.6	77.0
5	75.0	94.0	72.0	74.0	84.0	71.7	74.0	83.8	72.5	75.0	80.3	74.5	75.0	76.6	74.3	74.5	74.5	74.5	77.0	76.7	76.5
6	69.0	90.0	75.5	65.5	79.8	77.5	65.5	78.0	78.0	66.5	75.5	77.8	68.0	72.0	75.5	69.5	70.0	72.0	75.5	74.5	74.0
7	71.0	92.0	80.0	66.0	86.5	81.0	66.3	82.0	82.0	66.6	77.8	81.9	68.0	72.5	78.5	69.0	70.0	74.5	74.5	74.3	74.5
8	67.0	104.0	82.0	65.7	87.0	82.0	66.0	82.7	83.0	68.7	73.0	79.5	68.7	73.0	79.5	69.0	70.5	75.5	75.0	74.5	74.5
9	70.5	98.0	79.0	68.6	82.5	77.0	69.0	79.5	77.5	70.0	75.8	77.7	71.0	72.0	76.0	71.0	70.7	73.6	75.2	75.0	74.7
10	67.0	74.0	64.0	66.0	72.5	67.5	66.3	72.0	68.0	68.0	71.0	70.0	69.0	69.7	70.2	69.6	69.2	70.0	74.5	74.0	74.0
11	60.0	79.5	68.0	59.0	79.7	69.0	59.5	69.0	69.8	60.2	67.2	70.5	63.5	65.2	69.0	60.5	65.0	67.7	72.5	72.0	72.0
12	66.0	99.0	72.0	61.5	77.5	75.5	60.7	73.5	76.2	61.0	70.7	75.7	62.5	66.7	72.8	64.0	65.0	69.6	71.5	71.5	71.5
13	64.0	100.0	79.5	60.0	81.0	80.5	60.5	77.2	81.2	62.0	73.0	80.0	64.0	68.5	75.7	65.4	66.5	71.5	72.0	71.5	72.0
14	66.0	82.0	73.0	65.0	75.5	73.5	65.2	74.5	74.2	66.4	71.6	74.2	67.5	68.7	72.2	68.0	67.7	70.0	72.7	72.5	72.5
15	68.0	96.0	76.0	63.8	87.5	79.0	64.5	84.0	80.0	65.0	77.0	79.5	66.3	71.0	76.5	67.0	68.5	72.5	72.5	72.5	72.5
16	66.0	96.0	77.5	62.5	81.0	78.5	63.0	77.5	79.5	64.0	73.5	79.0	65.7	69.5	76.0	67.0	67.5	72.0	73.0	72.5	72.5
17	72.0	88.0	71.0	69.5	80.5	71.0	69.5	79.8	71.5	69.1	76.0	72.5	69.0	72.0	71.2	68.8	69.6	70.7	73.0	72.8	73.0
18	65.0	84.0	68.0	62.5	76.0	71.0	62.5	72.5	72.0	62.6	70.7	72.2	65.4	68.0	72.0	66.5	66.6	69.5	72.5	72.0	72.0
19	61.0	70.0	68.5	58.0	66.0	67.5	58.5	66.0	67.7	60.0	66.2	67.6	62.5	61.5	66.5	64.2	64.3	65.5	72.0	71.2	71.0
20	63.5	74.5	70.0	62.0	77.6	71.5	62.5	71.0	72.0	62.3	69.0	72.5	64.5	66.5	70.3	64.7	65.3	68.0	70.5	70.5	70.7
21	63.0	70.0	68.0	61.5	67.5	67.0	61.5	67.0	67.0	61.2	66.0	67.4	63.5	64.5	66.5	64.3	64.3	65.7	71.0	70.5	70.5
22	62.0	72.0	64.0	60.0	72.7	64.0	60.0	70.7	64.5	60.0	67.8	65.5	62.5	64.7	66.0	63.5	63.9	65.4	70.2	70.0	70.0
23	56.0	66.0	60.0	55.5	64.6	62.0	56.0	63.5	62.5	58.0	62.0	63.5	60.0	61.0	63.5	61.5	60.2	63.0	69.5	69.0	68.7
24	58.0	74.0	64.0	55.0	65.5	66.0	55.0	65.5	66.6	55.5	61.3	66.6	57.4	60.3	64.5	59.3	60.0	62.8	68.0	67.6	67.5
25	57.5	74.0	58.0	55.5	69.0	69.5	55.5	67.0	70.0	56.2	64.0	69.5	58.0	61.0	67.0	59.5	60.4	64.3	67.5	67.5	67.5
26	62.5	73.0	71.0	61.0	70.0	70.0	61.0	69.8	70.4	61.8	67.2	69.8	62.4	64.5	67.5	62.5	63.2	65.5	68.1	68.5	68.5
27	63.5	82.0	68.0	62.5	73.5	70.0	62.6	72.5	70.5	63.5	69.0	71.0	64.0	65.6	69.5	64.0	64.3	67.0	69.0	69.2	69.5
28	62.0	72.0	68.5	61.0	70.0	69.0	61.4	69.0	69.0	62.2	67.0	69.0	63.4	64.6	67.5	63.9	63.8	65.7	69.5	69.4	69.5
29	61.5	80.0	67.5	58.5	70.0	66.0	58.5	69.5	66.0	58.5	66.0	66.2	60.2	63.0	65.5	62.5	62.5	64.5	69.5	69.0	69.0
30	60.0	66.0	60.0	58.5	62.5	60.0	58.7	62.5	60.2	60.0	62.2	60.5	61.5	62.0	62.0	62.3	62.0	62.1	68.6	69.0	68.5
31	56.0	64.0	61.0	55.5	61.0	62.0	55.5	60.3	63.0	57.0	58.2	63.6	58.5	59.0	62.6	59.7	59.5	61.4	67.5	67.2	67.0

READING OF SOIL THERMOMETERS — (*Continued*).

1890.	Surface.			One Inch.			Two Inches.			Three Inches.			Six Inches.			Nine Inches.			Eighteen Inch's		
	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	5 P.M.	7 A.M.	12 M.	6 P.M.
September 1	56.0	78.0	68.0	54.0	70.6	70.0	54.4	70.3	70.6	55.0	65.0	70.0	57.0	61.0	67.0	58.5	59.5	64.0	66.7	66.5	66.7
2	57.0	80.5	70.0	55.3	72.5	72.5	51.0	74.2	73.0	57.0	67.8	72.2	59.0	63.0	69.2	60.5	61.5	65.7	67.5	67.3	67.5
3	59.5	84.0	72.0	58.0	76.5	75.0	58.5	77.5	75.5	61.0	70.8	75.0	61.4	65.4	71.5	62.0	63.0	67.5	68.0	68.1	68.3
4	62.0	84.0	74.0	60.5	77.0	76.0	61.0	77.8	76.8	62.3	72.0	75.8	63.5	67.0	72.5	64.0	64.8	68.2	69.3	69.0	69.5
5	70.0	85.0	75.0	67.5	78.5	74.5	67.5	78.2	75.0	67.6	74.0	75.0	67.3	70.0	72.5	66.5	67.5	70.0	70.5	70.5	70.6
6	69.5	80.0	74.0	68.0	73.5	74.0	68.0	73.0	74.0	68.5	71.0	73.8	68.2	68.0	72.0	71.4	67.7	69.8	71.4	71.3	71.5
7	69.5	82.0	77.5	67.0	78.5	78.0	67.5	79.0	78.0	67.8	75.5	78.0	68.0	71.0	75.0	67.8	68.5	71.7	72.0	71.7	72.0
8	70.5	84.5	74.0	69.0	77.5	73.5	69.0	77.5	74.0	69.2	74.5	74.0	69.2	71.5	72.6	69.0	69.5	70.7	72.5	72.7	72.7
9	65.0	71.5	67.5	64.0	71.5	67.0	64.0	71.5	67.5	65.2	69.0	69.0	66.5	67.0	59.0	67.2	66.8	68.0	72.5	72.2	72.0
10	60.0	64.0	61.5	60.5	63.0	61.5	61.0	63.0	61.5	61.6	63.5	61.5	64.0	64.0	63.5	64.5	64.0	64.0	71.2	71.0	70.6
11	60.5	64.0	64.0	60.0	62.6	63.2	60.0	62.2	63.5	60.0	61.6	62.5	61.5	62.2	63.0	62.0	62.0	62.8	69.5	69.0	69.0
12	66.0	72.5	72.0	60.4	70.2	70.5	64.0	69.6	71.0	63.6	67.7	70.0	63.2	65.0	68.0	63.0	63.8	66.0	69.0	69.0	69.0
13	68.0	82.0	64.5	66.5	71.0	66.6	65.5	71.5	67.7	66.8	69.4	69.4	66.5	67.2	69.0	66.0	66.0	68.0	70.0	70.0	70.3
14	53.0	84.0	63.0	53.7	66.5	64.8	54.5	68.0	65.7	57.0	65.0	67.0	60.0	62.4	66.3	62.0	62.0	65.0	69.7	69.5	69.0
15	57.5	86.0	68.0	57.0	68.0	68.5	57.5	69.5	69.0	58.0	66.0	69.0	60.5	62.7	67.0	61.5	62.0	65.0	69.0	68.5	68.3
16	62.0	79.0	66.0	61.5	70.0	67.5	61.5	69.7	68.8	62.5	66.5	69.4	63.5	64.0	68.0	63.5	63.3	66.0	69.0	69.0	69.0
17	62.0	64.0	60.0	62.0	63.0	60.5	61.5	63.0	61.0	62.5	62.0	62.0	63.5	62.5	62.5	63.5	63.0	63.0	69.0	69.0	69.0
18	58.0	82.0	66.0	56.5	70.2	68.2	56.5	72.0	69.2	56.2	67.0	69.5	58.5	62.5	67.5	60.0	61.0	65.0	68.0	68.0	68.0
19	56.0	78.0	68.0	56.0	77.5	67.5	56.5	68.5	69.5	58.0	65.5	69.0	60.0	62.5	67.0	61.0	61.5	64.5	68.0	68.0	68.0
20	57.0	60.3	54.0	57.2	59.5	58.0	57.5	59.6	58.6	59.0	59.2	59.0	61.0	60.5	60.7	62.0	61.0	60.9	68.2	68.0	67.5
21	53.5	68.0	57.0	53.5	61.5	61.0	53.5	61.0	62.0	55.0	58.0	63.0	57.0	57.0	62.5	57.5	57.5	61.0	66.8	66.5	66.2
22	54.0	77.0	64.0	51.7	64.5	64.0	51.7	66.2	65.2	53.0	63.0	65.5	55.4	58.5	63.8	57.0	58.0	61.5	66.0	65.8	65.7
23	53.0	66.0	60.0	53.0	65.0	63.5	53.5	65.0	64.5	55.5	63.0	64.8	57.6	59.7	63.0	59.0	59.0	61.5	66.0	66.0	66.0
24	51.0	60.2	57.8	51.5	61.5	59.7	51.0	61.7	59.7	53.7	59.0	61.5	56.4	57.5	61.4	58.0	57.5	60.0	65.7	65.5	65.0
25	44.0	73.0	56.7	44.2	60.7	59.6	45.2	62.0	60.7	48.0	48.0	61.2	52.0	54.5	60.0	54.5	54.7	58.4	64.5	64.0	64.0
26	54.0	54.0	58.0	53.5	56.5	57.0	53.5	56.5	57.5	54.5	56.5	58.0	55.5	56.2	57.2	56.0	56.4	57.2	64.0	63.8	63.5
27	53.0	53.0	51.2	53.0	52.6	52.2	53.5	53.0	53.0	55.0	54.0	54.2	56.0	55.0	55.2	56.8	56.0	55.8	63.8	63.7	63.2
28	46.0	62.0	51.0	46.0	58.2	53.5	46.5	57.7	56.2	48.8	56.4	58.0	51.5	54.0	58.0	53.6	53.8	57.0	62.5	62.5	62.3
29	44.0	70.0	54.0	44.5	60.0	59.0	44.6	62.5	60.5	47.0	58.5	61.5	50.0	54.0	60.0	52.5	53.4	57.6	62.0	62.0	62.0
30	46.0	74.0	60.0	45.6	64.7	62.2	46.2	65.0	64.0	48.3	59.9	54.2	51.2	55.0	62.0	53.0	54.0	58.8	62.0	62.0	62.0

Reading of Soil Thermometers — (*Concluded*).

1890.	Surface.			One Inch.			Two Inches.			Three Inches.			Six Inches.			Nine Inches.			Eighteen Inch's		
	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M.	12 M	6 P.M.	7 A.M.	12 M.	6 P.M.	7 A.M	12 M.	6 P.M.	7 A M.	12 M.	6 P.M.	7 A.M.	12 M.	6 P.M.
October 1	50.0	70.0	62.0	50.0	64.5	64.6	50.5	64.5	64.8	52.2	60.8	65.6	54.0	67.0	63.0	55.0	55.7	59.7	62.3	62.4	62.5
2	58.0	67.0	62.2	56.6	64.4	62.2	57.0	63.8	62.5	57.2	62.0	62.5	57.7	59.4	61.2	57.8	58.0	59.6	63.3	63.4	63.5
3	60.0	74.6	62.0	59.0	66.5	63.4	59.0	66.8	64.0	59.5	64.2	54.0	59.4	61.0	63.0	59.0	59.5	61.4	64.0	64.2	64.0
4	58.0	70.0	61.0	57.2	65.5	63.0	57.3	65.0	64.0	58.0	62.8	64.7	58.5	60.5	63.4	58.8	59.4	61.4	64.7	64.5	64.6
5	58.0	67.0	58.0	57.8	68.4	61.0	58.0	62.5	62.0	58.8	61.4	62.4	59.0	60.0	62.0	59.2	59.2	60.7	64.8	64.8	65.0
6	55.0	58.0	54.0	55.3	57.0	54.5	55.5	57.2	54.7	57.0	57.5	56.0	58.0	58.5	57.0	58.4	58.0	57.5	64.6	64.5	64.3
7	56.0	60.2	56.0	55.6	57.5	56.5	55.8	57.5	57.0	56.0	57.6	58.0	56.4	57.0	58.0	56.5	57.5	58.0	63.5	63.4	63.8
8	50.0	70.0	52.0	50.2	58.4	55.5	50.5	60.2	57.0	52.2	57.8	58.8	54.0	55.7	58.8	55.2	55.5	58.7	63.0	63.0	62.8
9	46.0	68.0	52.0	49.0	61.6	56.0	47.5	63.0	58.0	49.5	58.2	58.0	52.0	55.4	59.0	54.0	54.5	57.5	62.4	62.0	62.2
10	51.2	62.0	58.8	50.5	59.5	59.0	50.5	59.0	59.0	51.6	57.5	59.0	53.0	55.3	58.0	54.0	54.6	56.8	62.0	61.8	61.8
11	50.8	58.0	53.0	51.0	58.0	54.5	51.5	57.7	54.8	53.0	57.2	56.2	54.5	55.8	56.5	55.0	55.2	56.3	62.0	62.0	62.0
12	48.2	57.6	48.0	49.0	54.5	50.0	49.5	54.2	50.0	51.2	53.5	53.0	53.0	53.0	54.5	54.0	53.7	54.5	61.5	61.4	61.0
13	43.0	56.0	46.0	43.5	53.5	51.0	44.0	53.0	51.5	46.0	52.0	52.6	48.8	50.5	53.0	51.0	51.0	52.0	60.4	60.0	60.0
14	51.5	57.0	50.0	50.7	55.0	51.5	50.8	54.5	52.2	51.5	53.8	53.7	52.0	53.0	54.0	52.3	52.6	53.6	59.0	59.5	59.0
15	46.0	66.0	52.0	46.5	56.5	55.4	46.6	59.2	56.4	48.0	56.0	57.6	49.9	52.5	56.7	51.0	51.9	55.0	59.0	59.0	59.5
16	47.5	55.0	51.0	47.4	53.2	51.5	47.6	53.0	51.5	47.8	52.5	62.5	50.2	51.5	52.7	51.4	51.5	52.8	59.0	59.4	59.2
17	46.0	52.0	47.0	48.5	53.7	50.2	49.4	53.8	51.0	51.0	54.0	52.7	52.0	52.9	53.4	52.3	52.5	53.0	59.0	59.0	59.2
18	44.0	55.2	53.3	44.2	56.7	55.0	45.0	59.2	56.0	46.7	55.5	57.0	47.8	51.8	55.3	50.4	51.0	54.5	58.8	58.6	58.9
19	50.0	53.0	52.0	50.5	52.2	50.5	51.0	52.3	51.0	51.8	52.2	52.0	52.5	52.5	52.0	52.8	52.5	52.6	59.0	59.0	59.0
20	49.0	52.0	48.0	49.0	50.5	49.0	49.4	50.4	49.5	50.5	50.7	50.5	51.0	51.0	50.7	51.6	51.5	51.6	59.0	58.8	58.8
21	47.5	58.0	47.0	47.4	64.2	47.5	47.5	54.8	49.5	48.5	52.6	51.5	49.5	51.0	52.5	50.4	50.8	52.3	58.0	58.2	59.0
22	37.5	62.0	48.0	39.5	51.3	49.5	40.0	53.5	50.6	42.5	50.5	52.6	45.6	47.6	52.5	48.0	48.0	51.4	57.5	57.2	57.0
23	47.5	48.0	46.0	45.5	47.4	45.0	45.7	47.5	45.5	47.0	47.7	47.0	48.0	47.2	48.3	49.0	49.0	49.0	57.0	56.9	57.0
24	42.2	48.2	46.0	42.8	46.5	47.0	43.0	46.5	47.3	44.5	46.6	48.2	45.8	46.6	48.2	47.0	47.2	48.1	55.6	55.5	55.0
25	45.0	48.0	48.0	45.0	52.4	48.0	45.4	52.8	48.7	46.2	50.2	50.0	47.2	48.5	50.5	48.0	48.3	50.0	55.5	55.6	55.2
26	46.0	50.0	46.0	45.0	49.0	46.0	45.1	48.8	46.5	46.0	48.6	47.6	47.2	48.0	48.0	48.0	48.3	49.0	55.8	55.8	55.7
27	42.0	45.0	42.0	43.0	44.9	41.6	43.5	45.0	42.5	44.8	45.3	44.0	46.2	46.0	45.9	47.3	47.0	47.0	55.4	55.3	55.0
28	35.0	44.0	41.2	38.4	43.0	42.0	38.8	43.0	43.4	40.8	43.0	44.6	43.0	43.5	44.4	45.0	45.8	45.6	54.4	54.0	54.0
29	33.5	44.7	44.0	38.0	42.4	42.5	38.0	42.2	42.0	40.0	42.2	43.6	42.5	42.8	44.4	44.3	44.0	45.0	53.6	53.4	53.2
30	41.0	58.0	39.0	41.0	53.0	41.5	41.2	45.0	42.5	42.0	46.0	44.8	43.4	48.0	46.0	44.5	49.5	46.5	53.0	53.5	53.0
31	32.6	54.0	38.0	36.2	46.0	41.5	36.6	47.3	42.5	38.6	45.5	44.6	41.0	43.4	45.5	43.3	43.5	45.5	53.0	52.6	52.3

INDEX.

A.

B.

G.

H.