FIFTIETH ANNUAL REPORT OF ILLINOIS DAIRYMEN'S ASSOCIATION 1924

ILLINOIS STATE DAIRYMEN'S ASSOCIATION BOOTH
Commemorating its Fiftieth Annual Convention, Danville, January, 1924

FIFTIETH ANNUAL CONVENTION

OF THE

Illinois State Dairymen's Association

Held at Danville, Illinois,
January 10th, 11th and 12th,
1924

LETTER OF TRANSMITTAL

Office of Secretary,
Illinois State Dairymen's Association,
Chicago, Ill., 1924.

To His Excellency, Len Small, Governor of the State of Illinois:

I have the honor to submit the official report of the Illinois State Dairymen's Association, containing the addresses, papers and discussions at its fiftieth annual meeting, held at Danville, Illinois, January 10th, 11th and 12th, 1924.

Respectfully,

GEO. CAVEN, Secretary.

LIST OF OFFICERS

President —

W. S. O'HAIR, Paris, Ill.

Vice-President—

S. J. STANARD, Springfield, Ill.

Directors—

W. S. O'HAIR, Paris, Ill.

T. P. SMITH, Danville, Ill.

LESLIE MILES, Lawrenceville, Ill.

C. M. FILSOM, Salem, Ill.

JAMES PHILLIPS, Benton, Ill.

CHAS. FOSS, Freeport, Ill.

S. J. STANARD, Springfield, Ill.

Secretary—

GEORGE CAVEN, Chicago.

Treasurer—

CHARLES FOSS, Freeport.

CONSTITUTION AND BY-LAWS OF THE ILLINOIS STATE DAIRYMEN'S ASSOCIATION

Name and Purpose.

Section 1. The name of this Association shall be the "Illinois State Dairymen's Association." Its general purposes shall be to promote the dairy interests of the State of Illinois and to disseminate knowledge concerning the same, to bring about more economical production of dairy products, the production of a better quality of dairy products, and to increase the consumption of dairy products.

Membership.

Section 2. Any person who is a resident of the State of Illinois and who shall pay into the treasury of the association the sum of one dollar, shall be a member of the association until the first day of the opening of the next annual convention. Any person who is a resident of the State of Illinois and who shall pay into the treasury of the association the sum of four dollars shall be a member of the association for a period of five years from the first day of January preceding the date of said payment. Any person who is a resident of the State of Illinois and who shall pay into the treasury of the association the sum of ten dollars shall be a life member of the association and shall be exempt from payment of any dues with the exception of special assessments, which may be made by the Board of Directors on all members, which assessments shall not total more than fifty cents per member in any one year.

Honorary members may be elected by vote at any annual meeting of the association in recognition of services rendered to the dairy interests of the state, and such members shall be entitled to all privileges of membership with the exception of voting for officers, and shall be exempt from all dues and assessments.

Management.

Section 3. The full management of the affairs of the association shall be in the hands of the Board of Directors, which shall consist of a president, vice-president and five directors. Four members of the Board of Directors shall constitute a quorum to do business.

The Board of Directors may adopt such rules and regulations as they shall deem advisable for the government and conduct of the business of the association and may appoint such committees as they shall consider desirable.

They shall also make a biennial report to the Governor of the state of the expenditures of the moneys appropriated to the association and arrange the program and order of business for the same.

Elective Officers.

Section 4. The president- vice-president and Board of Directors shall be elected by ballot at the first annual meeting of the association. Only five-year or life members shall be eligible for election to the elective offices or Board of Directors. A plurality vote shall elect.

The elective officers and Board of Directors shall take office immediately following their election and shall hold office for one year or until relieved by successors who have been duly elected and qualified.

Any vacancy which may occur among the Board of Directors or officers may be filled by the Board of Directors for the unexpired term.

Appointive Officers.

Section 5. The Board of Directors shall appoint the secretary and treasurer who shall take office upon the first day of July following their appointment and shall hold office until relieved by duly appointed and qualified successors.

Headquarters.

Section 6. The headquarters of this Association shall be where the secretary has his place of business.

Annual Meeting.

Section 7. The association shall hold its annual meeting at such place and time as shall be determined by the Board of Directors, not less than thirty days in advance.

Duties of the President.

Section 8. The duties of the president shall be to preside at the meetings of the association and of the Board of Directors. It shall be his duty, together with the secretary, to arrange a program and the order of business for each regular annual meeting of the association and of each meeting of the Board of Directors and upon the request of five members of the association, it shall be his duty to call special meetings of the Board of Directors, or he may call meetings at such times as he deems advisable.

During the first day of the annual meeting of the association, the president shall appoint in open meeting a committee consisting of three members of the association, which committee shall place before the convention nominations for officers and directors of the association for the ensuing year, their report to be made not less than three hours after their appointment. The president shall at the time of the appointment of the nominating committee indicate in open meeting when the election of officers shall take place.

The president may, at this meeting, appoint whatever other committees that to him may seem advisable.

The president shall be a member ex-officio of all committees either appointed by him or by the Board of Directors, with the exception of the nominating committee.

Duties of the Vice-President.

Section 9. In the absence of the president, his duties shall devolve upon the vice-president.

Duties of the Secretary.

Section 10. The secretary shall record the proceedings of the association and of the Board of Directors. He shall keep a list of the members, collect all the moneys due the

association and shall record the amount with the name and postoffice address of the person so paying, in a book to be kept for that purpose. He shall pay over all moneys to the treasurer, taking his receipt therefor. It shall also be his duty to assist in making the program for the annual meeting and at the close of the said meeting compile and prepare for publication all papers, essays, discussions and other matter worthy of publication and cause to be published and distributed to members at the earliest day possible and shall perform all such other duties pertaining to his office as shall be necessary. Any compensation for the services of the secretary shall be established by the Board of Directors.

Duties of the Treasurer.

Section 11. The treasurer shall before entering upon the duties of his office, give good and sufficient bond to the directors of the association with one or more sureties to be approved by the Board of Directors, which bond shall be conditioned for the faithful performance of the duties of his office. He shall account to the association for all moneys received by him by virtue of said office and pay over the same as he shall be directed by the Board of Directors. No moneys shall be paid out by the treasurer except upon order signed by the president and countersigned by the secretary. The books or accounts of the treasurer shall at all times be open to the inspection of the members of the Board of Directors, and he shall at the expiration of his term of office, make a report to the association of the condition of its finances and deliver to his successor the books of account, together with all moneys and other property of the association in his possession or custody. The treasurer's bonding fee, if there be any, shall be paid by the association.

Quorum.

Section 12. Seven members of the association shall constitute a quorum for the transaction of business, but a lesser number may adjourn.

Amendments.

Section 13. This constitution and by-laws may be amended at any annual meeting by a vote of not less than two-thirds of the members present. Notice of the proposed amendment or amendments must be given in writing and at a public meeting of the association at least one day before any election can be taken thereon. This constitution and by-laws may also be amended by unanimous vote of the Board of Directors present at a meeting called for that purpose, written notice stating purpose of meeting having been sent to all members of the Board not less than ten days preceding date of meeting.

ONE-HALF CENTURY

FIFTIETH ANNUAL CONVENTION, ILLINOIS STATE DAIRYMEN'S ASSOCIATION

(Geo. Caven, Secretary)

An effort was made to make this meeting held at Danville, Jan. 8, 9 and 10, 1924 a memorable one in the history of the Association, and it was memorable in several particulars.

One particular was the presence of J. P. Mason, an ex-president of the Association for a number of years, and who was on the program at the Association's third annual convention. Mr. Mason spoke at the Jan. 8 session in Danville, giving a common sense and business dairy talk on the plan he has followed in his years of success as a dairy farmer. Mr. Mason is still a dairy farmer, living on his farm and each year makes a record that few dairymen or few in other lines can equal in profit on the amount invested. He advocates business methods in dairy farming and declared there is no better business than a dairy farm operated on business principles.

This Fiftieth Annual Convention was notable for the big exhibit of dairy cattle and the fact that Danville business men gave over $1,000 in cash prizes to competing dairy cattle breeders.

It was notable also for the large class of boys, close to 100, who entered the cattle judging contest. These boys, after an address on cattle judging by R. E. Caldwell of Waukegan, Ill., wrote their opinions of several dairy animals brought into the ring for the purpose and as a class made exceedingly good marks. That class of boys was considered by many the outstanding feature of the convention and pointed the way for an answer to the problem of how to keep the farmer boys and girls on the farms.

A dairy poster contest by children of the Danville schools and of the country schools about Danville, was a

new and surprisingly effective and attractive feature. The walls of the drill hall in the armory, in which the meeting was held, were covered with posters prepared by school children, they having received a series of talks on milk, and its value and necessity in the diet for young and old, the talks having been given by a worker of the National Dairy Council. Elsewhere is given a cut showing a few of these posters.

The exhibit by the National Dairy Council illustrating the value and necessity of milk was most impressive and attractive, and a milk fair play put on by the National Dairy Council, school children taking the parts or characters, attracted large audiences the evenings of Jan. 8 and 10.

The banquet Wednesday evening, Jan. 9, with W. W. Marple of Chicago as toastmaster, was a notable event. (This was the last event at which Mr. Marple, vice-president of the Association and famous as a toast master, presided. He went to Florida right after the convention for a rest, was taken sick in Jacksonville, and after his partial recovery and return north, died suddenly at Battle Creek, Mich., where he had gone for further treatment).

The program was excellent throughout and opened Tuesday afternoon, Jan. 8, with an invocation, an address of welcome by a representative of the city government and a response by President W. S. O'Hair of the Association. R. E. Caldwell of Waukegan gave a dairy cattle demonstration lecture using cattle from the herds exhibited as subjects, and after the lecture conducted the boys' class in dairy cattle judging.

Mr. J. P. Mason gave a short dairy talk and J. R. Dawson of the dairy bureau, U. S. Department of Agriculture, gave an address on "Why We Need Better Dairy Cows."

Committees were appointed and the convention was thus under way.

Tuesday evening brought 1,500 or more persons out to witness the "Milk Play," put on by the National Dairy Council, the play being preceded by a talk on "Milk a Necessary Food," by M. O. Maughan, secretary of the Council.

Wednesday's and Thursday's sessions of the Council were made up of addresses that are here given in full and make up a valuable contribution to dairy knowledge.

The final action of the convention was the adoption of resolutions and election of directors for the ensuing year.

EXHIBITORS AT THE STATE DAIRYMEN'S ASSOCIATION MEETING

Jersey Exhibitors.

S. S. Reinoehl & Son, Robinson, Ill. ---------- 1
Fred Fox, Robinson, Ill. ---------- 1
Ed Pifer, Palestine, Ill. ---------- 2
Otto Girard, Robinson, Ill. ---------- 1
Harley Frye, Robinson, Ill. ---------- 1
I. L. Henderson, Robinson, Ill. ---------- 1
B. A. Folk, Robinson, Ill. ---------- 1
J. H. Southard, Trimble, Ill. ---------- 1
Trimble Bros., Trimble, Ill. ---------- 5
W. S. O'Hair, Paris, Ill. ----------10
Clair E. Day, Williamsport, Ind. ---------- 1
J. M. Haworth, Danville, Ill. ---------- 1
C. P. Starkweather, Hettick, Ill. ---------- 1
Wm. Hammack, Pinkneyville, Ill. ---------- 2

Holstein Exhibitors.

T. R. Lovett, Danville, Ill. ---------- 6
James Plautt, Danville, Ill. ---------- 3

The premium fund of $1,035.00 was contributed by the following individuals and firms of Danville:

Chas. Swisher	$ 10.00
Ernest Fecker	25.00
Meis Bros.	10.00
S. M. Clark	25.00
Horneman-Cossey Co.	25.00
Horneman-Cossey Co.	25.00
Jos. W. Meitzler	25.00
Straus & Louis	25.00
Cherry & Prast	50.00
A. B. Bushnell	25.00
M. S. Plaut	25.00
Plaut Dairy Farms	25.00
John Hartshorn	25.00
Deutsch Bros.	15.00
Plaza Hotel	75.00
Blue Banner Dairy	25.00
Sugar Creek Creamery	300.00
Bredehoft Dairy Co.	300.00
Total	$1,035.00

REPORT OF GEO. CAVEN, SECRETARY, 1923-1924

Receipts

Memberships	$126.00
Advertising	180.00
Check Treasurer	100.00
Total	$406.00

Disbursements

Treasurer Foss	$221.00
Travel (Elgin and return, 3 trips)	8.50
Stamps and Parcel Post	14.34
Banquet	10.50
Porters (Danville)	2.50
Tags for Rubber Stamps	2.60
Express and Telegraph	1.85
Exchange	.25
Booth at Danville	149.70
State Food Exhibit	.80
	$412.04

Premium Fund ---------- $1,035.00

Deposited at Danville and Paid Out in Premiums.

INFLUENCE OF SEASON OF FRESHENING ON PRODUCTION AND INCOME FROM DAIRY COWS

(By J. C. McDowell, Dairy Husbandry, Dairy Division, Bureau of Animal Industry).

There is a widespread belief that cows produce more milk and butterfat, and that they produce more economically, if they freshen in the fall or winter than if they freshen in the spring or summer. Tabulations of cow-testing-association records show that a definite relation does exist between season of freshening and other factors, but that the relation is not the same everywhere and under all conditions. That relation seems to depend to some extent on cost of feed, condition of pastures, and geographical location with reference to markets.

Under such circumstances a study of averages for a large number of cow-testing associations taken indiscriminately might be misleading unless followed by a further study of the records of each association. The conclusions given in the following pages are based on averages of the records of 64 associations combined, and on averages of the records of each association. The figures cover the period 1910 to 1920, inclusive. From each association the records used were for one year only. To avoid possible error due to incomplete data or to short-time tests, records were discarded if the breed and age were omitted or if the cow was on test less than 12 months. Tabulations on breed and age showed that these were not factors influencing the conclusions drawn in this bulletin. In the 64 associations studied there were on yearly test 10,870 cows whose age and date of freshening were given. The computations in this bulletin are based on the records of these cows. Cost of feed and price of product are based on actual figures as given by the testers on the individual cow record sheets.

Influence of Season of Freshening.

In Table 1 the records of the cows on test 12 months in 64 cow-testing associations are grouped according to the season when the cows freshened.

TABLE 1.—Date of freshening, by seasons, with average yearly feed and production records, per cow.

Season	Number of cows	Milk Production			
Butter-fat production	Cost of roughage		Cost of grain		
Cost of feed	Income over cost		of feed		
Spring (March, April and May)					
3,196	5,842	236	$37.51	$19.22	$56.73	$70.73
Summer (June, July and August)					
1,328	5,941	236	37.62	22.48	60.10	66.59
Fall (September, October and November)					
2,862	6,689	268	38.94	28.45	67.39	76.65
Winter (December, January and February)					
3,484	6,439	258	37.65	25.51	63.16	75.66
Total and averages 10,870	6,269	252	$37.95	$24.06	$62.01	$73.36

The cows that freshened in the fall months ranked highest in average yearly production of milk and butterfat, in cost of feed and in income over cost of feed. In all these points, the cows that freshened in the winter ranked second. Of the 10,870 cows, 6,346 freshened in the fall and winter and 4,524 freshened in the spring and summer. On an average the cows that freshened in the spring produced the least milk and those that freshened in the summer produced the least income over cost of feed. Care and quality of cows are big factors in determining production and income, but the large number of records in each group would tend to prevent great variation among group averages due to such causes.

Fewer cows freshened in the summer than at any other season. This may have been due partly to a belief among dairymen that it pays better to have cows freshen at some other time of year, a belief that seems to be supported generally by the records. It is also true that the season of freshening can not always be controlled. The feed bill, especially the amount spent on grain, was lowest for the cows that freshened in the spring. This was doubtless because the long pasture period, when little grain was fed,

came during the early part of the lactation period. The total cost of feed, however, was not low enough to give the cows that freshened in the spring first or even second place in yearly income over cost of feed. If cost of labor were to be included, the figures would doubtless be even more favorable to fall and early winter freshening, on account of the scarcity and high cost of labor in some districts during the summer months.

Value of Products.

Table 2, which is derived from a tabulation of the records of the 64 associations, shows how many times the cows that freshened each season ranked first, second, third and fourth in average yearly price received for milk or butterfat produced by the cows that freshened within that season.

TABLE 2.—Seasons when cows freshened ranked according to average price of butterfat or milk.

Season of freshening	Number of times ranked			
	First	Second	Third	Fourth
Spring	12	11	14	27
Summer	36	14	9	3
Fall	39	18	5	2
Winter	12	20	26	6

The figures do not refer to the price received for the product at any season of the year, but to the average price received during the entire year for the product produced by cows that freshened at a certain season.

There were two associations in which no cows freshened in summer. This accounts for the summer ranks adding up to only 62.

As there were ties for first place in some associations, the total number of times the four seasons received first place is greater than the number of associations compared. The table shows that in average price received for butterfat produced during the year, fall freshening ranked first 39 times; summer, 36; winter, 12; and spring, 12. The cows that freshened in the fall may not have freshened at the time of year when prices were highest, but they produced most of their milk at the time of year when prices were highest.

Milk and Butterfat Production.

In milk production the ranks of the four seasons were as shown in Table 3:

TABLE 3.—Seasons when cows freshened ranked according to average yield of milk.

Season of freshening	Number of times ranked			
	First	Second	Third	Fourth
Spring	7	13	24	20
Summer	10	4	19	29
Fall	29	23	7	5
Winter	18	24	14	8

In average yearly milk production, fall ranked first in 29 associations and second in 23 associations. Winter ranked first in 18 associations and second in 24. Summer ranked first in 10 associations and spring ranked first in only 7. It is also worthy of note than in milk production spring and summer ranked third and fourth in most of the cases.

Table 4 shows the number of times each season ranked first, second, third and fourth in butterfat production:

TABLE 4.—Seasons when cows freshened ranked according to average production of butterfat.

Season of freshening	Number of times ranked			
	First	Second	Third	Fourth
Spring	7	8	27	22
Summer	8	6	17	31
Fall	38	16	7	3
Winter	13	35	11	5

Out of a possible 64, fall ranked first 38 times in average yearly production of butterfat per cow and second 16 times. Winter ranked first 13 times and second 35 times out of a possible 64. Summer ranked first 8 times and fourth 31 times out of a possible 62, there being two associations in which no cows freshened during the summer months. Spring ranked first only 7 times in butterfat production and second 8 times. In average pounds of butterfat produced per cow for all associations combined (see Table 1) fall ranked first, winter second, and spring and summer tied for third and fourth places.

The cows that freshen in the fall not only rank first in yearly butterfat production, but they produce most during

the winter months. In many parts of the country the dairyman has more time in winter to do the extra work connected with their feed and care. It is also true that fall-freshening cows are dry at the time of year when field work is generally greatest.

Feed Cost.

The cost of roughage was about the same regardless of the season of freshening, but there was a considerable difference in the cost of grain. Table 5 shows how the four seasons ranked on average cost of grain per cow; that is, the year's cost of grain for cows of the different seasons.

TABLE 5.—Seasons when cows freshened ranked according to cost of grain required for the year's feed.

Season of freshening	Number of times ranked			
	First	Second	Third	Fourth
Spring	6	5	12	41
Summer	9	15	23	15
Fall	44	14	5	1
Winter	5	30	24	5

In 44 of the 64 associations fall freshening ranked first in cost of grain to feed a cow a year and in only one of the 64 associations did the fall-freshening cows rank fourth in cost of grain. On an average the cost of grain was highest for the cows that freshened in the fall (see Table 1), next highest for those that freshened in the winter, and lowest for those that freshened in the spring. The average cost of grain per cow was lowest in 41 of the 64 associations for the cows that freshened in the spring.

As the cost of roughage for the year was about the same regardless of the date of freshening, the total cost of feed varied approximately according to the cost of grain. Table 6 shows how the seasons ranked on total cost of feed.

TABLE 6.—Seasons when cows freshened ranked according to total cost of feed.

Season of freshening	Number of times ranked			
	First	Second	Third	Fourth
Spring	8	5	11	40
Summer	9	14	24	15
Fall	42	18	3	1
Winter	5	27	26	6

In 8 associations the feed cost was greatest for the cows that freshened in the spring, in 9 the feed cost was greatest for those that freshened in the summer, in 42 the feed cost was greatest for those that freshened in the fall, and in 5 the feed cost was greatest for those that freshened in the winter. Referring to Table 1 we find that in all the associations combined and over a period of years the average cost of feed for the cows that freshened in the fall was $67.39; for those that freshened in the winter, $63.16; for those that freshened in the summer, $60.10; for those that freshened in the spring, $56.73. In practical application the figures should be considered as relative, not absolute. These variations are not great when averages are considered, but they are much greater for some associations and very much greater for single herds in some associations. Where pastures are good and cheap the summer feed cost is low, and where pastures are poor and hard to get the summer feed cost is relatively high.

Influence of Pasture on Feed Cost.

To determine the influence of good pastures on production and income, a comparative study was made of one year's records of two cow-testing associations in the same State and not far apart. For convenience we will call these associations A and B. Association A had good pastures and association B had relatively poor pastures.

In association A the feed cost was greatest for the cows that freshened in the fall, their yearly milk production averaged 446 pounds less and their yearly butterfat production averaged 12 pounds less than those that freshened at other seasons of the year. In income over cost of feed they fell $17.88 behind the average of those that freshened in the summer and $25.97 behind those that freshened in the spring. In income over cost of feed the figures were as follows: Spring freshening, $94.83; winter freshening, $91.67; summer freshening, $86.74; and fall freshening, $68.86. The figures for that association were decidedly against fall freshening, but these results were the exception

and not the rule when all the 64 associations were considered.

In association B, where the pastures were poor, feed cost was also greatest for the cows that freshened in the fall, but these cows, as well as those that freshened in the winter, were ahead in production of milk and butterfat and in income over cost of feed. In income over cost of feed the figures for association B (having the poor pastures) were as follows: Fall freshening, $86.18; winter freshening, $85.99; spring freshening, $82.02; and summer freshening, $81.73.

For association A the average income over cost of feed was $85.59 and for association B it was $84.26. The figures do not prove that dairying is more profitable where pastures are good, but they furnish some evidence that the question of pasture should have weight in determining the time of year when it will pay best to have cows freshen. Labor, too, must be considered.

On account of labor and miscellaneous expenses the income over cost of feed is not all net profit in the dairy business, but it is from the income over cost of feed that net profit is obtained. So far as possible, the dairyman should aim to have his cows freshen at the time of year that will bring him the greatest net return. That may or may not be the date of freshening that gives the greatest income over cost of feed. Income over cost of feed is only one of the factors that give net profit, but it is one of the most important. Labor is also a very important factor, but cow-testing records do not furnish data regarding labor costs.

Income Above Feed Cost.

According to Table 1 fall freshening ranks first in income over cost of feed; winter, second; spring, third; and summer, fourth. There was not much difference, however, between fall and winter freshening in this important respect. For the four seasons the average income over cost of feed for the 64 associations was as follows: Fall freshening, $76.65; winter freshening, $75.66; spring freshening, $70.73; and summer freshening, $66.59.

In Table 7 the seasons are ranked with reference to the relation of date of freshening to income over cost of feed per cow.

TABLE 7.—Seasons ranked according to relation of date of freshening to income over cost of feed.

Season of freshening	Number of times ranked			
	First	Second	Third	Fourth
Spring	9	8	21	26
Summer	8	10	17	27
Fall	30	24	7	3
Winter	17	23	18	6

The table shows the number of times each of the four seasons ranked first, second, third and fourth on income over cost of feed. Fall ranked first 30 times and fourth only 3 times. Winter ranked first 17 times and fourth only 6 times. Spring ranked first 9 times and fourth 26 times, while summer ranked first 8 times and fourth 27 times.

Influence of Month of Freshening.

Table 8 shows the relation between month of freshening and milk production, butterfat production, gross income, and income over cost of feed of the same cows previously discussed under seasonal influences.

TABLE 8.—Month of freshening in relation to average annual production and income per cow.

Month of freshening	No. of cows	Milk production	Butterfat production	Gross income	Income over cost of feed
		Pounds	Pounds		
January	1,209	6,416	256	$137.64	$74.98
February	1,185	6,164	250	131.24	71.43
March	1,472	5,962	241	129.80	72.51
April	1,047	5,698	231	126.55	70.21
May	677	5,806	232	123.77	67.65
June	460	5,717	224	123.81	65.61
July	396	5,864	233	123.06	63.93
August	472	6,225	250	132.54	69.77
September	779	6,408	259	137.97	72.91
October	1,016	6,865	274	148.33	79.04
November	1,067	6,727	271	144.38	77.10
December	1,090	6,764	268	148.38	81.01
Total and averages	10,870	6,269	252	135.37	73.36

The cows that freshened in September, October, November, December and January averaged high in production of both milk and butterfat. For each of these five groups the average butterfat production was above 250 pounds, but for cows that freshened during other months the average butterfat production never went above 250 pounds. The cows that freshened in April, May, June and July were lowest in average production of butterfat and those that freshened in July had the lowest average income over cost of feed.

Considering butterfat production alone, October freshening ranks highest for the 64 associations, although November, December, September and January are not far behind. The regularity with which yearly butterfat production went down as the date of freshening approached midsummer is only a little less marked than the regularity and rapidity with which yearly butterfat production went up as the date of freshening advanced from June to October. It must be remembered that these figures are the averages for 64 associations and that they do not hold true for every one of the associations.

How the Months Ranked.

Table 9, which was made from the averages of the 64 associations, shows that the cows that freshened in the fall and winter months ranked high in production of milk and butterfat and in income over cost of feed.

TABLE 9.—Months when cows freshened ranked from 1 to 12 on yearly records of production, costs, and income.

Month	Milk production	Butterfat production	Value of product	Cost of roughage	Total feed cost	Income over cost of grain
January	4	5	5	7	5	6	4
February	7	6	7	12	7	7	7
March	8	8	8	8	10	10	6
April	12	11	9	6	12	11	8
May	10	10	11	11	11	12	10
June	11	12	10	8	9	9	11
July	9	9	12	10	8	8	12
August	6	6	6	5	6	5	9
September	5	4	4	4	4	4	5
October	1	1	2	1	1	1	2
November	3	2	3	3	2	3	3
December	2	3	1	2	3	2	1

On every topic in this table the three months October, November and December won the first three ranks, though not always in the same order. This indicates that, on the average, it generally pays to have cows freshen in the fall and early winter. Though they eat more grain, the greater production generally gives them an advantage all along the line.

Conclusions.

The study that has been made of the records from 64 cow-testing associations shows that fall or early winter freshening is desirable in most parts of the country. The influence of season of freshening is important, but the dairyman who has a steady market for milk at fair prices during all seasons of the year will usually find it to his advantage to keep the supply of dairy products fairly uniform from month to month.

Often the results due to date of freshening are different in different associations, even in the same agriculaural district. For that reason no set rule can be given as to what percentage of the cows should freshen each month in the year. That will vary to some extent in different localities and on different farms in the same locality. At the present time in market-milk districts there is generally a surplus of milk in the late spring and early summer. For that reason, if for no other, the dairy business should be so managed as to have more cows freshen in the fall. Such a practice would add to the profits of the producer, give the consumer a more constant supply of dairy products, and bring about a better distribution of farm labor throughout the year.

Summary.

1. The tabulation includes the yearly records of 10,870 cows in 64 cow-testing associations.

2. On an average the cows that freshened in the fall produced 6,689 pounds of milk, while those that freshened in the winter, summer, and spring produced 6,439, 5,941, and 5,842 pounds, respectively.

3. On an average the cows that freshened in the fall produced 268 pounds of butterfat, while those that freshened in the winter, spring, and summer produced 258, 236, and 236 pounds, respectively.

4. On an average the cows that freshened in the fall returned $76.65 in income over cost of feed, while those that freshened in the winter, spring, and summer returned $75.66, $70.73, and $66.59, respectively.

5. In the 64 cow-testing associations fall freshening ranked first 29 times in average milk production, winter freshening ranked first 18 times, summer freshening 10 times, and spring freshening 7 times.

6. In butterfat production fall freshening ranked first 38 times, winter 13 times, summer 8 times, and spring 7 times.

7. In income over cost of feed fall freshening ranked first 30 times, winter 17 times, spring 9 times, and summer 8 times.

8. In considering the months separately the cows that freshened in October ranked first in production of milk, those that freshened in December ranked second, and those that freshened in November ranked third.

9. In butterfat production October freshening ranked first, November second, December third, and September fourth.

10. In income over cost of feed December freshening ranked first, October second, November third, and January fourth.

SWEET CLOVER PASTURE

(Prof. W. J. Fraser, University of Illinois)

No fact in dairydom has been so widely demonstrated or is so widely accepted at the present time as that cows must be well fed to make a profit. Feeding trials have been conducted by several of the leading Experiment Stations which have definitely proved that production can be greatly increased by the use of proper feeding methods.

Not only is there the matter of feeding cows for high production but also the feeding them at as low a cost as possible to consider. The feed cost on one dairy farm may be easily twice as great as that on the adjoining farm simply because feeds are used which are uneconomical, either due to high cost or poor milk producing qualities.

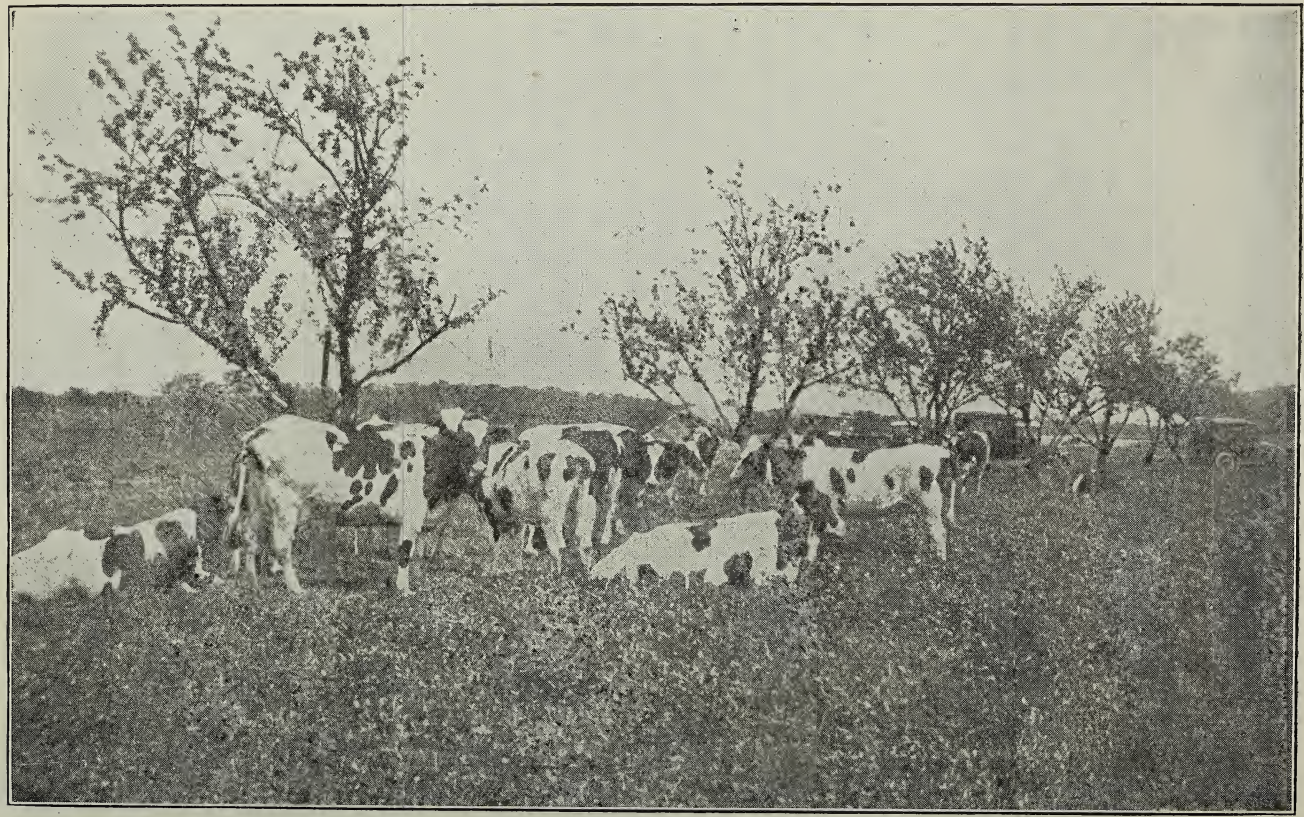
Good Pasture Best and Cheapest Feed

It is admitted that good pasture is the best and most suitable feed which can be fed a dairy cow. It gives her fresh air and exercise, thereby keeping her in fine physical tone, and in addition, supplies feed which can not be improved upon as a milk producer.

Here in Illinois the growing season is about six months, and so for one-half the year we have the opportunity of furnishing an abundance of cheap feed for our cows which they can gather themselves in the open under the most desirable conditions for economic milk production.

Cows Poorly Fed in Summer.

It is then surprising that these six summer months should be the time of year when cows are in general fed the poorest, but in reality this is true. Just at this time when there is the greatest opportunity for abundant and cheap feed production, when the factors of nature are so



Mr. Ed Rehling's dairy herd in Monroe County, Illinois, on sweet clover. The cows had been on this pasture two weeks and the clover was eight inches high when the picture was taken on May 10.

combined as to make possible the greatest growth, the dairy cows are coming in from pasture thinner and thinner as each day goes by, until by fall when barn feeding starts they are in such poor flesh that it requires two or three months of heavy feeding to get them back to anywhere near normal.

A dairy cow should never be allowed to become emaciated, and yet on half the dairy farms the cows are mere shadows of what they should be by the time fall comes and they are put into the barn for winter feeding.

There Must Be Feed in the Pasture.

The reason for this poor feeding in summer is that it is with a sense of relief that men turn cows on pasture during the busy cropping season of the year. They have thought that when cows were on pasture they were well fed and gave little time to the consideration of whether the cows' needs were really supplied.

Each year it is the same story. The inevitable drouth comes and bluegrass fails, leaving the cows without feed, and yet bluegrass still remains the chief pasture crop in the dairy districts. The farmer can easily see the difference between a 25 and 50 bushel yield of corn, but the failure of bluegrass he does not seem to realize or else he takes it for granted and does not try to remedy the situation.

Need a Real Pasture Crop.

What is needed in the cornbelt is a real pasture crop—one that will withstand the drouth so that it can produce an abundance of feed throughout the growing season. Bluegrass fails absolutely to "fill the bill' in this respect. It is not drouth-resistant and dries up after 6 or 8 weeks in the spring, producing little or nothing until fall when, under favorable conditions, it may furnish some pasture.

In the face of such failure on the part of our most common pasture crop, and the realization that good pasture is the cheapest feed he can produce, the dairyman naturally asks whether there is not some other crop which he may

A luxuriant growth of sweet clover pasture on Mr. S. D. Wilson's farm in Champaign County, Illinois. Picture was taken early in July.

grow that really will fill in the summer six months with good pasture for his cows. The answer is **"yes,"** and that crop is sweet clover.

I have been studying sweet clover for the last 12 years; have grown it on my farm, and have taken every opportunity to visit dairy farms where it has been used as a pasture crop, and make a study of it. Where they had a reasonably good stand, the results which I have seen have been in practically every case all that could be desired from a pasture crop.

It furnishes an abundance of feed from April, throughout the hot, dry months of summer, until November. The cows eat it readily after they are accustomed to it, and it is an excellent milk producer, besides keeping the stock in excellent physical tone.

In addition to being such an excellent feed for milk production, it is a great land and labor saver. Sweet clover requires, according to questionnaires answered by 81 dairymen, only about three-fourths of an acre of land to pasture a cow, while under most conditions at least over two acres of bluegrass are required. Due to its hardiness and ability to withstand the drought, it requires very little supplementing for cows of usual production, which fact eliminates the necessity of the use of a great many supplementary feeds with all the labor involved in growing, harvesting and feeding them.

Creates a Threefold Saving.

So we see that the use of sweet clover pasture results in a three-fold saving. It saves the cow's energy by permitting her to gather all the fine feed she can consume, in the natural way from pasture, with the minimum amount of grazing. It saves land by permitting the same amount of feed to be grown on one-third the area, and saves labor by eliminating the work of raising and feeding the supplementary crops, which is necessary if cows are to be kept up in milk flow, when other less productive pastures are used.

WILBER J. FRASER,
Prof. of Dairy Farming, University of Illinois.

J. P. MASON

In the Spring of 1868 I began my dairy work, working in one of the first cheese factories in the Fox River Valley, for the firm of Wanzer, Moran & Devine—Mr. Wanzer was a pioneer dairyman, Mr. Pat Moran was a Commission merchant at 199 South Water St., and Mr. M. A. Devine was one of the pioneer milk dealers of Chicago, and also owner of a large dairy farm adjoining the factory. Several years later he sold out to the Bowman Dairy Co. At that time he was running about sixteen wagons. Through progressive ideas, the Bowman Co. have enlarged until they run about 1,200 wagons. This factory run through the summer season from April 1st to November 15, closing through the winter; they manufactured full cream cheese, about 35 per day, weighing 55 to 60 lbs. each at the tip of the season. This was before the advent of the Holstein cow, silo alfalfa, balanced rations, Babcock test—just plain, native cows and some of them very good at that. I worked for this firm two seasons.

In the Spring of 1870, I went to Missouri and managed the first cheese factory in the State—for Perrine & Kellogg of Cameron, Clinton Co. They kept 300 cows of their own and bought some milk outside; they had a farm of 1,400 acres. I was young then, and they paid me a good salary. After I had worked for them about two months, one of the firm came to me and said to me, "We are going to increase your salary 33 1-3 per cent." I worked for this firm four years. We found ready market for our cheese in St. Joe, Kansas City, Mo., and Leavenworth; they kept from 20 to 40 men improving the place. They had great difficulty in securing a good farm foreman—they would quit and change quite often—then the firm would come to me. It was my work to run the factory, I did not milk or have anything to do with the outside work, but I always went where duty called, for the success of the business was my work, and many and many a time I would go out in the boiling hot sun to help harvest and thresh, and lead the van. I did not say,

as they would now, "that is not my work," and decline to do it, but always lent the willing hand and did my best. I call to mind one time when we were threshing—we had 500 acres of wheat—the men struck, said they would not milk the cows. One of the firm happened to be there and he said to let the cows go. I said, "not on your life do we let the cows go." I got together enough of the standbys—my foreman in the factory and myself took one barn of 103 cows—he milked fifty and I milked fifty-three—and the next milking I milked 40, or 93 cows in the 24 hours. This was in the fall of the year and not so heavy milking as in the Spring when they were fresh. Having worked for this firm for four years, I decided I could not afford to give my service to someone else, that I had better work for myself, and I have never regretted it.

I came back to Illinois after spending nearly seven years in Missouri, and bought a small place of 98 acres and started in the dairy business. I grew corn largely, and then run a winter dairy and feed it out, and made as high as twenty-five 8-gallon cans of milk per day on my small farm; I bought more land, and kept more cows, and have been one of the heaviest milk producers in the Fox River Valley. I drew Borden around $100,000 worth of milk and drew it five miles, but have been shipping to the Chicago market for around twenty-five years off and on; we contracted for six month periods—the largest contract I ever had was for six winter months with Ruchie & Haller Co. of Chicago, to deliver them fifty 8-gallon cans of milk daily from my 285-acre farm; the highest single day's shipment was 55 cans.

I joined the Elgin Board of Trade in 1877, an organization organized by the farmers wihch was in existence about 53 years—they were instrumental in naming the price on butter for years for the Middle West, and created a name and fame for the Elgin Dairy District that was world wide. At the peak of their success they sold around fifty million pounds of butter annually; the last few years of its existence I was a director and treasurer of the Board. The creameries gradually lessened as the Chicago Milk market in-


Judging Class 1924 Illinois State Dairymens Association
Danville, Illinois Jan. 8, 1924
CAMPBELL'S PHOTO

creased, and it takes approximately 40,000 8-gallon cans of milk and cream for its daily supply.

I was also president for several years of the Chicago Milk shipping union, prior to the Tri-State Milk Producers Association, which was organized fifteen years ago in the Sherman House. I was elected its first President, and at their high point had 16,000 members from southern Wisconsin, northern Illinois, and Indiana, and this concern did good service in maintaining a uniform price, and the officers and directors should be commended for the loyal services they are rendering now.

I also helped organize the Kane County Farm Bureau and was its first president—the third county to organize in the State.

I was president of the Board of Education in the Non-High School Districts of Kane County for four years. Have been director of the State Farmers' Institute, representing the Eleventh Congressional District for twenty-two years, and served two terms as President and five terms as Treasurer.

Have also served seventeen years on Advisory Committee of Five on Soil Experiments and Improvements, at the Illinois University under Dr. C. G. Hopkins, having some thirty experimental fields in different counties in the State, which we visited now and then. This was very interesting and there is no man who has rendered the State a greater service than this man Hopkins, and his work will be appreliated more and more as the years roll by.

I served for fifteen years on the Advisory Committee on Dairy at the University, and it was at my suggestion that they show us how much milk and money was produced per acre, which led up to the twenty-acre demonstration. Also acted on the Advisory Committee to the first Directors of Agriculture of Illinois. Served for years on eight different Boards of Directors in different lines of activities; was at the Third Annual Meeting of the Illinois Dairymen's Association held in Elgin—Dr. Joseph Tefft was President. My topic on this program was, "Which is the most profitable to manufacture, butter or cheese, or both?"—this was forty-

seven years ago; all of the officers and speakers at that meeting have long ago passed to their reward, but me. D. E. Wood was the last one.

In the past century—or fifty-five years—I have seen the sloughs tiled out, the trees and stones and stumps removed, large barns and good buildings built, fine farms improved, fine dairy herds, and good roads made. Today we have in this Fox River Valley a Dairy District second to none. I have always had unlimited faith in agriculture and no branch of it offers greater opportunities than dairying, and the future looks brighter today than ever. While realizing that I am coming down to the "evening of life," and retiring from this association, it cannot but bring a tinge of sadness after the years of mingling with the members and officers, and directors that have always been loyal and true.

MINERALS FOR DAIRY COWS

E. B. Hart and F. B. Morrison,
Wisconsin College of Agriculture

No question is probably discussed more frequently by farmers at the present time than the mineral requirements of livestock and especially of dairy cows. This whole general question is discussed in detail in Wisconsin Bulletin 350, **Minerals for Livestock.** For convenience and ready reference this statement concerning the mineral needs by dairy cows has been prepared.

Always Supply Plenty of Common Salt.

Dairy cows must have plenty of salt in order to thrive. Allow them to have free access to salt, or feed it to them regularly in their feed. Many dairymen mix 0.5 to 1 lb. of salt with each 100 lbs. of concentrate mixture or grain mixture, and then supply salt in addition so the cows can take what they wish. (See Bulletin 350, Page 3).

Salt is cheap. Don't neglect supplying it.

Guard Against Goiter.

If trouble has been experienced from goiter or "big neck" in calves, this may be prevented in the future by giving potassium or sodium iodide to the cows throughout the gestation period. Where there is no trouble from goiter, this treatment is not needed. (For a full discussion and method of treatment see Bulletin 350, Pages 4 to 10).

Cows Need Plenty of Calcium (Lime) and Phosphorus.

Milk is very rich in both calcium (lime) and phosphorus. Therefore, dairy cows must receive liberal supplies of both these minerals to secure continued high production and to have thrifty offspring. In the usual dairy rations

there is more danger of a lack of calcium than there is of phosphorus. This is because the protein-rich feeds most common in Wisconsin are also rich in phosphorus. This includes wheat bran in particular and also wheat middlings, cottonseed meal, and linseed meal. Gluten feed, germ oil meal (corn germ meal), or brewer's grains and distillers' grains are not especially high in phosphorus.

When 20 per cent or more of the concentrate mixture or grain mixture consists of wheat bran, wheat middlings, linseed meal, or cottonseed meal, the cows will get plenty of phosphorus. If less of these high-phosphorus feeds are fed, it is best to supply additional phosphorus by adding bone meal, ground rock phosphate, or acid phosphate, as stated later.

Calcium is Important.

A large production of milk and thrifty calves are an impossibility if there is a lack of calcium in the ration. The best way of furnishing plenty of lime is to grow and feed an abundance of alfalfa, clover, or soybean hay whenever it is possible. All legume hays are rich in lime. Furthermore, well-cured, green-colored legume hay contains a vitamine which animals need to enable them to assimilate and use the calcium in their feed.

If poor roughage must be used, such as hay from the grasses (not legumes) corn stover grown on acid soil, or straw, add 3 to 4 lbs. of ground limestone, wood ashes, or dried marl to each 100 lbs. of the concentrate or grain mixture. Non-dolomitic (non-magnesian) limestone may be preferable to dolomitic limestone. This point has not been yet settled by actual experiments.

If there is not 20 per cent of high-phosphorus feeds in the concentrate mixture (wheat bran, wheat middlings, linseed meal, and cottonseed meal), it is best to use 3 to 4 lbs. of steamed bone meal, ground rock phosphate, or acid phosphate with each 100 lbs. of the concentrate mixture, instead of using the limestone, wood ashes, or marl. Bone meal and the phosphates supply both calcium and phosphorus, while limestone, wood ashes and marl furnish lime, but practically no phosphorus.

If plenty of alfalfa, clover, soybean or other legume

hay is fed, then there may possibly be no advantage in adding a calcium-rich mineral supplement to the ration. However, even with legume hay available for winter feeding, it can do no harm and may do considerable good to add one of these lime carriers to the ration.

Feed Calcium Supplements on Pasture.

Fresh, green crops contain an especially large amount of the vitamine needed to enable animals to assimilate calcium. Therefore, the best way of replenishing the calcium in the cow's body, which may have been seriously depleted by high milk production during the winter feeding period, is to feed a calcium supplement when she is on pasture. Therefore, it is especially important to mix one of the calcium-rich supplements with the concentrate mixture fed to cows on pasture. It is probably best to use more of the calcium-supplement than for winter feeding. As much as 8 to 10 lbs. of one of the calcium-supplements may be mixed with each 100 lbs. of the concentrate mixture. If this mixture should not be very palatable to the cows, the allowance of the mineral supplements may be reduced somewhat.

When the cows are not fed any concentrates during a part of the pasture season, the calcium-supplement may be mixed with salt and the cows allowed free access to it. A mixture of one-half salt by weight and one-half of limestone, wood ashes, marl, steamed bone meal, or ground rock phosphate may be used for this purpose. In recent experiments at the Wisconsin Experiment Station as much as ½ lb. to 1 lb. of steamed bone meal per head daily has been fed to dairy cows under pasture conditions with good results.

What About Commercial Mineral Mixtures?

It is entirely unnecessary to buy expensive commercial mineral mixtures. Just as good results can be secured by following the simple recommendations on these pages.

REPORT OF THE RESOLUTIONS COMMITTEE.

BE IT RESOLVED, By the Illinois State Dairymen's Association, at its 50th Annual Convention, that we express to the people of Danville, the Chamber of Commerce, financial and business interests, and especially H. C. Horneman and his organization, the Sugar Creek Creamery Company, our gratitude and most sincere appreciation of their untiring efforts which have been the most potent factors in making our 50th annual convention a success and our stay in Danville so pleasant that it will be remembered by all visitors for many years as the outstanding convention of the association, for we feel that the Illinois State Dairymen's Association has gained a new start and that a precedent has been established which will cause other cities where this convention is held in the future to put forth greater efforts.

Be It Further Resolved, That we express to those instrumental in obtaining attendance on the part of the students at the cattle judging contest, our appreciation of their efforts, for this we believe to be an important factor for the agricultural training of these young people and in this case the very large class taking part in this contest demonstrates that much effort has been put forth.

Be It Further Resolved, That this Association is in hearty accord with the movement of the Illinois Allied Dairy Interests in its campaign of placing official record dairy sires throughout this state, and that we contribute all possible assistance to this campaign making the resources of the association available to carry on this work in so far as is possible and reasonable, for we believe that this campaign will contribute much toward the success of Illinois as a dairy state.

Be It Further Resolved, That we express to the National Dairy Council our appreciation of the valuable work being done by that organization and for their co-operation in the success of this convention by the excellent program

which they have furnished. We wish to further endorse their lines of endeavor which are doing so much toward increasing the consumption of dairy products in this state.

Be It Further Resolved, That we thank the parents and children of this community for the interest shown in the poster contest and the assistance rendered by the children of Danville in the National Dairy Council program.

Be It Further Resolved, That this Association go on record as most sincerely appreciating the dairymen's dance given at the expense of a small group of commercial men who have ever been ready to show their interest and to render assistance to this organization. In this connection we desire to express to the ladies of Danville our unanimous appreciation of the part which they have played in making our visit most delightful.

Be It Further Resolved, That we express our thanks to the press of Danville and the middle west who by their hearty support have contributed much toward the success of this convention and the Illinois Allied Dairy Campaign.

(Signed) S. J. STANARD,
(Signed) H. A. RUEHE,
(Signed) C. M. FILSON,

Committee on Resolutions.

INCREASING THE PROFITS IN THE DAIRY BUSINESS BY DECREASING THE COST OF PRODUCTION.

(Chas. Foss, Freeport, Ill.)

There are two ways in which the farmer can market his crops which he grows on his farm. The one way is to sell his crop on the market for cash and the other way is to feed his crop to livestock or the dairy cow and sell the livestock or the dairy products on the market for cash.

To the man engaged in dairying, the cow is the market to which he sells his crops. The price that he will receive for the crops that he grows on his farm will depend on the price he receives for his dairy products, the ability of his cows to transform the feed he grows into milk and butter fat economically and the skill of the dairyman as a feeder and care taker. The first essential in a profitable dairy is good cows. Cows that have the capacity to consume large amounts of feed and the ability to convert the feed they consume into milk and butter fat economically. The second essential is to feed these cows the right kind of feed and give them the right kind of care necessary to produce large amounts of milk and butter fat. Unless good cows are fed a sufficient amount of the right kind of feed and are given the right kind of care they cannot produce economically.

Our highest producing cows would prove disappointing if given the feed and care that many herds now receive. On the other hand there are many herds that would produce more economically if they were fed and cared for in the right way.

Two Ways to Increase Profits.

There are two ways in which to increase the profits in the dairy business. One is to get an increased price for our dairy products and the other is to decrease the cost of production by weeding, breeding and feeding. While dairy-

men are entitled to a fair price for their dairy products they can not arbitrarily fix the price for the same and continue in business. The willingness and the ability of the consuming public to buy their products must always be taken into consideration. The fact of the matter is that they can not very often control the selling price of their product. Increasing the profits by decreasing the cost of production by weeding, feeding and breeding is under his control.

Cost of Producing 100 Pounds of Milk.

The Department of Dairy Husbandry of the University of Illinois has found from data secured from cost accounting records of dairies in the Chicago milk district representing approximately 1,000 cows that an average of 44 pounds of grain, 188 pounds of silage, 50 pounds of hay and 2.42 hours man labor were required in the average herd cost of producing 100 pounds of milk.

On this basis the cost of producing 100 pounds of milk at present day prices of hay, grain and labor is about $2.00. If this was the average cost of producing 100 pounds of milk charged by these cows, it is evident that about one-half of them must have charged more than this while a large number charged less. By weeding out the low producers in our herds and by feeding the good cows a more liberal balanced ration the average cost of producing 100 pounds of milk can be materially reduced and the profit thereby increased.

Two Essentials to Economic Milk Production.

There are two essentials to the economic milk production. The first is good cows—cows that will take the feed grown on our farms and convert it into milk and butterfat economically and at a profit. Unless a cow has this ability she has no place in a dairy. There is but one place an unprofitable cow has a legitimate right to go to and that is the butcher. The second essential is good care and feeding a liberal balanced ration. No cow, however well bred, can produce milk economically unless she receives good care

and is fed a balanced ration. Perhaps as many cows fail to make a profit because they are under fed and get poor care as do because of poor breeding. The use of purebred sires will not do us very much good unless we feed liberally. A large part of the feed consumed by a cow is required for a maintenance ration and whatever she consumes over this amount goes for milk production. The more feed a cow can consume and convert into milk the more economical producer she will be. Herein lies the difference in the ability of different cows to produce.

What Breed of Dairy Cows?

There are five breeds of dairy cows and they all have their strong points as well as their weak ones. If we weed out the low producers and keep only the best ones it will not make very much difference which breed of cows we have. The fact is there is no one best breed of dairy cows. However, in breeding up a herd of dairy cows it is very essential that we stick to one breed if we ever expect to get anywhere. The kind of market we have for our dairy products, the breed we like best as well as the breed that predominates in our community should be the factors which determine the selection of breed. In breeding up a herd it is very necessary that we have a sire at the head of the herd that is backed by high producing ancestors of both sire and dam. A record of production of each individual cow must be kept and in this way the low producing cows can be eliminated from the herd. The daughter of a good sire will exceed their dams in production so that in a few years' time the average production of the herd can be materially increased.

Records of Milk and Butterfat Production of Cows in the Orangeville Cow Test Association.

Group	Milk	Production Fat	Cost of feed	Ret. above feed cost
1. 33 Cows	11,032 lbs.	349.80 lbs.	$111.10	$200.04
2. 57 Cows	8,932 lbs.	294.44 lbs.	96.79	156.16
3. 87 Cows	7,027 lbs.	236.56-lbs.	85.46	110.43
4. 92 Cows	5,074 lbs.	172.69 lbs.	66.06	70.64
5. 36 Cows	3,338 lbs.	114.52 lbs.	36.16	29.95

Cow test association records show very conclusively the great difference in the ability of cows to produce economically. The records of the Orangeville Association are no different from the general averages of any other association. The above data was compiled from the records of the association for the year beginning with June, 1918, and ending with May, 1919. There were more than 500 cows in the association at the beginning of the year. Of this number 305 cows remained in the association. Most of the remaining cows were sold during the year and were replaced by other cows, none of which had completed a year's record. Of the 305 cows that completed a year's record there were 33 cows that averaged 11,032 pounds of milk and 349.8 pounds fat. This group consumed an average of $111.10 dollars' worth of feed and returned $200.04 above the cost of feed. There were 57 cows in Group 2, which averaged 8,932 pounds of milk and 294.44 pounds fat. Cost of feed averaged ninety-six dollars and seventy-nine cents and the net profits were $156.16. Group 3 contained 87 cows, which averaged 7,027 pounds of milk and 236.56 pounds of fat at a cost of $85.46 for feed and returned a profit of $110.43. Group 4 contained 92 cows which averaged 5,074 pounds of milk and 172.69 pounds of fat at a feed cost of $66.06 and returned an average of $70.64 profit. Group 5 contained 36 cows which produced an average of 3,338 pounds of milk and 114.51 pounds of fat at a feed cost of $63.16 and an average of $29.95 profit.

The cows in Group one returned $1.81 above the feed cost for every dollar's worth of feed consumed, those in group two returned $1.61, group three $1.28, group four $1.07 and group five $.47. The cows that consumed the most feed returned the most milk and butter fat and also the largest returns above feed cost for every dollar's worth of feed consumed. One cow in group one is equal to nearly seven cows in group five and ten cows in group one is equal to about sixty-seven cows in group five. A cow that is an economical producer must have the ability to consume a large amount of feed. This qualification the cow inherits

from her ancestors. It can not be developed by feeding or care if it is not inherited.

Value of a Good Purebred Sire.

In grading up a good herd of dairy cows the sire is the most important factor. All the improvement that can be made must come from the sire. He must be backed by high producing ancestors and must possess the ability to transmit this qualification to his offspring. The importance of this fact is too often overlooked. It is often the case that a man thinks he cannot afford to pay the difference between the cost of a good purebred sire and a grade with the result that in many cases grade sires are used instead of purebred sires. What is a good sire worth? What can we afford to pay for one whose offspring will be the equal of the cows in group one even if he is only used in a small herd? Let us suppose that a man has a herd of ten cows and that he will use the same sire for two years. Assuming that his cows will all be fresh each year and that one-half of his calves will be heifers he will have ten heifer calves as the offspring of one sire. If these daughters are the equal of the cows in group one they will return $2,000.00 above feed cost in one year and in five years they will return $10,000.00. Using the same line of reasoning for the cows in group five we will have $300.00 above feed cost for ten cows in one year and $1,500.00 for five years. There is a difference in the returns above feed cost of $8,500.00 between the daughters of these two types of sires during the lifetime of the daughter.

The writer has been grading up his herd for eighteen years. Beginning with a herd that averaged 5,054 pounds of milk and 190 pounds of butter fat in eight years' time this average production was increased to over 9,000 pounds of milk and 320 pounds of butter fat. This increase, however, was not made alone by breeding but by better feeding and care as well. For eighteen years a purebred sire has been used in the herd and a record of the milk and butterfat production of each cow has been kept and the lowest producers in the herd were sold as fast as better cows were

raised. The influence of a good sire in increasing the production of the daughters over that of the dam in my herd is shown in the following table. All the records are for twelve months, during which time the cows usually were dry from six to eight weeks.

	Milk	Fat
Daughter	11,199	397
Dam	8,199	264
Increase	3,000	133
Daughter	10,010	419
Dam	6,141	325
Increase	3,869	84
Daughter	9,489	328
Dam	8,811	319
Increase	678	9
Daughter	11,289	380
Dam	7,614	246
Increase	3,675	134
Daughter	9,603	335
Increase	1,989	89
Daughter	11,582	402
Dam	10,578	336
Increase	1,004	46
Daughter	9,638	363
Dam	8,811	319
Increase	827	44
Daughter	8,912	361
Dam	5,970	270
Increase	2,942	89

The breeding of a sire, whether he is used in a grade herd or in a herd of purebreds must be better than the breeding of the cows in the herd in which he is used if we expect to make any headway in breeding. When we consider that the sire is one-half of the herd, so far as breeding is concerned, the best sires are always the cheapest.

Nearly one-half of the feed a cow consumes is required for maintenance and whatever she consumes over this requirement she converts into milk and butter fat. If she is

only fed what is required for maintenance she cannot give any milk.

Not only must she be fed a liberal ration but the protein, carbohydrates and fat must be in the right proportion. It is just as essential for a cow to get in her feed the right proportion of protein, carbohydrates and fat in order that she can produce milk economically as it is for a mason to use the right proportion of sand, gravel and cement to make concrete. Balancing a ration for the dairy cow is not difficult. Protein is usually the limiting factor in the ration as ordinarily fed to the dairy cow. Most of the crops that we grow on the farm are high in carbohydrates and low in protein. Legumes, such as clover and alfalfa are high in protein and should be regularly grown in our rotation of crops, especially is this true of alfalfa as it is much higher in protein than clover. Home grown feeds should be supplemented with high protein feeds such as linseed meal or cottonseed meal.

A few general rules which serve as guides for successful feeding.

1. Feed the grain mixture in proportion to the milk yield. The general rule is to feed one pound of grain per day for every three or four pounds of milk produced, according to the quality of milk. Cows that produce high testing milk should be fed one pound of grain for every three pounds of milk produced, while those that produce low testing milk need only one pound for every four pounds of milk produced.

Feed all the roughage the cow will clean up, as it is the cheapest source from which we get digestible nutrients. Part of the roughage should be succulent in nature. If silage is not available roots can be fed. Silage and alfalfa hay make an excellent combination as they furnish both carbohydrates and protein. Feed from 2½ to 3½ pounds of silage for each 100 pounds live weight of the cow. In addition to silage feed 5 to 8 pounds of hay for each 100 pounds live weight of the cow. When no silage is fed feed 1.6 to 2 pounds of hay for each 100 pounds live weight of the cow.

3. Whenever the cow shows signs of becoming fat, reduce the grain ration as it usually is the most expensive. If the cow becomes thin in flesh increase the grain. This usually is an indication that she is not getting enough nutrients in her feed to produce the milk that she is giving.

Hay and silage should be secured in the best possible condition. This is very important as hay and silage contain much more digestible nutrients when made at the right time. Nearly one-half of the total dry matter in the corn crop grows from the time it is in the milk stage until it is glazed. A period of two or three weeks. Clover hay contains the largest amount of nutrients when cut when in full bloom.

The best time to put corn into the silo is when it is about all glazed as it contains the maximum amount of digestible nutrients at this time. On some farms it is the practice to fill the silos when the corn is in the roasting ear stage. Silage put up when corn is at this stage is not nearly so valuable as it does not contain nearly the amount of digestible nutrients that it does when it is glazed.

CHAS. FOSS.

DAIRY BUTTER

(By Charles Foss, Freeport, Ill., R. 6.)

It is needless to say that poor dairy butter is a drug on the market. While on the other hand good dairy butter is always in demand and will always bring a good price. Unless one has the inclination and apparatus to make the very best dairy butter he had better not make any.

One of the first essentials to butter making is cleanliness. Clean food for cows, clean stable, clean cows, clean hands, clean apparatus and utensils. My cows are kept in "Bidwell Stalls" both day and night during the winter. Each cow's stall is carefully adjusted so that she cannot become soiled. Silage is never fed until after the milking is done, and the milk has been removed from the barn. If their udders become soiled they are washed. As soon as the milking is done the milk is taken from the barn to the creamery where it is immediately separated, the skim milk is fed to calves and pigs and the cream is immediately taken to the spring, where it is cooled down to about 48 degrees F. The cream is kept in cooling cans and while it is being cooled the cover is partly removed from the can to allow the animal odor to pass off.

The Dairy.

The dairy is 10 feet by 16 feet, built to the end of the barn, but has no opening into the barn, making it necessary in going from the barn to the dairy to first go outside of the barn before going to the dairy. The idea is to have the air in the dairy to be as nearly perfect as possible.

The dairy is double sided on the outside with two thicknesses of building paper between the siding and is sided and ceiled in inside with matched boards. The sides and ceiling are painted and are washed twice a year, the sides at the bottom are washed oftener.

The floor is made of concrete, sloping gently to one corner, where it has a tile drain to allow the water used in washing to immediately pass out.

The dairy is equipped with a No. 6 Sharples Tubular Separator, a Victor Combination Churn, a 1½ horse Perkins Air Cooling Gasoline Engine, a stove, a rack for cream cans, a pair of scales and a cupboard in the wall for butter jars and for the butter in the winter.

Care of Separator, Churn and Milk and Cream Cans.

The milk cans, pails, strainer and separator are thoroughly washed twice a day. The washing is done as follows: The cans and pails are first rinsed in cold water, removing as much of the milk as possible, then they are washed with warm soft water containing washing powder to cut the grease, then rinsed with cold water to remove all soapy water, and lastly they are rinsed with boiling water, then placed out of doors with the opening to the sun. Care must be taken to have every particle of milk removed before scalding. If any milk remains the scalding coagulates the albumen in the milk and causes it to adhere to the cans. In washing milk utensils never use a cloth, but always use a good stiff brush.

The churn is washed by first putting a pailful of hot soft water containing washing powder into it, and then closing the churn and revolving it for a few minutes. Remove this water and wash another time with boiling water but no washing powder. After draining the water out of the churn it is turned so that the opening will be at the side, the cover is removed and in this position it is left until the next churning. The cream cans are washed in the same way as the milk cans. Care must always be taken to keep churn and separator and cans in a sweet condition, in order to do this no milk or butter dare remain in them.

Each morning and evening after the washing has been done the floor of the creamery is scrubbed. This is very easily done if it is done immediately after the washing is done. In this way everything connected with the dairy is always kept in a neat and clean condition.

The Spring.

I have one of the largest and best springs in the county, the water running at the rate of more than a barrel a minute. The temperature of this water is 49 degrees F. in summer and 48 degrees F. in winter. This spring is walled up and a house was built over it. In this spring the cream is cooled and kept until it is ripened and the butter is kept in the summer from the time it is churned until it is delivered. I use no ice whatever.

The spring answers for cooling purposes much better than ice. The temperature of the water is always uniform, the air in the spring house is always pure. It is much cheaper than ice—doing away with a refrigerator and ice house.

Were it not for the spring a refrigerator and an ice house would be indispensable. Good dairy butter cannot be made unless you have the proper facilities to keep the cream at a low temperature.

Ripening of the Cream.

I churn twice a week—on Tuesday and Friday of each week. The cream is ripened on Monday and Thursday of each week. The cream from one churning to another is kept in the spring at a temperature of 49 degrees F. in summer and 48 degrees F. in winter. It is essential that the cream is kept at this temperature. If it is kept at a much lower temperature it may develop a bitter flavor and if kept at a much higher temperature it becomes stale.

The fresh cream must never be added to the older cream until it has been cooled to 49 degrees F.

Just before ripening the cream is all thoroughly mixed so it will be uniform. The cream thus mixed always tests less than .2 of one per cent. acid. After the cream is thus mixed a 10% starter is added to the cream which is then placed where it will warm up to about 65 degrees F. to 70 degrees F. It is held at this temperature for about 8 hours, after which it is allowed to cool off to about 62 degrees F. The entire time required for ripening is 24 hours. The

cream is ripened to about .6 of one per cent. acid. This is the method used in winter. In the summer less starter is used and a little higher temperature—70 degrees F. to 75 degrees F. It is held from about 6 to 8 hours at this temperature, after which it is placed in the spring and cooled to 50 degrees F. The time for ripening in summer is about 12 hours.

It matters very little whether the cream is ripened at 65 degrees F. or 75 degrees F., so long as it is not allowed to develop too much acid. My reason for using a higher temperature and less starter and less time to ripen the cream in summer is that cream must be churned at a much lower temperature in summer than in winter and ripened cream cools off very slowly. By having a little higher temperature, the cream has developed sufficient acidity that it can be placed in the spring in the evening and will be thoroughly cooled to 50 degrees F. by morning. During the time that the cream is ripening, it must be thoroughly stirred several times so that it will develop a uniform degree of acidity. If the ripening is not uniform, the churning will not be exhaustive. In the winter the churning temperature must be higher, and by not allowing the temperature to go so high, it can be kept from acquiring too much acid until the next morning and the temperature will then be about right for churning.

The Starter.

I use a home made starter made as follows: I take the milk from a cow that has not advanced too far in her period of lactation, set this milk at a temperature so that it will be coagulated in 24 hours. Before milking, the flank and udder are carefully brushed, the fore milk is rejected and the pail and strainer are scalded.

During the ripening process this milk should be stirred occasionally and should be loosely covered. This starter is propagated from day to day by adding enough of the starter to some fresh skim milk to coagulate it in 24 hours at a temperature of about 65 degrees F. On the days that the cream is ripened the balance of the starter is used for

ripening the cream, or so much as is required to develop the proper degree of acidity. On other days the starter not needed for propagation is thrown away.

Care must be taken in propagating the starter. A poor starter is worse than none at all. A starter that has developed gas bubbles in it should not be used.

Before using a starter always reject about an inch from the top of the starter. It is not so good. After rejecting an inch from the top of the starter it is thoroughly stirred before it is added to the cream.

The length of time that a starter can be propagated depends on how carefully you handle it, and how clean your milk and milk utensils are. I have also used a commercial starter but could see no difference in the result.

By carefully using a good starter a more uniform butter can be made and a better flavor can be developed.

The starter and acid test are indispensable for good butter making.

The Churning.

After the cream is properly ripened and cooled to the proper temperature it is taken to the creamery where it is churned. The temperature of the cream when placed in the churn is from 60 degrees F. to 62 degrees F. in winter and about 50 degrees F. in summer. The temperature of the butter milk after churning is about 58 degrees F. in winter and 55 degrees F. in summer. The time required for churning is from one-half to three-quarters of an hour.

The churning temperature depends on the season of the year, the kind of feed, the richness of the cream, the amount of acid in the cream and the stage of the lactation period.

Before the cream is churned, the churn is scalded with boiling water and then cooled with cold water, after which the cream is placed in the churn and churned until the butter granules are about the size of a kernel of wheat. The butter milk is then drawn off and the butter washed in two wash waters, using enough water at each washing to float the butter nicely. In washing the butter the churn is revolved several times before the water is drawn off.

Salting the Butter.

After the butter has been washed and the water drained off, salt is added at the rate of 1¼ ounces to the pound of butter, the churn is revolved several times and then the worker is started. The working usually requires about 3 minutes. This will depend, however, very much on the judgment of the buttermaker. After the butter has been worked for about 5 minutes the worker is stopped, the brine drawn off and some water thrown into the churn to rinse out the salt that may be in the churn. The salting and coloring must be made to suit the demands of the trade.

DAIRY ECONOMY AND SANITATION

(S. J. Stanard, Supt. Division of Dairy Extension Illinois Department of Agriculture.)

Selection.

There are two ways by which we may obtain our cows. One is by purchasing them and the other is by raising them. The latter is, of course, the more ideal method, but it is sometimes necessary to buy stock, and when this is done there are many things to be taken into consideration, such as:

Health.

Be sure the animal is "free from tuberculosis" before you make a purchase, or make it subject to the tuberculin test and have that test made before you add the newly purchased cow to your herd.

Tuberculosis is the most dreaded of all latent diseases found in the bovine animal. Often the fattest animal in the herd is the most generally infected and dangerous to the welfare of the herd.

Until a few years ago the percentage of bovine tuberculosis was gradually on the increase and since that time some slight reduction has been observed. However, due to the fact that ninety-five percent of tuberculosis in hogs is of bovine origin and that twelve and one-half percent of all the hogs slaughtered in centralized markets are infected it might be presumed that the apparent decrease is not an actual decrease.

Too often farmers have spent years in building up a splendid herd of dairy cattle only to find in the end that their herd is rotten with tuberculosis, which results in the loss of years of hard labor.

The old adage, "a stitch in time saves nine," is more truth than poetry when relative to tuberculosis in dairy cattle. Insist that the cattle you buy are tuberculin tested

and save yourself severe losses which you may be subjected to in the future.

Abortion.

Contagious abortion in a herd is very serious and often causes it to become necessary to dispose of the entire herd. It is caused by a germ that is often carried into the animal's body in feed or water. It may be brought into your herd by an animal which you have purchased, so you cannot be too careful about the history of animals which you place in your herd.

In case abortion appears, remove the cow from your herd, burn everything with which she has been in contact as far as possible. Disinfect the stable with a very strong disinfectant.

If the afterbirth has been retained, have a competent veterinarian remove it. It would then be well to flush the cow daily with a gallon of warm water which has five tablespoons of salt in it or which is one part lysol to fifty parts water. This should be used for some time after all signs of discharge have ceased.

Milk Fever.

Milk fever is very dangerous to the life of good producing cows. Cows are usually affected with this shortly after freshening and more often when they have not been properly dried off prior to freshening. A good preventive means would be to give the cow a complete rest of from four to six weeks prior to calving.

When an attack of Milk Fever comes the cow shows signs of paralysis, temperature rises and she usually lies with her head pointing toward her flank. Do not attempt to give the cow any medicine. In such cases it is best to call a competent veterinarian, but if this is impossible, get an air pump, have it thoroughly sterilized and with it fill the cow's udder, fastening the teats so as to keep the air from escaping immediately.

Garget.

The cow gives stringy milk which is caused by a bruise or by garget germs. Massage the udder with warm lard

which has a small amount of turpentine in it. Be sure to disinfect your hands so as to not take garget germs to other cows.

Bloat.

Bloat in cows is often caused by their eating spoiled feed or such feeds as green alfalfa or clover. Drench the animal with three or four tablespoons of soda in warm water and call a competent veterinarian. If a veterinarian is not available it may in extreme cases be necessary for you to tap the left flank with a knife or trocar. This should be done about half way between the hip and last rib, or at the most distended point.

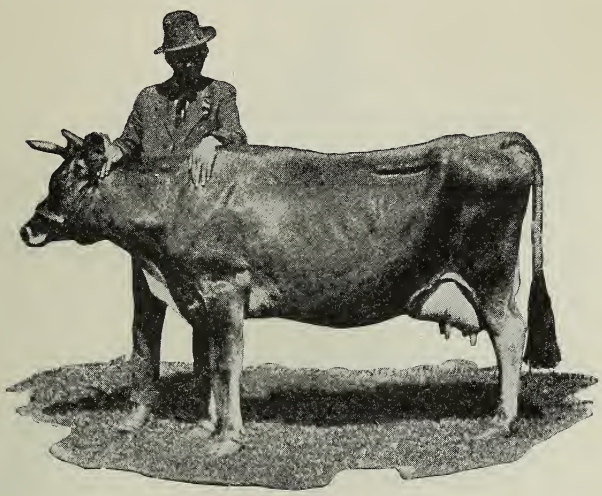
Production.

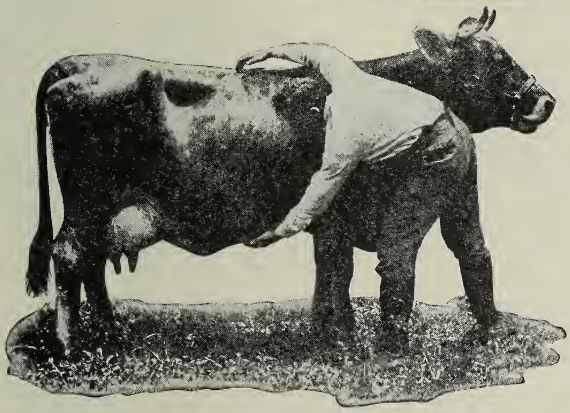
In purchasing a dairy animal, production power to produce over a long period of time and ability to transmit that power is, of course, some of the most important things to be taken into consideration. Official or semi-official records furnish us the most ideal means of determining the ability to produce, but when these are not available, it is sometimes necessary for us to be governed by the type and conformation of the animal.

Even when official records are available, type, conformation and temperament should always be taken into consideration, so let us note a few of the desirable points of a Dairy Cow.

Large flaring nostril and wide mouth. Large prominent eyes set well apart.

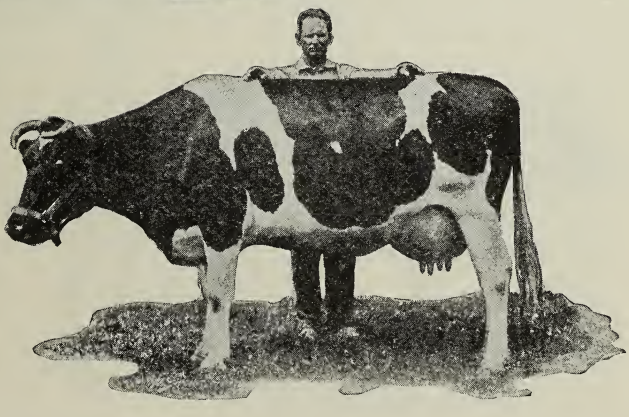
Long refined neck.





Good lung and heart space, deep abdomen. A cow cannot be a good producer unless she has capacity for feed.

Long straight back, long hips.

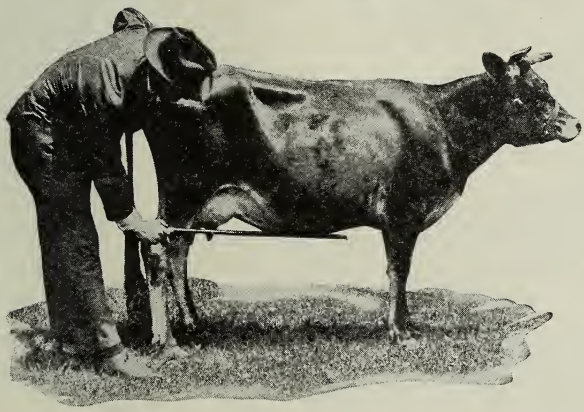


Good quality of hide indicating digestive power.

Well sprung ribs and wide hips.

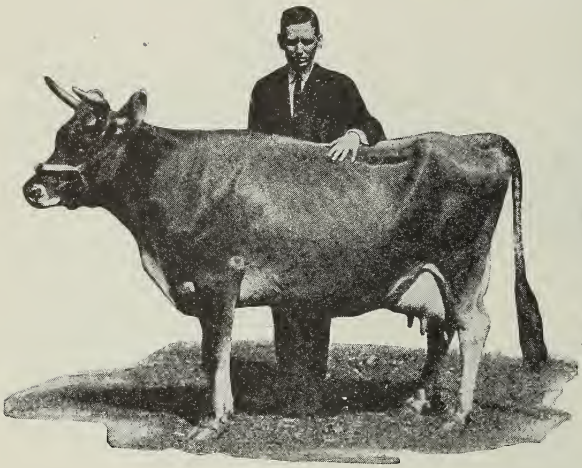
Udder should be attached well up in the back.

Well forward.

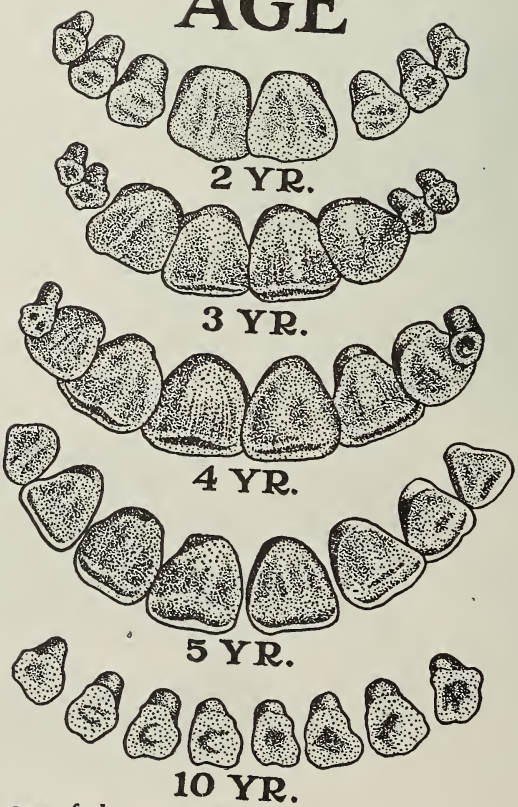


Udder should hang level. Teats should be good distance apart and of good size.

Milk veins should be large and crooked. Milk wells should be numerous and large.



No surplus flesh on sides. A cow cannot be a good producer of dairy products if she pads herself with flesh from the feed you give her instead of producing dairy products from that feed.



The age of the cow is an important item, but can be easily determined by the teeth.

Dairy Future is in Calf.

Good Blood.

In raising our calves let us first of all be sure that the calf has a right to live, because it has flowing through its veins the blood of producing ancestors. Do not fail to see that the herd sire is not only a good individual, but that he has "production records behind him" which will assure us that he will build up our herd.

Disinfect the Calves' Navel.

In order to give the calf a good chance, its mother must be dried off six to eight weeks before freshening. This gives her a chance to feed her unborn calf well. Calves out of cows which have not had a rest are usually small and

weak. Both the cow and her calf are handicapped in such cases. As soon as the calf is born, paint the navel cord with iodine or dip it in some other good disinfectant of proper strength. Many of the bowel troubles in young calves could be avoided by disinfecting the navel cord at birth.

Feed for the Calf.

Feed the calf on its mother's milk for at least the first three days, then feed two pounds of whole milk warmed to about the temperature of freshly drawn milk three times a day. After it is two weeks old you may start feeding slightly warmed skimmed milk and use a small amount of ground grain or calf meal, which should be placed in the bucket after the calf has finished the milk. This method will be necessary only until the calf learns to like the grain. Care should be taken to see that it does not get any foam.

All changes in feed should be made gradually, as sudden changes are likely to cause digestive disturbances. Be sure the calf has an opportunity to drink water, as milk does not take the place of water. Encourage it to eat good hay, but it is not best to feed ensilage until the calf is well started.

A good rule to go by in feeding calves is to feed one pound of milk each day to each eight pounds the calf weighs. Feed sweet milk, preferably three times a day, and see that the milk does not come in contact with any utensils which have not been properly sterilized.

Scours.

If you should have to contend with a case of scours cut down on the feed immediately and give a couple of tablespoons of castor oil. In extreme cases it may be necessary to repeat the dose in about twelve hours. When you increase the feed again do it gradually.

White Scours.

White scours differ from common scours in that the straining is more severe and the fecal matter discharged is white in color. There is no cure for white scours. Kill the affected animal and bury it in lime, then disinfect the place where the calf has been, remove and burn all straw, hay, etc. It is best, even after properly disinfecting where calf has been, to keep other calves away for a time.

Cramps.

Cramps in calves are similar to colic in babies except that cramps in calves are more likely to be fatal unless something is done immediately.

The calf shows signs of pain in the abdomen, often getting up and lying down repeatedly, sometimes lying stretched out on one side occasionally pointing its nose towards its abdomen. In such cases give one tablespoonful of turpentine with a tablespoonful of castor oil or in a pint of milk to keep it from burning the calf's throat.

Teaching the Calf to Lead.

There is a great deal of satisfaction in having a cow which will lead nicely and the best time to teach them is while they are quite young calves.

Don't Wean Too Young.

Do not wean the calf until it is at least five or six months old, as weaning before this age is likely to stunt the growth of the animal.

Keep your calves in clean, bright, well ventilated quarters, for these things are essential to good health.

Care of the Heifer.

Breeding too young is sure to stunt the animal so that you will never have the cow you should have. Breed to a

carefully selected bull of the same breed as the heifer and be sure that the bull comes from a family of high producers. It is recommended that the heifer be bred so as to freshen in the fall, as less trouble, is experienced with calves in cold weather if properly sheltered, and this will give the advantage of having the cow freshen on dry feed. However, individual conditions should govern each case in this regard.

Don't Breed Too Young.

The extent to which the heifer has developed should be taken into consideration, but as a rule do not breed until the heifer is at least as old as the following scale:

Jersey	16 months	Ayreshire	20 months
Guernsey	18 months	Holstein	22 months

Feed Concentrates.

Keep the heifer in good, thrifty condition so she will have less trouble in calving. If she is kept on dry feed it is advisable to feed some concentrates, such as a ration of two parts ground corn, one part bran or ground oats.

A small amount of such ration will be all that will be necessary to keep the heifer in good, thrifty condition, provided she is receiving a sufficient quantity of roughage, such as ensilage and clover or alfalfa hay. Plenty of good water is essential at all times.

Calving Rules.

When the heifer nears calving time, see that her bowels are working properly. If she shows any signs of constipation, it is best to give her a dose of raw linseed oil or other laxative of recognized worth.

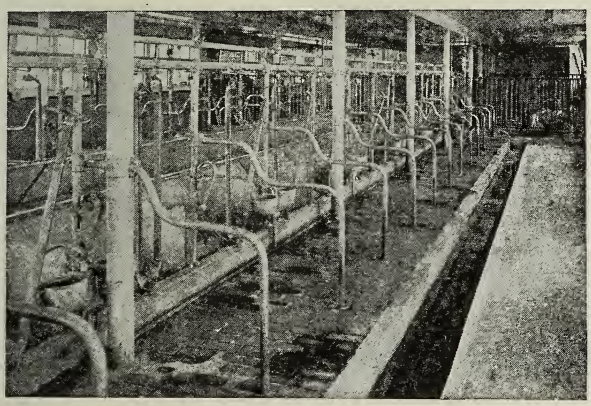
She should not be disturbed when calving unless it becomes apparent that assistance is necessary. It is very important that calving should take place if not on pasture in a clean, well-bedded box stall.

Bear in mind that after calving the vitality of the cow is low and luke warm water should be given her to drink for

three or four days, also a mildly laxative feed during this time, after which, if the cow is in good condition, feed can be gradually increased until the animal is on a full ration.

Housing.

We must keep our dairy cows clean, well fed, comfortable and in all ways contented, if we are to obtain good production from them. This can be done in an ordinary barn, if that barn is so fixed that it affords proper protection from the weather, allows plenty of sunlight to enter and



can be ventilated without having direct draft on the animals. It is also necessary that the barn be so situated that it can be kept clean. A concrete floor with gutter properly located behind cows is important.

It is not always possible for us to have as fine a structure for a dairy barn as we would like to have, especially at the start, but if we will give the Dairy Cow the opportunity which she deserves, she will in time furnish the money with which to build the fine barn.

Feeding Dairy Cows.

In determining the nutrients required by a dairy cow, there are several vital things to be taken into consideration, such as the size of the cow, the amount of milk and the quality of milk she is giving. We must know the size of

the animal so we can tell how much is needed for her maintenance. It is very obvious that a cow yielding a large quantity of milk will require more feed than a cow of the same size yielding a small quantity of milk. It is equally obvious that it will require more feed to produce milk with high butterfat content than it will to produce milk with a low butterfat content.

First, we must find how much protein, carbohydrates and fat are required for maintenance (see following table):

Table.

Food Required for Maintenance.

Weight of Cow	Protein	Carbohydrates	Fat
800	0.560	5:60	0.08
900	.630	6:30	.09
1000	.700	7:00	.10
1100	.770	7:70	.11
1200	.840	8:40	.12
1300	.910	9:10	.13
1400	.980	9:80	.14

Second, we must find how much fat, protein and carbohydrates are needed to produce the particular quality of milk that this individual animal is giving (see following table):

Table.

Nutrients Required for the Production of Milk with Given Butterfat Content.

Amount of Milk Lbs.	Percent of Fat	Protein	C. H.	Fat
1	3.0	.047	.20	.017
1	3.4	.049	.22	.018
1	3.8	.052	.23	.020
1	4.2	.055	.25	.021
1	4.6	.058	.27	.023
1	4.8	.059	.28	.024
1	5.2	.062	.29	.025
1	5.6	.064	.31	.026

Third, having multiplied the amount of protein, fat and carbohydrates required for one pound of milk by the number of pounds of milk which the cow is giving, we must add the amount of protein, fat and carbohydrates required by this individual for maintenance and the result is that we

have just what the cow needs and we can select the kind and quantity of feed needed from the three following tables, which give the digestible nutrients in feed. In selecting feeds to constitute a ration, be sure that you do not get a ration which is too constipating or too laxative. Be sure the cow has plenty of water at all times and has access to salt at all times.

Table.

Roughage. One pound contains the following digestible nutrients.

Kind of Feed	Protein	Carbohydrates	Fat
Corn Stover	.014	.31	.007
Timothy Hay	.028	.43	.014
Red Top Hay	.048	.47	.010
Prairie Hay	.03	.42	.014
Oat Hay	.047	.37	.017
Cow Pea Hay	.058	.39	.013
Red Clover Hay	.071	.38	.018
Alsike Clover Hay	.084	.42	.015
Alsike Clover Hay	.117	.41	.01
Wheat Straw	.008	.35	.004
Oat Straw	.013	.39	.008

Table.

Silage. One pound contains the following digestible nutrients.

Kind of Feed	Protein	Carbohydrates	Fat
Corn Silage	.012	.14	.007
Clover Silage	.020	.13	.01
Cow Pea	.015	.09	.009

Table.

Concentrates. One pound contains the following digestible nutrients.

Kind of Feed	Protein	Carbohydrates	Fat
Corn	.079	.67	.043
Barley	.084	.65	.016
Oats	.107	.50	.038
Wheat	.088	.67	.015
Wheat Bran	.119	.42	.025
Middlings	.17	.54	.041
Corn and Corn Meal	.044	.32	.069
Linseed Meal	.302	.32	.069
Cottonseed Meal	.376	.21	.096

A few suggestions on a proper method of feeding may be of assistance to you, for example:

Feed about 3 pounds of ensilage per day to each 100 pounds the cow weighs.

Feed one pound of clover or alfalfa hay per day to each 100 pounds the cow weighs.

Feed one pound of concentrate mixture to each three to four pounds of milk she is giving. However, it is best to take into consideration the quality of the ensilage fed when deciding the quantity of concentrates.

The following are two concentrate mixtures which will prove quite satisfactory if fed with proper roughage and according to above suggestions:

1. 4 parts ground corn, 2 parts ground oats and one part oil meal.
2. 4 parts ground corn, 2 parts bran and one part cottonseed meal.

By the use of a silo, you can increase production and lower the cost of your feed.

Kindness.

Intelligent, individual attention and care are fundamentals on which all dairymen must work if they are to obtain the best results. The dairy cow is naturally a nervous animal, responding very readily to the kind of treatment given her. Handle a cow in a kind manner and she quickly becomes quiet, gentle and confiding. Exciting or frightening a cow by rough handling, loud talking, chasing by thoughtless persons or dogs, often results not only in cutting down her flow of milk but ruins her disposition perhaps permanently.

Regularity.

Regularity is one of the most important factors in obtaining high production and in keeping up production. Have a regular milking time and a regular feeding time. It does not matter which cow you milk and feed first, but feed and milk the same one first each time.

When milking twice a day, have your milking periods as near twelve hours apart as possible.

Drying Off the Cow.

The two ways of drying off a cow are to reduce feed and milk less frequently and more irregularly. This should

always be done gradually, if you would avoid injuring the animal.

Care Before Freshening.

A cow should have six weeks rest before freshening. This six weeks not only gives her a rest, but also gives an opportunity to get her in perfect condition for calving. Before freshening, she should be kept particularly quiet and well fed on a slightly laxative diet so as to insure her being in a strong, healthy condition at calving. Just before calving, if there is a tendency toward constipation, give her a dose of raw linseed oil or some other laxative.

Use a Pure Bred Dairy Bull.

In selecting a bull, be sure he is the same breed as your cows and comes from a high producing family as the bull furnishes the best opportunity for herd improvement.

If the heifers are not better than their dams, their sire is a failure.

The bull should be given plenty of exercise but never be allowed to run with the herd as he is likely to sap his strength and vitality and it makes the keeping of records on the herd much more difficult.

The feed for the bull should be much the same as for a cow giving milk except that it is not wise to give him very much silage and it is not necessary for him to have quite as much protein in his ration as a cow who is being fed for high production.

Scales and the Babcock Test.

Dairying has become a business and to run our dairy on a business basis we must keep production records on our cows. A pair of scales hanging in a convenient place will enable us to weigh each cow's milk each milking time without much extra work.

At least once each month we should test the milk from each cow with a Babcock tester to determine just how much butter fat we are receiving per cow.

If possible join a cow test association, but if you do not have one in your locality, buy a small Babcock tester and do the testing yourself.

When you find a cow is not producing as you think she should do not condemn her until you have found the cause for her low production and given her the opportunity to produce which she deserves.

Skimmed Milk.

Skimmed milk is one of the most valuable by-products of the farm. It may be profitably used in many ways, such as cooking, feeding young chicks, laying hens, calves, pigs, etc.

Garlic and Onion Flavor.

It is a well known fact that when cows eat wild onion or garlic their milk and cream has a disagreeable flavor and odor, which is not only unpleasant but lowers its commercial value.

It is best to keep dairy cows out of pastures where onions and garlic are likely to be found during the onion and garlic season, but if this is impossible keep the cows away from onions and garlic for at least four hours before milking and you will find the bad flavor greatly reduced.

Dairy Sanitation.

The question of sanitation in our dairies and our methods of handling dairy products, are of vital importance. The consuming public demands and is justified in demanding, that its dairy products be healthy and wholesome articles of food.

Believing that the milk and cream producers of this State desire to produce the best products possible, we wish to make a few suggestions which may be of assistance to them in producing an article of better quality.

1. Keep Your Cows as Clean as Possible.

This is best done by keeping them in clean quarters and by using a good quantity of bedding. Few people realize the importance and economy of using a large quantity of bedding for dairy cows. Brush your cows well before milking.

2. Wash, Scald and Dry Utensils.

Thoroughly wash, scald and dry all untensils immediately after using them. It is always wise to keep all utensils dry when not in use, as this method very much hinders the development of bacteria. Special attention should be given the cream separator as it is very essential that this machine should be washed and thoroughly scalded each time it is used.

3. Use a Small Top Milk Pail.

Bu the use of a small top milk pail you will be able to keep out much of the dirt ordinarily contracted in the barn.

4. Milk With Dry Hands.

Milking with wet hands is insanitary and often results in causing the cows' teats to become chapped and unclean.

5. Care for Milk Immediately After Milking.

Remove the milk from the barn immediately after milking, and if it is to be sold as whole milk cool it as quickly as possible, for by so doing you will very much hinder the development of bacteria in the milk.

6. Cool Fresh Cream.

If the milk is to be separated, separate it at once. Always be sure to cool fresh cream before adding it to other older cream. It is best to have your separator set so that it will separate cream that will test from thirty-five to forty-five percent fat.

7. Keep Milk and Cream in a Clean Place.

Keep your milk and cream in as clean a place as possible and away from odors of all kinds. This will necessitate your keeping it away from the barn and from cellars where vegetables are stored, or any place where it might become contaminated. Always keep your cans of milk and cream covered with at least two thicknesses of sterilized cheese cloth.

8. Stir Cream.

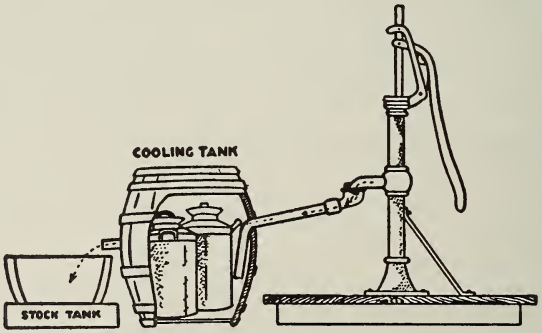
Cream should be well stirred at least twice each day. This greatly helps to keep it smooth and in good condition.

9. Delivery of Milk and Cream.

If you are selling whole milk you will of course have to deliver it each day. If you are selling cream, you should deliver it at least twice a week in winter and at least three or four times a week in summer, also be careful to keep it out of the hot sun while it is being transported to market.

10. Tank Cooling System.

On all farms where dairy products are produced and where ice is not obtainable a cooling tank between the



pump and the stock tank will prove to be a very satisfactory means of keeping milk and cream at a proper temperature. In this tank you can place cans of milk or cream, allowing

the water to come up to within a few inches of the top of the can, having your drain into the stock tank set at such a point as to allow the water to drain off when it reaches the proper height on the can. Cross bars can be placed across this tank over the top of the cans so as to prevent their rising. This cooling tank should be covered so as to prevent the rays of the sun from striking it.

If these simple suggestions are used, we feel sure that the dairy products produced in this State will be much improved in the future.

MINERAL NEEDS OF DAIRY COWS

(F. B. Morrison, Professor of Animal Husbandry and Assistant Director of Agricultural Experiment Station, University of Wisconsin).

At the present time, the importance of mineral matter for live stock is receiving much popular attention, due chiefly to striking results which have been secured in recent experiments by nutrition experts. As a consequence, many proprietary mineral mixtures are now being widely advertised, often with extravagant claims. It is therefore essential that stockmen understand clearly just how much is known concerning the mineral requirements of live stock. They can then supply any needed mineral supplements for their stock at low expense, without spending unnecessarily large sums on expensive preparations.

Importance of Mineral Matter.

That the mineral matter is of the greatest importance to animals is shown by feeding rations freed as far as possible from it, in which case they die of mineral starvation. Indeed, animals thus fed generally perish sooner than when no food is given. During such starvation the nervous system first suffers in a perceptible manner; marked weakness of the limbs, trembling of the muscles, convulsions, and great excitability result.

Mineral matter is found in all the vital parts of the body. The nuclei, or life centers, of all cells are rich in phosphorus, and the skeleton is composed largely of calcium (lime) combined with phosphorus. Blood deprived of its calcium does not clot. The blood serum is rich in common salt and other salts of sodium, while the red blood corpuscles are rich in potassium compounds. The power of the blood to carry oxygen is due to hemoglobin, an iron-protein compound in the red corpuscles. In the stomach

the pepsin acts only in the presence of an acid, normally hydrochloric, derived from the salts of this acid present in the blood.

Mineral Compounds Control Life Processes.

In some mysterious manner, possibly by carrying electric charges which stimulate the body cells, the mineral compounds of the body direct its various vital processes. A simple experiment often performed in the laboratory will illustrate the important functions of the mineral elements in life. If the heart, still beating, is removed from a frog and placed in a solution of pure sodium chlorid (common salt), its beats soon fade out.

Now if a small amount of a calcium salt (lime) be added to the solution, the heart will at once begin to beat again, and will continue in rhythmical contraction for some time. Unless a small amount of a potassium salt is also added, the beat will not, however, be normal, but the heart will fail to relax quickly and completely enough after each contraction. Therefore, if potassium is not added the relaxations become more and more feeble, until the heart stops in a contracted state.

Not only must potassium be present, but there must be a correct proportion between the amounts of calcium and potassium. If too much potassium is added, the heart will fail to contract properly, and finally will again stop beating, but this time in a state of complete relaxation.

Similarly, the other vital processes are dependent not only on the presence of various mineral salts, but also on a proper relationship between them. Therefore it will be seen that unless the amount of these mineral salts in the blood is kept normal, serious consequences will follow. In large measure the kidneys protect the animal against an unbalanced mineral matter content in the blood by promptly excreting any excess of various salts which may be present.

However, when the food continually furnishes the blood an unbalanced salt mixture, the kidneys may be unable to keep the blood composition normal, with result-

ant injury to the animal. For instance, magnesium and calcium seem antagonistic in their action, and in voiding the excess of magnesium the body loses calcium. Given in excessive amount for long periods, feeds which contain much magnesium in proportion to calcium, such as wheat bran and middlings, are said to cause a weakening of the bones, leading to such troubles as "bran disease" or "miller's horse rickets." This does not mean that bran or middlings are not among our most valuable and healthful feeds when properly fed in combination with other feeds.

Mineral Requirements for Maintenance.

The common feeding stuffs contain all the necessary mineral salts, at least in small amounts. As a rule, the roughages, except some of the straws, are much richer than the grains in mineral matter. Moreover, the body is probably able to use many of the mineral compounds over and over, taking them back again into the circulation after having been used. Therefore, for animals which have finished their growth, rations containing plenty of good-quality roughage will usually furnish sufficient mineral matter, except common salt. It is in general always advisable to supply farm animals common salt in addition to that in their feed.

Since over 90 per cent of the mineral matter of the skeleton consists of calcium (lime) and phosphorus, these mineral constituents may also fall short in some rations, especially in those for young, growing animals, which need an abundance for building their skeletons, and for dairy cows, which need an abundance of calcium and phosphorus for their milk. As is shown later, under certain conditions there may be a lack of iodine in the feed, which may cause serious results. The special requirements for these mineral constituents are discussed in the following paragraphs.

Calcium and Phosphorus.

When the supply of either calcium or phosphorus is too low in the feed, the skeleton acts as a reserve store-

house, doling out these minerals so that the life processes of the body may continue normally for a time. Under such conditions the calcium and phosphorus in the muscular tissues and other vital tissues of the body remain practically as high as in animals liberally supplied with these minerals. In a trial at the Wisconsin Experiment Station by Hart, McCollum, and Humphrey a cow fed a ration deficient in calcium during 110 days gave off 5.5 pounds more calcium in milk and excrement than was in the feed. This was about one-fourth of all the calcium in her body, including the skeleton, at the beginning of the trial.

Such withdrawal of mineral matter from the skeleton produces porosity and brittleness of bone. In certain localities where the hay and other roughages are especially low in calcium and phosphorus, farm animals are so affected by the lack of these mineral substances that their bones are broken easily and in seemingly inexplicable ways. Often this brittleness of bone is noticeable only in years when the normal absorption of calcium and phosphorus by the roots of plants is hindered by drought. Of grown animals, those carrying their young are most apt to suffer from the lack of these substances, since considerable amounts are deposited in the fetus. Growing animals whose bones are rapidly increasing in size suffer from a lack of calcium or phosphorus sooner than grown animals.

Fortunately, roughage from the legumes, such as clover and alfalfa hay, is especially rich in calcium and is also quite high in phosphorus. Previously the high value of these roughages in stock feeding has been attributed primarily to their richness in protein. Experiments carried on continuously since 1908 at the Wisconsin Experiment Station by Hart, Steenbock, and Humphrey have shown clearly that the beneficial effects of leguminous roughages are also due to their richness in lime. Dry cows fed oat or wheat straw, with grain and grain by-products added to make a ration balanced according to the feeding standards, have usually aborted or produced dead or weak offspring. When calcium has been added to the ration in such forms as calcium phosphate or wood ashes, the results have been great-

ly improved, but the calves have not been as vigorous as where alfalfa or clover hay has formed part of the roughage. Other roughages high in lime have likewise given satisfactory results, including corn stover and even timothy hay and marsh hay, which were higher in lime than is frequently the case, because they had been grown on alkaline soil. From these experiments they advise that rations for dry breeding cows contain at least 0.45 per cent of lime (calcium oxide), and preferably even a larger amount.

In similar experiments with swine it was found that when brood sows were restricted to a ration of grain and common salt, many of the pigs produced were dead at birth, even tho the sows drank water which contained considerable lime. When 15 to 25 percent of alfalfa hay was added to the ration, normal living litters were produced.

These trials show in a striking manner that in forming rations the calcium content of feeds should be considered. Forage from the legumes greatly excels all other farm-grown feeds in amount of calcium. Milk and the dairy by-products, skim milk and buttermilk, are also very rich in calcium. Tho containing much less than legume hay, the legume seeds in general, and also cottonseed meal and linseed meal, are richer than the cereal grains. Straw, root crops, molasses and the cereals and their by-products are low in calcium.

Most of the common feeds which are rich in protein are also high in phosphorus. Therefore, rations which contain sufficient protein to meet the feeding standards will usually contain plenty of phosphorus. The cereals and their protein-rich by-products are rich in phosphorus, as are also the various oil meals and cakes, the slaughter-house and fish wastes, and the leguminous roughages. On the other hand, straw, beet pulp, potatoes, and molasses are low in this mineral constituent.

Formerly it was believed that phosphorus in such organic compounds in feeds as the proteins and the phosphorus-bearing fatty substances had a higher nutritive value than phosphorus in such materials as ground bone and ground rock phosphate, which contain phosphorus in

the inorganic form of phosphate of calcium. Contrary to the earlier opinions, numerous experiments have shown that animals can assimilate and use these inorganic phosphates just as well as phosphorus in the organic compounds.

Mineral Supplements.

Whenever there is any danger that the feeds given farm animals contain too little calcium or phosphorus for health and maximum production, these mineral nutrients may be supplied at little expense. Calcium alone may be furnished in the form of precipitated calcium carbonate, finely ground limestone, wood ashes, or chalk. Both calcium and phosphorus are supplied by steamed bone meal, bone flour, bone black, precipitated bone, or even ground rock phosphate, tho the latter is probably less soluble in the digestive tract than the other forms. When animals are allowed to help themselves to the mineral supplement, it is best to use one of the phosphates, for they are usually more palatable than the carbonates, such as ground limestone, and also they may be eaten in much greater quantity without causing any disturbance in digestion. In supplying a mineral supplement, it is a good plan to mix the supplement with the concentrates. The use of expensive proprietary mineral mixtures is unnecessary and generally uneconomical.

Common Salt.

In spite of the well-known hunger of herbivorous animals for salt, practical men have differed as to the necessity or advantage of adding it to the ration. It is now agreed, however, that salt should be supplied regularly to farm animals. It not only serves as a spice to whet appetite and add to the palatability of many feeds, but it also stimulates the digestive glands and prevents digestive disturbances.

At least for cows in milk, a supply of salt in addition to that contained in the feed is absolutely necessary for health. This was shown in experiments by Babcock and Carlyle at at Wisconsin Experiment Station in which dairy cows, well

fed otherwise, were given no salt for periods as long as a year. After 2 to 3 weeks, they showed abnormal appetites for salt, but their health was not usually affected for a much longer time. Finally, a complete breakdown occurred, marked by loss of appetite, lusterless eyes, rough coat, and a very rapid decline in both live weight and yield of milk. If salt was supplied recovery was rapid. In one case potassium chlorid was given instead of common salt (sodium chlorid). Recovery followed as quickly as when common salt was supplied, showing that not the lack of sodium but the lack of chlorin was responsible for the troubles.

Cows in milk and sheep need the largest amounts of salt; fattening cattle, horses, dry cows, and stock cattle require less; and pigs but little. The salt requirement will vary considerably in different localities. Soils which contain large quantities of salt doubtless produce feeds containing more salt than those poor in this ingredient; and also the water of streams and wells varies in salt content.

Iodine.

Especially in certain sections of the northwestern states, during recent years heavy losses have been experienced of new-born pigs, lambs, kids, calves and foals, due to goitre or "hairlessness." The young so affected are born dead or weak, are frequently hairless, and commonly have enlarged necks. This is due to the thyroid gland in the neck being diseased and enlarged, just as in the case of humans suffering from goitre, brought about probably by a lack of iodine in the feed or a failure to absorb and use the traces of iodine usually present in the feed. Recent investigations have shown that this trouble with the offspring can be overcome by administering iodine in the form of potassium iodide to the pregnant dams.

Mineral Matter Required for Milk Production.

It was formerly assumed that when dairy cows were fed common well-balanced rations containing plenty of pro-

tein and a liberal amount of legume hay, there could be no deficiency in calcium (lime) or in phosphorus, for legume hay is rich in calcium, and protein-rich feeds are in general high in phosphorus. Surprising results have, however, been secured in extensive experiments at the Ohio Experiment Station by Forbes, in which high producing cows have been fed such excellent winter rations as alfalfa or clover hay, corn silage, and corn with such high-protein concentrates in addition as wheat bran, cottonseed meal, linseed meal, dried distillers' grains, or gluten feed.

On these rations the cows in most instances lost calcium, phosphorus, and also magnesium from their bodies, being able to assimilate and retain so small a portion of the liberal supply in their feed that it was insufficient to meet the requirements in producing the milk. Even when abundant amounts of calcium, or both calcium and phosphorus, were added to the ration in such forms as steamed bone, calcium carbonate, or calcium lactate (a soluble form of calcium), the losses of these mineral constituents from the body continued.

The cause of this condition is still a problem. Possibly the milk producing capacity of our dairy cows has been so increased by selective breeding that it exceeds the ability of high yielding cows to assimilate sufficient mineral nutrients from their feed to meet the heavy demand in producing the large flow of milk during the first part of the lactation period. Later on in lactation, or when they are dry, it was found that they are able to build up again the stores of these mineral constituents in their bodies.

In recent experiments at the Wisconsin Experiment Station, Hart and Steenbock have found that dairy cows and milk goats are able to assimilate calcium more completely from fresh green forage than from dried forage, such as hay. This is undoubtedly due to the fact that such green forage contains larger amounts of the anti-rachitic vitamine, which is necessary for the assimilation of calcium from the food.

These various trials emphasize the importance of pasture and other green forage for dairy cows during the grow-

ing season, and of an abundance of well-cured legume hay during the rest of the year. Also, the cows should be dry from 6 to 8 weeks before freshening, and during this time should be so fed that they will be in good condition at calving.

Summary of Mineral Needs of Dairy Cows.

For ready reference the following paragraphs may be found of convenience. These give in brief form simple directions with reference to the use of minerals in practical dairy rations.

Always Supply Plenty of Common Salt.

Dairy cows must have plenty of salt in order to thrive. Allow them to have free access to salt or feed it to them in their feed. Many dairymen mix 0.5 to 1 pound of salt with each 100 pounds of concentrated mixture or grain mixture, and then supply salt in addition so the cows can take what they wish.

Salt is cheap. Don't neglect supplying it.

Guard Against Goiter.

If trouble has been experienced from goiter or "big neck" in calves, this may be prevented in the future by giving potassium or sodium iodide to the cows throughout the gestation period. Where there is no trouble from goiter, this treatment is not needed.

The iodide can be conveniently given by the following method: Make up a solution of 1 ounce of potassium iodide or sodium iodide to one gallon of water. Sprinkle on the feed for each cow daily during pregnancy one tablespoonful of this solution. This amount will contain 2 grains of the drug, which is the desired daily dose.

Cows Need Plenty of Calcium (Lime) and Phosphorus.

Milk is very rich in both calcium (lime) and phosphorus. Therefore, dairy cows must receive liberal supplies of both these minerals to secure continued high production and to have a thrifty offspring. In the usual dairy

rations there is more danger of a lack of calcium than there is of phosphorus. This is because the protein-rich feeds most common in Wisconsin are also rich in phosphorus. This includes wheat bran in particular and also wheat middlings, cottonseed meal, and linseed meal. Gluten feed, germ oil meal (corn germ meal), or brewers' grains and distillers' grains are not especially high in phosphorus.

When 20 per cent or more of the concentrate mixture or grain mixture consists of wheat bran, wheat middlings, linseed meal or cottonseed meal, the cows will get plenty of phosphorus. If less of these high phosphorus feeds are fed, it is best to supply additional phosphorus by adding bone meal, ground rock phosphate, or acid phosphate, as stated later.

Calcium is Important.

A large production of milk and thrifty calves are an impossibility if there is a lack of calcium in the ration. The best way of furnishing plenty of lime is to grow and feed an abundance of alfalfa, clover, or soybean hay whenever it is possible. All legume hays are rich in lime. Furthermore, well-cured, green colored legume hay contains a vitamine which animals need to enable them to assimilate and use the calcium in their feed.

If poor roughage must be used, such as hay from the grasses (not legumes) corn stover grown on acid soil, or straw, add 3 to 4 pounds of ground lime stone, wood ashes, or dried marl to each 100 pounds of concentrate or grain mixture. Non-dolomitic (non-magnesian) limestone may be preferable to dolomitic limestone. This point has not been yet settled by actual experiments.

If there is not 20 per cent of high-phosphorus feeds in the concentrate mixture (wheat bran, wheat middlings, linseed meal, and cottonseed meal), it is best to use 3 to 4 pounds of steamed bone meal, ground rock phosphate, or acid phosphate with each 100 pounds of the concentrate mixture, instead of using the limestone, wood ashes, or meal. Bone meal and the phosphates supply both calcium and phosphorus, while limestone, wood ashes, and marl fur-

nish lime, but practically no phosphorus.

If plenty of alfalfa, clover, soybean or other legume hay is fed, then there may possibly be no advantage in adding a calcium-rich mineral supplement to the ration. However, even with legume hay available for winter feeding, it can do no harm and may do considerable good to add one of these lime carriers to the ration.

Feed Calcium Supplements on Pasture.

Fresh, green crops contain an especially large amount of the vitamine needed to enable animals to assimilate calcium. Therefore, the best way of replenishing the calcium in the cow's body, which may have been seriously depleted by high milk production during the winter feeding period, is to feed a calcium supplement when she is on pasture. Therefore, it is especially important to mix one of the calcium-rich supplements with the concentrate mixture fed to cows on pasture. It is probably best to use more of the calcium-supplement than for winter feeding. As much as 8 to 10 pounds of one of the calcium-supplements may be mixed with each 100 pounds of concentrate mixture. If this mixture should not be very palatable to the cows, the allowance of the mineral supplement may be reduced somewhat.

When the cows are not fed any concentrates during a part of the pasture season, the calcium-supplement may be mixed with salt and the cows allowed free access to it. A mixture of ½ salt by weight and ½ limestone, wood ashes, marl, steamed bone meal, or ground rock phosphate may be used for this purpose. In recent experiments at the Wisconsin Experiment Station as much as ½ pound to 1 pound to steamed bone meal per head daily has been fed to dairy cows under pasture conditions with good results.

What About Commercial Mineral Mixtures?

It is entirely unnecessary to buy expensive commercial mineral mixtures. Just as good results can be secured by following the simple recommendations on these pages.

ECONOMICAL RATIONS FOR DAIRY CALVES*

F. B. Morrison, Wisconsin Agricultural Experiment Station

Where there is an abundance of skim milk for calf feeding, the raising of vigorous dairy calves is relatively simple. Various experiments have shown clearly that as thrifty calves can be raised when changed to skim milk at but few weeks of age as those which are fed whole milk until weaning time. However, when a liberal supply of skim milk is not at hand, the problem is a more complicated one.

Over increasing areas of our country dairymen do not have an abundance of skim milk for feeding their calves. They may sell cream to the creamery, but may wish to use part of the skim milk for feeding swine or poultry. In several large districts dairymen now sell their milk to condensaries or ship it to city markets, thus having no skim milk whatsoever available. In cheese-producing districts plenty of whey is available for calf feeding, but such poor results have been secured by most farmers with this dairy by-product that probably the majority make no attempt to use it for this purpose.

Three Trials Conducted.

To secure information on the most economical rations for calves under various conditions, trials have been carried on during the past three years at the Wisconsin Experiment Station. Each year high grade Holstein and Guernsey heifer calves have been purchased and placed on experiment when two to three weeks of age. Up to this time they had received whole milk, as is the universal practice in feeding dairy calves. The calves were continued on experiment for 24 weeks, or until they were about 6 months of age. The trials thus cover the entire period during which skim milk or milk substitutes are ordinarily fed.

*The investigations here reported were carried on under the immediate direction of Professor R. S. Hulce and the general supervision of the author.

In each of the three trials two Holstein and two Guernsey calves were assigned to each lot. These two breeds were used so that the results would apply to both types of calves. Each calf was kept in a separate pen and an accurate record was kept of all the feed and water consumed by each animal. Live weights were taken weekly and on three consecutive days at the beginning and end of the experiment.

Skim Milk Fed Calves Make Excellent Gains.

Each year Lot I, the check lot, has been fed the sort of a ration used by dairymen who have plenty of skim milk. The calves were fed whole milk until 21 days of age at the rate of about 1 pound of whole milk daily to each 10 pounds of live weight. When a calf became 21 days of age, a week to 10 days was taken to substitute skim milk gradually for the whole milk. The allowance of skim milk was then gradually increased to a maximum of 14 pounds.

This lot was fed a concentrate mixture consisting of 3 parts by weight of ground oats, 4 of ground corn, 2 of wheat bran, and 1 of linseed meal. The calves were allowed to eat all of this mixture they wanted up to 5 pounds a head daily. They also had all the hay they would consume (clover hay in the first two trials, and mixed clover and timothy hay in the third trial). Care was taken to provide salt, and the calves were watered twice daily.

In each trial these calves fed a liberal allowance of skim milk made excellent gains, averaging 1.76 pounds a head daily.

Limiting the Skim Milk Allowance.

In two of the trials other groups were fed similarly except that the amount of skim milk was limited to 10 pounds a head daily, to represent conditions on farms where the supply of skim milk for calf feeding is limited. These

calves made very good gains, though somewhat less than Lot I, which was fed 14 pounds of skim milk a head daily. They gained 1.52 pounds a head daily in comparison with 1.72 pounds for Lot I in corresponding trials. Owing to the lesser amount of skim milk fed, the feed cost up to six months of age was $21.32, compared with $23.80 for Lot I. The calves receiving 14 pounds of skim milk daily were slightly more growthy, although there was no apparent difference in the vigor of the two lots, and the gains of the calves limited to 10 pounds of skim milk a day were actually a trifle larger than is considered normal.

These results show that good thrifty calves can be raised on an allowance of skim milk limited to 10 pounds daily, if a good concentrate mixture and good hay are fed in addition. When an abundance of skim milk is at hand it is best to feed the larger allowance given to Lot I. However, sometimes it may be advisable to limit the allowance of skim milk fed to calves in order to have more skim milk for young pigs or poultry.

A Ration for Market Milk and Condensary Districts.

Each year a third lot has been fed no skim milk, but has been raised on a minimum amount of whole milk, which did not exceed 400 pounds for each calf from birth, or about 375 pounds from the fourth day after birth, when the dam's milk was salable. This was supplemented by a simple concentrate mixture rich in protein, consisting of equal parts ground oats, ground corn, linseed meal, and wheat bran. After the calves were seven to nine weeks old, they were fed only this mixture with hay, water and salt, no expensive calf meal whatsoever being fed at any time. In two trials these calves have made an average daily gain of 1.43 pounds at a feed cost of $22.64 per head to six months of age. This lot gained slightly less than Lot II, fed 10 pounds of skim milk a head daily, but did remarkably well considering the small amount of milk fed. In fact, the gains would be considered normal for well-reared dairy calves.

These results show plainly that good thrifty calves can

be raised on market milk in condensary districts at a reasonable cost by following this simple method, and without the use of any expensive commercial mixtures. In raising calves by this method, if a calf is delicate and not making good gains, it will be necessary to continue the feeding of whole milk longer than otherwise. In these experiments, however, little difficulty has been experienced in getting the calves entirely off milk at seven weeks of age in the case of Holsteins and eight to nine weeks in the case of Guernseys.

Good Calves Raised on Whey.

In 1921 and 1922 two lots were fed whey supplemented by a concentrate mixture rich in protein, consisting of three parts of ground corn, three of standard middlings, and four of linseed meal. The whey was pasteurized skimmed whey and no attention was paid to variations in sourness after the calves were used to this feed. In making the change from whole milk to whey somewhat more care was necessary than in changing from whole milk to skim milk.

Lots thus fed whey gained on the average 1.49 pounds per head daily, or nearly as much as the calves fed 10 pounds of skimmed milk a day. This satisfactory gain was due in all probability to the fact that the whey was never allowed to stand in a filthy tank or can, but was fed with reasonable care and under sanitary conditions. Furthermore, a concentrate mixture rich in protein was used to make good the casein which had been removed from the milk in the cheese making process. The average feed cost of raising these whey-fed calves to six months of age was $21.58. These result show that thrifty calves can be raised on whey readily and cheaply when simple precautions are taken.

Yellow vs. White Corn for Calf Feeding.

Each of the first two years one lot of the whey-fed calves was fed yellow corn and another lot white corn in the concentrate mixture. This was done as it had been recently found by Dr. Steenbock of the Agricultural Chem-

istry Department that yellow corn was rich in fat-soluble vitamines, while white corn contained little or none. It had also been found in experiments with growing, fattening pigs carried on by the Animal Husbandry Department that this made white corn much inferior to yellow corn when fed with such supplements as skim milk or tankage to pigs not on pasture.

These calves fed white corn in these trials did fully as well each year as those fed yellow corn. This result, which was expected, was undoubtedly due to the fact that the hay the calves consumed supplied considerable of these fat-soluble vitamines. These results correspond to those secured in the trials with pigs. Though yellow corn has been superior to white corn when fed to pigs in dry lot with supplements like skim milk or tankage, which are not rich in these vitamines, white corn is just as good as yellow corn for pigs on pasture or for those receiving alfalfa or other legume hay.

Do Not Neglect Watering Calves.

The importance of supplying plenty of water to dairy calves even when fed a fairly liberal allowance of skim milk is not appreciated by many dairymen. To gain definite information on this matter, in two of the trials a lot was fed the same ration as Lot I, except that no water was given these calves. Both lots received a liberal allowance of skim milk, the good concentrate mixture mentioned previously, and common salt. Lot I received what water they would drink twice daily, while the other lot had no water except that occurring naturally in the skim milk and the trifle in the "dry" concentrates and hay. The calves not given additional water gained only 1.32 pounds a head daily, while Lot I watered twice daily gained 1.86 pounds during corresponding trials. The lack of water, therefore, causes a surprising difference in the gains of calves. No farmer who wishes to grow his calves rapidly and well can afford to neglect supplying them with plenty of water—the cheapest item in the ration.

WHY WE NEED BETTER DAIRY COWS

J. R. Dawson, Bureau of Dairying, U. S. D. A.

Success in dairy farming depends largely upon three factors—the man, the feed and the cow. As a dairyman, the man must have a keen interest in the business and must strive to keep himself informed as to the factors that will influence his profit. A dairyman may be likened to a factory manager and it is just as necessary that he watch the details of his factory or plant as it is for the manager of an automobile factory or coal mine or creamery. He must know the conditions under which he is operating and must have an accurate knowledge of his workers so that he can eliminate or discharge those that are not efficient. His is a big job and it is one that can not be mastered in a year or two.

As a grower and buyer of goods he must provide suitable rations which will furnish proper food nutrient for his cows at a low cost. While both of these points are important, it is probable that success will come only in proportion to the kind of cows a man keeps. I am not referring to the breed of cows but to the ability of those animals to produce. I have often been asked in my work as to which is the best breed of dairy cattle. That is a difficult question to answer from a general point of view, because one might just as well attempt to say which is the best automobile, tractor, binder or header. There are several breeds of dairy cattle that have been developed along particular lines for many years and they have been found entirely satisfactory from a breed standpoint. Some of these breeds in view of their characteristics are suited for particular purposes and conditions. They are all satisfactory if properly handled. In choosing a breed or a purebred bull to grade up a herd, one should study the conditions and opportunities for a particular breed in his locality.

Dairy cattle have been developed for one particular purpose— a purpose which I think we often lose sight of and which should have more consideration. What is the dairy cow for and what is our purpose in feeding and milking her? Some of you will, no doubt, say because of the milk she gives. This is true, but it is not the fundamental principle which I want to get before you as the one big reason why we need better dairy cows.

Cows, like hogs, chickens, sheep, etc., are feed markets. Some of you grow corn, and buy tankage and shorts to feed your hogs. If you have good foundation stock of hogs that will grow and mature quickly on a minimum quantity of feed, you have no doubt found the hog to be a profitable feed market. The same thing holds true for beef cattle and poultry or other livestock. Some of you raise wheat. If your land is properly plowed or disked and good seed are planted and conditions are favorable, you have no doubt found wheat a fair market for your labor and investment. After your hogs, or your steers, or your wheat has been finished for market or harvested, you spend considerable time and worry about the best place to market these crops.

If Jones offers you 7 cents a pound for your hogs and Smith offers 8 cents there is not much question as to who gets your hogs. If one buyer offers 70c a bushel for your wheat and another bids 72 cents, the latter will undoubtedly get your wheat. I wonder how many of us really look at and size up our cows in this manner. They are markets for our alfalfa and silage, our corn, bran and cottonseed meal.

It has been definitely proved beyond a doubt that some cows will return a higher yield of milk for the **feed** that they consume and **labor** that is expended upon them than others. In other words, some cows are good feed markets, while others are poor ones. If one cow will return $2 from a dollar's worth of feed and another only $1, we scarcely notice it. Here is a difference of a dollar every time each of these cows eat a dollar's worth of feed, and frequently within a year, this difference is enough to buy something of

considerable value. I believe much more attention would be given to the kind of cows that are kept if we thought of them as markets for our labor, silage, alfalfa and other feeds. Here is one place where the farmers may have the market largely under his control.

The Agricultural Colleges and dairy specialists are often criticized because they are trying to increase the production of cows and are losing sight of, or not paying enough attention to the marketing or selling of the milk or cream. That may be true in certain cases, but it must be remembered that the keeping of dairy cows or any class of livestock is a marketing proposition, because this livestock is the market for a large portion of our farm crops. By keeping more efficient animals we are marketing these crops to better advantage.

It is a well known fact with dairymen, that profitable production of butterfat, or, in other words, an efficient dairy herd must be made up of high producing cows. Suppose, for example, that you have two cows in your barn at home standing side by side. You have kept feed and milk records for the last year. One of these cows produced 100 pounds of butterfat, while the other produced 300 pounds of butterfat. The low producing cow has taken up just as much of your time and labor as the higher producing cow and has also occupied just as much room in your barn. In other words, the overhead on the two animals has been the same. You have no doubt fed these cows in the same manner—each one getting a big fork full of hay and a small measure of grain a day, in the winter and pasture during the summer. If it cost $100 a year to feed and care for each one of these cows, including interest on the investment, overhead expense and labor, and butterfat sold for an average of 50c per pound, the higher producing cow has returned a profit of $50 while the 100 pound cow has been kept at a loss of $50, or in other words, you have practically paid $50 for the privilege of milking and feeding the lower producer. If your herd was made up of ten cows and half of them were of the kind that produced only 100 pounds of butterfat and the other five produced 300

pounds each, you would be far better off to get rid of the five lower producing ones. It is true you would not have as much cream or milk to sell but your profits would be greater. As it is, you are spending valuable time and feed on five low producing cows and they are eating up the profit of the five good producers. This is not a far fetched idea or example but is an illustration of what is taking place in thousands of herds in the United States.

Considering the fact that the average cow in Nebraska produces only 102 pounds of butterfat per year, I think it is a good example of exactly the condition of the majority of the dairy cows. You have 500,000 milk cows. Probably fully one-half of the dairy cows in Illinois are such low producers that they are unprofitable and bring down your average, and eat up the profits of the other half. I do not mean to convey the idea that you should immediately sell or slaughter half the milk cows in your State, but I do want to bring out the fact that it would be easily possible for you to double the average production of your cows in a few years if you everyone would start breeding up and selecting individuals for your herds.

During the last five or six years I have been in position to come in contact with a great many dairy men in different parts of the East and Middle West. I have visited their farms, bought their cattle and discussed with them their problems. I have come to the conclusion that the production of milk or butterfat is just like any other business; there is keen competitoin, but plenty of opportunity for those who go at it in the right way. Those men who are keeping low producing cows as a basis for their business are not making a success and they become discouraged and take up some other line of work. It is those that are building up their herds to high and economical production that are doing well in the dairy business because they have more efficient cows for marketing their feed.

The Dairy Division of the U. S. Department of Agriculture has recently made a study of the feed and production records of several thousand cows in cow testing associations in the United States. So far more than 18,000 of

these records have been tabulated and studied. These records showed that the cows giving 100 pounds of butterfat a year produced an average income above feed cost of about $10; at 200 pounds of butterfat a year the income above feed cost averaged about $42; at 300 pounds a year the income averaged $72 and at 400 pounds of butterfat the average income was about $106 per year per cow.

While the cows in the 400 pound class averaged four times as much in production as those in the 100 pound class, they gave an income over feed cost that was more than ten times as great. These figures represent actual facts and can not be disputed. Each one of the 18,000 records represent the amount of butterfat given in a year's time and the amount of feed consumed. Some of these records were obtained from cows in your own and neighboring states.

According to these figures, if the cows in Illinois, by better feeding, breeding and handling, could be gotten to the point where they would produce twice as much as they produce now, the income above feed cost would be four times as great as it is at the present time.

It is a comparatively easy matter to build up a herd of cows from a low average of 100 pounds of butterfat to 175 or 200 pounds. It is somewhat more difficult to go from 200 to 300 pounds. It is a real proposition but not impossible to get a herd up to and maintain an average of 400 pounds of butterfat. It is the dairyman that has his herd on such a high producing basis that has the big job, because he will find it difficult to maintain high production of from 400 to 500 pounds of fat. There are, no doubt, many herds in Illinois that are getting high average production, but there are entirely too many that are producing below the profitable point.

I am not pointing out these things in a spirit of criticism but for the purpose of getting before you the great need in your state as well as most other states, and in your herds at home—the necessity of better cows if dairying is to be more profitable. It is not, in my opinion, a question of more cows, but a matter of better and more efficient cows in order that you may have a more profitable market

for your feed. It must be remembered that as a state you must compete with other states that have better cows than Illinois and that as individual farmers you must compete with other dairymen that have more economical producing herds.

It is a well established principle of big business that in order to meet competition and have big sales, an article or product should be produced at the cheapest cost consistent with good quality. Any number of business enterprises make this their golden rule. Can we as dairymen make the same claim for our dairy cows as a whole? If we are getting 50 cents per pound for butterfat produced with 100 pound cows, and it costs us 48 cents a pound to produce it, our profit is two cents. If we can produce the same amount with a less number of 175 or 200 pound cows at a cost of only 30 or 35 cents per pound, that is good business and is one way of making more money. Let us take it as an established fact then, that the farms of Illinois need better milk cows in order that a better market will be had for your feed.

It would be poor judgment on my part to outline your problems and not offer some means or methods of solving them. The important question is how are better cows to be obtained. Should they be purchased outright or is it best to raise them yourselves?

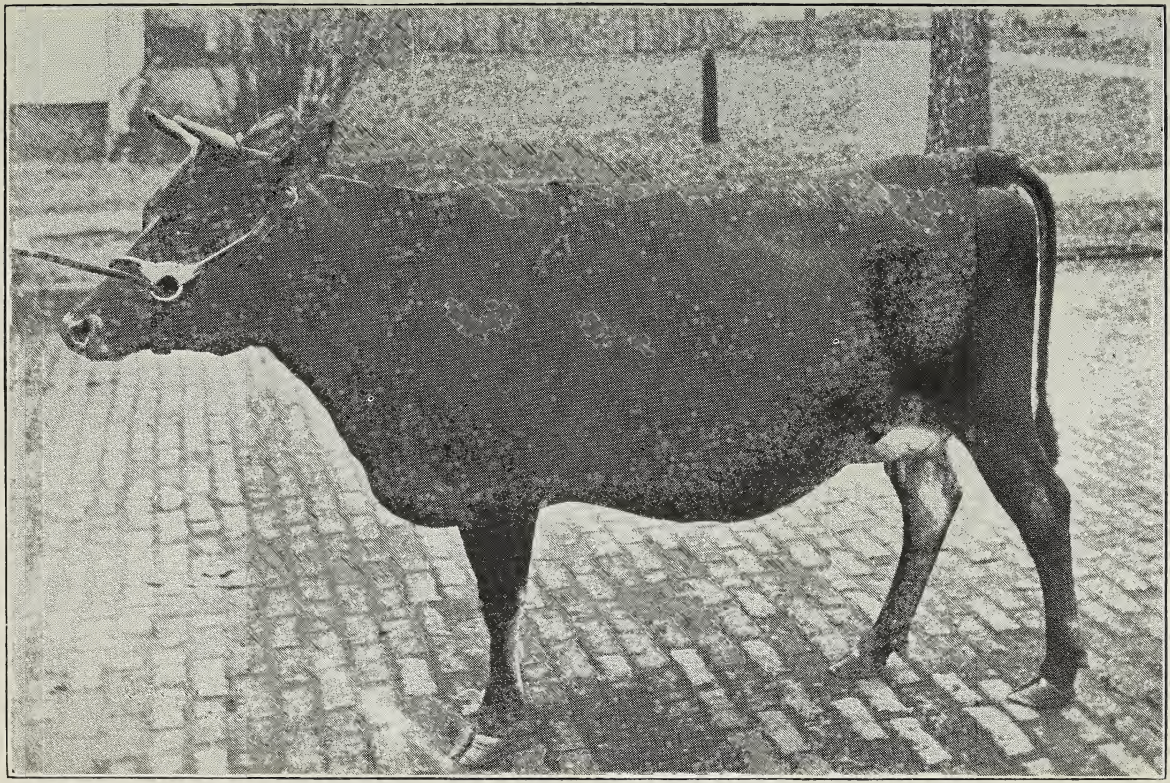
The amount of milk or butterfat a cow will give depends upon first, how good a cow she is and, second, upon how skillfully she is fed and managed. The two go hand in hand and can not be separated. The best feeder in the world with the best feeds can not induce a cow to give a large flow of milk if she was not born with the ability to give a large amount of milk. On the other hand, the most highly bred dairy cow can not produce heavily unless she is provided with proper feed and good care and management. Good breeding merely makes it possible to get high production. If every farmer in Illinois were provided now with a herd of cows with ability to produce like Segis Pietertje Prospect, or Countess Prue, or any other world's record dairy cow, the average results would be somewhat better but still low, because the limiting factor in many

herds is as often a lack of proper feeding as it is the ability of the animals to produce. It is not my intention to discuss feeding, but I am pointing it out as one essential basis for developing your cows. Feed them well, so that they can have a chance to show what their ability or breeding is—then if they do not come up to the proper standard of production—get rid of them.

An example of what feeding will do is related by a Nebraska dairyman who was a member of a cow testing association. He owned a cow called "Prohibition," so named because she was dry so much of the time; at least it appeared so to the owner, because she would give milk for only five to six months and then go dry. Feed was quite expensive at the time. When her owner found out from the first year's record that she had been dry for six months and had produced only 3,351 pounds of milk, he decided that she should go to the stockyards at Omaha, when she went dry again. So, as soon as the cow freshened, the owner began to feed her a little grain to keep her in condition so that it would not take so long to fatten her for beef after she went dry. But "Prohibition" did not go dry. With that extra grain she kept milking month after month and at the end of the year she had 7,043 pounds of milk to her credit. The owner did not sell her but he changed her name.

The dairymen in Illinois have distinct feeding problems that are different from other sections of the country, but in my opinion you raise, and can raise, the kind of feeds that form the basis of economical production. Your College of Agriculture has solved and is solving these problems for you and you should keep in close contact with their work.

Some of you, no doubt, are interested in going into the dairy busines, as a means of obtaining some ready cash or money. As has been pointed out, proper feeding is important in this connection, but closely related to this is selection of the best cows in your herd today, and eliminating the poor ones. Professor C. H. Eckles of the University of Minnesota is quoted as saying that "Using any cow for dairy purposes, merely because she happens to be a female



ROSE BUD'S LITTLE ROSE
Champion Cow 305 Days, 1923
Tested as a 2-year-old, 480 lbs. fat.

of the bovine species, is about as sensible as it would be to select a president by drawing a name from a box containing the names of all the men in the country." The importance of selecting cows is known by most dairymen but for various reasons a large number do not do it. You can all readily understand that the only basis for intelligent selection or feeding is a reliable system of record keeping. Experience has shown that but a few dairy farmers will keep regular systematic records necessary in order to know what each cow is doing. The system need not be elaborate or of such a nature that it will require a great deal of time. But it should be such that at the end of each day or week or month you can look at your record sheet and see what the cows are doing. Your agricultural college, no doubt, has sheets for the purpose of putting down daily or weekly weights of milk from each individual cow. It takes only a few seconds to weigh and record the quantity of milk from each cow and mark it on a sheet tacked up in the barn for that purpose. Once a month a fair sample of the milk should be tested for butterfat and that is used as a basis for figuring the amounts of butterfat produced by individual animals. The amount of feed eaten is recorded in the same way and the cows should be fed according to the old reliable rules of production. If you feed your grain in a half gallon measure, find out how much this measureful of grain weighs and use that as a basis for giving the cows the amount they should have. Weigh a forkful of silage and hay once a week and use this as a guide in feeding the roughage. A set of scales for weighing milk and feed will pay for themselves many times over if they are used. Knowing the amount of food consumed and the amount of milk and butterfat given will then form the basis which will enable you to have the necessary information for selecting your better or profitable cows and culling out the unprofitable ones. Fortunately the cow testing association of which you are no doubt familiar offers a practical way of getting the information at a comparatively small cost considering the value of the information. There are twenty-three of these associations now operating in Illinois at the present time, but you need more of them.

I do not wish to convey the idea that the cow testing association is adaptable to every one milking cows, because many of you do not have a large enough herd to justify being in one. But your extension department of the University is no doubt attempting to solve this matter in a satisfactory way. The big thing is get the necessary information relative to your cows, so as to be able to select those you should keep, and get rid of those that are requiring too high a board bill.

Reference was made a few moments ago to the effect that the profitableness of cows depended not only upon the care and feed they receive, but also upon their ability to give large quantities. In other words a good cow must be born with the ability for high production. This fact forms the basis or background for all the breeding work that has been done, with dairy cattle, and the problem is uppermost in the minds of dairymen today. It is generally said that considering all our cows, we have to raise at present three in order to get two that are satisfactory. The big point of our breeding practice should be then to raise a higher percentage of big producers. Every farmer who has given careful thought to herd improvement realizes that the main chance for rapid improvement of a herd is in the use of better blood through the sire. No one recommends the purchase of a high class cow and an inferior bull as a means of improving a herd. If you have ten cows in your herd, you will, theoretically, get ten calves a year by the bull and only one calf a year from each cow. In other words, the blood of the sire will be piled up ten times greater than will the blood of any one cow. That is the fundamental reason why we should look upon the sire as offering the quickest and most practical means of getting good producing blood in our dairy herds.

It is estimated that dairymen must raise three cows in order to get two that are profitable. It must be remembered that they are raised at great expense and that two years must elapse before any return can be expected. If we go to this expense of raising them, we should have some assurance that they will be profitable. The fact that they

are sired by good purebred bulls should furnish this assurance in a large degree. Then instead of only two out of every three being profitable, we can get 4 out of 5 or 6 out of 7. It seems to me that this is your greatest problem so far as profitable dairying is concerned, to increase the number of desirable purebred bulls to breed your cows to so that there will be more of these better heifers coming on each year to replace the low producing cows.

The Iowa Agrciultural Experiment Station demonstrated in a striking manner the value of purebred bulls as a means of increasing herd production. A number of native cows were brought to Iowa from an isolated section in Arkansas. After they were brought to Ames, they were given good feed and care and milk and butterfat records were kept. The original cows averaged 3,991 pounds of milk and 187 pounds of fat. Thirteen daughters of these original cows sired by purebred bulls averaged 5,566 pounds of milk and 253 pounds of butterfat. Cows of the second generation or granddaughters of the old original Arkansas cows averaged 358 pounds of fat.

The production of granddaughters was almost double that of the original scrub cows due almost entirely to the purebred bulls used. The same result or even better can be gotten on a large number of farms in Nebraska.

If herds are not large enough to warrant the keeping of a good purebred bull, it is often possible for a group of farmers to go together and form a bull association. This type of organiaztion was designed to meet the needs of the farmer with a small number of cows, but it is by no means limited to him. It enables one to have the use of a high class purebred bull over a period of years at a small cost. There are over 200 of these in the United States at the present time. That they are getting results is shown by records of the daughters of these bulls as compared with the dams. So far 70 daughters of association bulls (all that are available for study), have produced 22 per cent more milk and 25 per cent more butterfat than their dams, on an average. Illinois has 7 of these associations at the present time.

Many states and organizations realizing the import-

ance of better bulls are carrying on scrub sire eradication campaigns in particular counties or localities. They offer inducement to the farmers in an effort to eliminate scrub bulls. These should have a far reaching effect.

I recently attended a meeting of farmers in an eastern state incident to scrub bull eradication. This meeting was in the nature of a scrub bull trial. A scrub bull was led out before a jury composed of farmers and was tried, convicted and sentenced to death upon various charges, including larceny, highway robbery, and pauperism. The argument against the scrub bull brought out the fact that among other things he was a robber because he had robbed the owner of the profit of the dairy business in just as sure a manner as if he had held him up at the point of a gun. He was pronounced a pauper, because he not only had a roving disposition himself, but caused his owner to rove from one type of farming to another and made a pauper out of him. The argument in favor of the scrub bull was to the effect that he was a harmless creature and required less feed and care than a purebred. Then, too, he was good to eat, and if all scrub bulls in the county were eliminated, the butcher that bought them would be compelled to take his family to the poor farm and the public taxes would necessarily have to be increased to take care of them.

I do not wish to be understood as saying that all purebred bulls are valuable in increasing production of a herd. Some of them are no better than scrubs, but in general, especially when used on ordinary herds, a purebred bull can be relied upon to better the production of that herd. If it is a purebred or high producing herd, there are other things to consider.

In my opinion the cheapest and most practical plan for the average dairy farmer to follow is to feed and manage properly the cows he has now so as to find out what they will do. Select the better cows and breed them to good purebred bulls of the breed he desires. Select the best heifers from the best cows and build up your herd on this basis. It may appear somewhat slow but it is sure, and one has an opportunity to learn as he builds up his business.

It would be a good plan, no doubt, if circumstances warrant, to purchase one or several good purebred cows as a foundation and use these and their offspring as the basis for a purebred herd. The grade cows can be gradually gotten rid of as purebreds take their places. This method can be followed at a small outlay of capital and is sound. There is absolutely no question but that in general purebred cattle are more profitable than scrubs and grades, if they are properly handled. But too many farmers have bought purebreds without understanding that they must be given just as good if not better feed and care than scrubs if they are to be profitable. Consequently, they are disappointed and have no use for purebred cattle. Purebred cattle represent years of breeding and effort of breeders and they can be relied upon to yield more profitably than ordinary cows if handled in the right manner. Good purebred cows can be bought at reasonable prices, but it is probable that they can be raised as cheaply in Illinois as anywhere. The main point is to get your foundation for starting. The grade cow is valuable from the standpoint of utility and her worth is quite largely based upon the amount of purebred blood she has in her breeding.

It takes several years of hard work and worry to build up a herd of high producing dairy cows. It takes even more effort and thought to maintain high production after it is gotten. Dairy farming is a business that one must stay with over a period of years in order to get the greatest results. One can not leave his cows in the pasture to suckle calves during the summer and expect heavy milk production from them during the winter.

The dairy business is in favorable circumstances but at the same time there are many difficult problems to be overcome. But chief among these problems is the large number of low producing cows, the result of improper feeding, management and breeding. It makes no difference whether we are concerned with one or all of them, the main thing we need to do is to create a better market for our feed through good cows. This can be done by finding out what our cows are doing and using this information as a basis for making them more efficient.

FEEDING THE DAIRY CALF.

R. E. Caldwell.

The individual charged with the feeding and care of dairy calves should realize the truth of the old adage, "The eye of the master fattens his cattle." The importance of the feeder's personal and intelligent attention in caring for all classes of livestock cannot be over-emphasized. This is especially true in the feeding of calves; in fact, few classes of our domestic animals offer a more complicated problem than does the young calf. It is worthy of note that success usually follows the dairyman who appreciates the significance of giving his individual attention to his calf herd. The delicate digestive system of the growing calf calls for the careful selection and frequent variation of rations to satisfy its changing needs. The average calf is naturally a healthy animal and any departure from this condition has a specific cause. It is the herdsman's duty to endeavor to correctly diagnose any abnormalities affecting his calf herd and to strive to maintain ideal conditions as regards both feed and environment.

Care of New-born Calf and Dam.

Immediately upon birth the responsibility for the well-being of the cow and the calf passes into the hand of the attendant in charge. It is important that he possess detailed knowledge regarding how to proceed in the matter of caring for them. Such a person should fully appreciate how necessary it is that the calf promptly establish the use of its vital functions.

If the calf is breathing normally and is not exposed in unsafe or improperly sheltered surroundings, both calf and mother should be allowed to remain undisturbed for a time. The cow will soon turn her attention to the calf and lick its entire body. If she fails to do this the calf should be wiped dry with a clean cloth or bright straw. In 30 or 40

minutes the calf should be attempting to rise. Frequently a strong, normal calf will be able to walk about before it is an hour old. If the calf is unable to rise within two or three hours it should be aided to its feet and given its fill of milk from its mother. Both should then be permitted to rest. Normally, a new-born calf will sleep a great deal of the time for the first week. If prematurely born the calf will usually sleep almost constantly until it reaches the age of normal birth. It is important that both calf and mother be well protected from adverse weather conditions as well as the irritation due to the presence of other stock.

Aseptic Procedure.

Under the artificial surroundings of the modernly housed dairy herd it is important, in the handling of maternity cases, that care be exercised to prevent both calf and mother from developing infections. The chief trouble encountered in this connection is that of navel infection which results in the frequently observed irregularity among calves known as "white scours."

In disinfecting the navel, prepare a 5 per cent solution of liquor chesolis compound and fill a pint tin cup three-fourths full of the mixture. Have an assistant lift the calf free from the ground, in this way making it possible for the navel to be submerged in the solution in the cup for two or three minutes. Next, take a light, disinfected cord and tie it securely around the navel, one and one-half inches below the body. As a further precaution or in the absence of the above treatment the exposed portion of the navel may be painted with tincture of iodine. Such treatments should guard the calves from all navel infection taking place after birth of calf.

It is quite generally agreed among experienced breeders that in the presence of infectious abortion, navel infection may have taken place prior to birth and in such instances the disinfecting of the navel subsequent to birth will have little, if any, influence in preventing the development of white scours.

The time to treat the navel, as above directed, is as soon as the calf is breathing normally after birth.

The Nursing Calf.

Within four hours after birth a strong, normal calf will nurse 10 or 12 times per day. Obviously, only a small amount of milk is consumed at such feeding periods. As the calf grows older it nurses less frequently although when four or five days of age it will feed eight or 10 times per day. For this reason, it is advisable to permit the new-born calf to remain with its mother for the first four or five days. When separated from its mother at the end of the first day, the calf is usually denied frequent feedings. This causes it to gorge itself with milk at all opportunities which tends to establish a severe handicap at this critical period of its life. It is true that many successful feeders follow the practice of permanently weaning their calves at 24 hours of age, but such a practice is apt to lead into serious difficulties, especially with animals of low vitality.

"Colostrum Milk."

The term "colostrum" is applied to the udder secretion at time of parturition. Its presence in the udder is always associated with the process of reproduction. Prior to calving the udder contains a yellowish pus-like material which is replaced by colostrum as the date of parturition approaches. With cows that milk continuously the presence of colostrum is quite generally agreed to be to serve as a gradual changing ration for the calf from the nutrients received prior to birth to those of normal milk. It is extremely laxative in its effect and its absence is a serious matter in securing the proper functioning of the digestive tract of a new-born calf.

In composition, it will be noted from the table entitled "Composition of Colostrum" that the total solids may run as high as 23 per cent. All solids of colostrum except fat and sugar are higher than in normal milk. The proteins, "Globulin" and "Albumin," are extremely high. The total pro-

tein varies from 12.23 per cent in colostrum to 3.24 per cent in milk at the seventeenth milking. It has been noted that the change in composition of milk continues for several weeks after calving, it being, of course, much more gradual after the first eight or ten days following parturition.

Milking	Number	Total	solids		Ash		Fat	
Sugar	Total	proteid	Caseinogen		Globulin			
Albumin			$123456	7890$	123456		6....6	123
Composition of Colostrum (Southhurst)								
1	22.87	1.03	2.30	2.74	12.23	4.86	5.32	1.45
2	16.23	0.87	2.49	2.85	6.97	3.35	2.04	1.01
3	15.16	0.86	3.41	3.37	5.82	3.09	1.45	0.75
4	15.19	0.82	4.74	3.62	4.69	2.70	0.66	0.78
5	15.74	0.82	5.10	3.63	4.01	2.61	0.55	0.52
6	15.75	0.82	4.55	3.86	4.04	3.56	0.48	0.49
7	15.72	0.80	5.49	3.92	3.46	2.21	0.31	0.62
8	15.62	0.80	5.47	4.57	3.36	2.17	0.27	0.61
9	15.47	0.82	5.62	4.22	3.35	2.15	0.25	0.59
11	15.97	0.84	5.04	3.82	3.52	2.52	0.22	0.59
14	16.55	0.84	5.15	5.00	3.21	2.20	0.20	0.56
16	16.28	0.83	4.90	5.01	3.32	2.34	0.19	0.55
17	16.06	0.81	4.79	4.87	3.24	2.25	0.19	0.56

Experience in the feeding of calves teaches the importance of providing the new-born calf with an adequate supply of colostrum for the first four or five days following birth. In its absence a tablespoonful of castor oil should be given with each feeding for the first two or three days, or until the bowels have functioned properly.

The Cow That Refuses to Own Her Calf.

Occasionally, especially with heifers, one may observe the unnatural act of a calving cow refusing to own or care for her new-born calf. No explanation is offered for this strange condition. In such a case it is unwise to attempt to force the calf upon her. The cow may be milked and a small portion of the colostrum fed to the calf artificially. Feedings should be frequent. After the bowels have functioned the calf may be shifted to the regular method of hand feeding, receiving unseparated herd milk for the first two or three weeks.

Keeping Cow and Calf Together.

In the foregoing discussion mention has been made of the most advantageous time for separating the young calf from its mother. The chief guide in this matter should be the condition of the calf. Its bowels should function within 12 hours after birth and, if no action has taken place within 24 hours, it is advisable to give the calf an enema of warm soap suds. The condition of the mother's udder may also guide one in removing the calf, as frequently the calf is more useful in reducing inflammation of the udder than is the average milker. Likewise, incomplete milking such as practiced by the calf tends to ward off such ills as milk fever more than does complete hand milking.

Experienced dairymen realize the annoyance created when a young calf is separated from its mother. Much of this unrest upon the part of both may be reduced if they are separated so that it is impossible for them to hear each other's cries. On many farms this is impractical but in most cases they can at least be kept from each other's sight. Also, the frequent milking of the cow and the regular feeding of the calf will aid in developing contentment upon the part of both.

Methods of Rearing Calves.

Nature intended that the new-born calf should be grown chiefly upon milk drawn by the calf itself from its dam's udder. In the wild state the mother cow produced only enough milk for this purpose. As man's servant she has been developed into an extremely artificial state, until now average representatives of the superior dairy breeds produce many times the amount of milk needed by the growing calf. Also, the fuller understanding of the value of milk solids as a human food has caused the value of milk to become such that its unlimited use for calves is, in most instances, an economic impossibility.

The methods now used by dairymen in the growing of calves may be divided into the following classes, so far as the liquid ration is concerned:

1. Calves grown entirely upon whole-milk, the calf being permitted to have free access to nurse either its mother or a nurse cow.

2. Calves grown upon whole-milk but limited in the quantity secured by giving the calf access to its mother or to a nurse cow for but a limited time at each feeding period.

3. Calves grown upon whole-milk, same being supplied artificially after the calf has been weaned.

4. Calves grown upon whole-milk and milk from which the butterfat has been removed, whole-milk feeding usually being discontinued by the time the calf is four to six weeks of age.

5. Calves grown upon whole-milk, skim-milk, water, and a calf meal. The calf meal and water gradually supplanting the milk portion of the ration.

6. Calves grown upon milk, calf meal, and whey, the whey being used in connection with the calf meal in place of the water which is usually used in preparing the calf meal gruel.

7. Calves grown upon buttermilk in its natural state or upon the commercial semi-solid product properly diluted.

Evolution in Feeding Methods.

The change in methods of feeding calves has been very rapid within the last few years. The hand feeding of calves was little practiced 25 years ago except in the intensified dairy districts. With the development of markets for whole-milk and the establishment of factories manufacturing butter, cheese, powdered and condensed milk, dairymen quickly realized the impracticability of permitting their calves to have free access to their herds. It has been realized, also, that the proper functioning of a dairy cow is seriously handicapped by the continuous nursing of calves though but for a limited period each day.

The invention of the cream separator made generally available a product commonly known as "skim-milk," and since its introduction this product has been very extensively used in growing dairy calves, especially in districts where there is no favorably located whole-milk market.

As has been stated, the importance of milk as a human food has quite recently become more thoroughly appreciated than in the past. With this has come an unprecedented demand for whole-milk resulting in the further complication of the problem of calf feeding. The phenomenal increase in population of our cities and the more universal use of condensed milk, cheese, and ice cream have so depleted our supply of milk that the dairyman has turned his attention to milk substitutes for his calves. Experience with these products has been varied. However, after the calf has passed the most critical stage there is a pronounced saving of milk to be effected through the use of an efficient calf meal.

PRESENT KNOWLEDGE OF TUBERCULOSIS.

Probably no disease affecting either the human race or live stock is better known or has been the object of so much study as tuberculosis. Present knowledge of the disease is derived from many sources, including the work of eminent scientists who discovered its cause, and studies of the numerous ways in which it is spread, of the manner by which man and animals contract it, and the effects it produces.

The tuberculin test—the means of detecting tuberculosis—was devised in 1882 by the eminent scientist, Dr. Robert Koch. Thus the test has been known for more than a third of a century. The facts regarding it and other information presented in this bulletin are based upon long experience and results verified many times. The methods recommended to be used in the eradication of tuberculosis have been tried upon large numbers of herds and found to be effectual and practicable.

Early Eradication is Most Economical.

Live-stock owners are earnestly requested not to wait until the States and Federal Government come into their localities to eradicate tuberculosis. It would not be possible indeed, at this stage to undertake to eradicate tuberculosis from the live stock of the United States solely through organized official forces established by the respective States and the Federal Government. The area over which tuberculosis has spread is too vast, the herds too numerous, and funds are insufficient for conducting the work on so extensive a plan even though trained veterinarians were available in sufficient numbers to do the work. Every live-stock owner should be a party to this campaign which has been inaugurated to eradicate tuberculosis. In almost every locality of the United States are veterinarians capable of rendering valuable services to live-stock owners in this great work, and the cost of eradicating is greatly reduced by combating

the disease in its early stages. Yet even in badly affected herds eradication can be undertaken with success. There are records of many herds, in which three-fourths of the animals were affected with tuberculosis, which eventually were freed from it and afterwards maintained in a healthy condition.

The extirpation of tuberculosis from live stock is important not only from an economic standpoint, but also because a considerable percentage of tuberculosis in the human family, especially among children, is positively due to the consumption of infected milk or other dairy products from tuberculous cows. It is eminently proper for the respective State governments to expend funds for the maintenance of tuberculosis sanitariums for the care of persons afflicted with that disease, and likewise it is extremely important to use vigorous measures to check the marketing of germ-laden milk. While it is true that proper pasteurization of milk destroys the living organisms of tuberculosis, a large part of the milk consumed daily is not pasteurized, and some of the milk so treated is not always made entirely safe.

Tuberculosis a Deceptive Disease.

If tuberculosis were similar to foot-and-mouth disease in cattle, swine, and sheep, which causes rather spectacular symptoms, it would arouse immediate alarm among the live-stock owners, who would insist upon its immediate eradication; but because it is generally slow in developing and its symptoms commonly are not easily recognized from the general outward appearance of the animals, many people believe that it does comparatively little damage among live stock. Contrary to such opinions, however, the loss from tuberculosis is one of the heaviest taxes imposed upon our live-stock industry, amounting, probably, to at least $40,000,000 a year in the United States.

Prevalence of Tuberculosis.

In every State and Territory in the Union there is some tuberculosis among cattle and swine, though the degree varies considerably. In some States it probably exists quite

extensively, the percentage varying from 5 to 30 per cent of the cattle population, while in certain others investigations indicate that less than 1 per cent of the total of beef and dairy cattle are utberculous.

Tuberculosis is known to exist also quite extensively among cattle and swine in all the European countries; in fact, no part of the world is known to be free from it absolutely. There are, however, some restricted regions where its presence is not known, or it exists to but a very moderate degree.

Until cattle from the eastern part of the United States were introduced into the Middle Western, Western, and Southern States, tuberculosis among live stock in those regions was unknown so far as we know. The disease at that time was confined to the herds east of Allegheny mountains. It was known then that a considerable percentage of herds in those States were affected, but live-stock owners were not inclined to consider tuberculosis as of very great economic importance or dangerous to human health. Therefore very little progres was made in its eradication. As the Central and Western States became settled and cattle were moved westward the disease spread much more rapidly than is generally realized. The spreading in those areas is due, of course, to the fact that livestock industry occupies a more important part in agriculture than in the Eastern States. Cattle are traded in more extensively and are continually being shipped and trailed from State to State and from farm to farm.

In some localities in the West, where dairying has developed extensively, it is now known that carload lots of cows purchased in other States have contained 50 per cent or more of tuberculous animals. Some herds of beef cattle in our western country have become contaminated with the disease by placing among them tuberculous pure-bred bulls and cows that came from diseased herds elsewhere. The importance of controlling tuberculosis and preventing its spread by the interstate movement of diseased animals was not so well recognized during the times of pioneer development as it is today. Consequently in the absence of regula-

tions and inspections, diseased animals moved from one State to another. The shipment of cattle from Eastern and Northern States to the South, with the exception of dairy herds near the larger cities, did not commence until progress had been made in the eradication of the cattle tick. Therefore there is probably less tuberculosis among the herds of the Southern States than in any other part of the Nation. This favorable condition should be taken advantage of, for in all probability the live-stock industry will reach a high development in that area in future years. It is especially important that the herds of the Southern States be protected by permitting only tuberculosis-fee animals to enter.

How the Disease Spreads in a Herd.

The tuberculosis cow is the greatest source of danger to healthy cattle. Any reacting cattle not promptly removed from the herd constitute a source of constant infection.

Tuberculous cattle, sooner or later, begin to give off the germs of the disease. These germs escape by the mouth, nose, and bowels, in the milk, and other discharges. The discharged germs are carried in the air for a time until they fall to the ground.

Animals in adjoining stalls may take in the germs in the feed they eat and thus contract the disease. Continuous water troughs in barns containing diseased cattle are a source of danger. Drinking holes containing material from infected animals are likewise dangerous.

Failure to clean and disinfect the premises occupied by the diseased cattle constitutes another source of danger. Infected milking tubes and the practice of feeding calves with raw milk from tuberculous cows are other means by which tuberculosis spreads in a herd.

Losses of Meat Food Products.

Records kept by the Meat Inspection Division of the bureau show the great financial loss caused by tuberculosis every year. They also indicate how widespread tubercu-

losis in cattle and swine is in the United States, as the establishments in which the diseased animals were slaughtered are in all parts of the country. More than that, only about 65 per cent of the cattle and swine, it is estimated, are slaughtered each year in establishments under Federal supervision, so that about 35 per cent of these classes of animals slaughtered each year in the United States do not appear in these records. It is known also that the percentage of tuberculosis is greater in the uninspected animals. In view of these points the losses shown in the following table are believed to be scarcely one-half of the total loss throughout the country.

When animals are "retained" by the Federal inspectors on account of tuberculosis it means that some evidence of the disease is discovered and the carcass is placed aside for further examination. If the disease is found to be so slight as to render the undiseased portion of the carcass fit for food, the diseased area is removed and the remainder is passed. It will noted that such is the case in most carcasses retained, but some loss occurs for the reason that the diseased portions found unfit for food would have a considerable value if healthy.

If the animals that are retained and when the disease is not extensive enough to cause condemnation of the entire carcass, the disease is in most cases in the early stages. Had the animals been allowed to live for possibly only a short time longer, the disease would have progressed until all the carcass would have to be considered diseased. In others the lesion of disease has become surrounded by tissue that "locks it up" and prevents it from spreading to other parts of the body. Such a condition, however, is liable to change at any time during the animal's life and allow the disease to enter other parts of the body, and also to be carried out of the body and endanger healthy cattle and swine.

How to Proceed to Make Certain that Cattle and Swine Are Free from Tuberculosis.

Have a competent veterinarian apply the tuberculin test. Remove all reactors promptly, and disinfect the

premises **immediately** after the removal of the reacting cattle.

Do not feed any infected dairy products to swine or young cattle.

Retest the herd with tuberculin once a year.

On the farms from which these animals come, some of the remaining cattle and swine are probably affected with tuberculosis, or will be if allowed to remain there for a sufficient length of time. Knowing this danger, State and Federal officials. when the identity of the animals can be established, trace back as many of the shipments of diseased animals as possible, and through the co-operation of the owner try to exterminate the disease from that farm

Cause of Tuberculosis.

The direct and primary cause of tuberculosis is a rod-shaped germ which can be seen only with the aid of a microscope of high magnifying power. The presence of this germ in the bodies of human beings or live stock is absolutely necessary to produce the disease. The germs of tuberculosis may also be grown artificially in proper material at a temperature of about 98° F.

Outside the bodies of animals the organism is not capable of reproducing itself. When exposed to the direct rays of the sun it dies quickly—a fact to be noted in the disinfection of pastures, paddocks, and barn lots. The organism may live for months, however, when it is protected by dry manure and other materials which form a crust over it and prevent its destruction by the sun's rays. It is of extreme importance, therefore, to clean and disinfect thoroughly all barns, stalls, and other inclosures which contained tuberculous animals before healthy ones are again placed in them.

While it is necessary for the germs of tuberculosis to be introduced into the body of the animal before the disease can be produced, there are many conditions or accessory causes which make animals fall victims to tuberculosis.

Animals which are fed on non-nutritious foods, as well as those that have too little feed, become weakened consti-

tutionally and lose the power to resist the invasion of the organisms. Stabling animals in dark, poorly ventilated and dirty barns helps to spread tuberculosis among the stock whenever the germs are present. Introducing a tuberculous animal is almost sure to give the disease to healthy animals in a short time. If the healthy animals drink water from the same trough or bucket the tuberculous animal uses, and if that animal is coughing up tuberculous sputum, all the animals are in serious danger of infection. Any condition that produces constant strain upon the systems of animals, such as the continued forced lactation periods of dairy cows, renders them fit subjects for the development of tuberculosis.

How Cattle Become Infected With Tuberculosis.

The tuberculous cow is the greatest source of danger to healthy cattle, and inasmuch as it can not be determined just when that animal becomes a "spreader" of the germs, unless daily microscopic tests are made of the discharges from the body, and the milk is also examined microscopically, it is unsafe to keep it with healthy cattle. No cattle from outside sources should be introduced into a healthy herd until they have been tuberculin tested and found free from the disease. Unquestionably more healthy cattle acquire tuberculosis by coming into contact with affected animals than in any other way. It has been observed frequently that cattle which stand on either side of or face tuberculosis animals in barns are the first to contract the disease.

The continuous water trough in barns is also accountable to a very large extent for spreading the disease. Cattle may become infected by picking over manure infected with the germs of tuberculosis. Hay, straw, or any other feed contaminated with the germs may give the disease to animals that consume such material.

Water holes and creeks into which infected milk or the washings from infected milk cans have been dumped may also be a source of the infection. The teat siphon or milking tube, in a number of instances, has been the medi-

um by which the disease has been conveyed from one animal to another. Calves contract tuberculosis by nursing, even for a short time, cows whose udders are affected. Calves also become infected frequently by drinking milk from diseased cattle isolated from the main herd. To be safe for feed, milk from such cows should first be heated to a temperature of 145° F. and held there for at least 30 minutes, but as this method requires considerable attention to assure proper heating, boiling for a few minutes is considered a better plan.

How Swine May Become Infected.

The tuberculous cow is not only a menace to other cattle but is also the commonest source of infection to swine. In some parts of the country, especially where there are whole-milk creameries and skimming stations, feeding mixed skim milk to swine is a common practice. In that way the skim milk from one farm may be fed to hogs on another. Thus it is possible that milk from a few tuberculous cows may set up the infection among swine on many farms.

Milk is a good medium for the development of the tubercle bacilli, and swine seem to be extremely susceptible to tuberculosis. Numerous instances are on record, also, in which the whole milk is separated on the farm, the cream shipped, and the skim milk fed to swine. Consequently one tuberculous animal that is passing the germs in the milk secretions may give the disease to any or all of the animals to which any of the milk is fed. Investigations made by the Bureau of Animal Industry show that in practically every instance where tuberculosis exists among cattle, and swine are kept on the same farm, some of the latter are tuberculous. Eradication of tuberculosis from cattle, it is believed, will greatly reduce its prevalence among swine.

Another common practice of feeding, especially in the Corn Belt States, is to allow hogs to run with cattle in the feed lots or pastures. If the cattle are tuberculous and the feces contain the germs of tuberculosis, in all probability the swine will contract the disease. Swine may contract

tuberculosis also by eating parts of the carcasses of infected cattle, swine, or poultry. Other sources of contamination are infected sputum from human beings, and the feeding of uncooked garbage containing the germs of tuberculosis. Tuberculous swine, like diseased cattle, may also infect one another.

Symptoms of Tuberculosis.

It must be understood that tuberculosis is a disease which often gives no indication of its presence by external symptoms. Yet persons skilled and experienced in dealing with the disease among animals frequently are able to detect certain abnormal conditions which lead them to pronounce the animal as probably affected with tuberculosis. A generally run-down condition, accompanied with a cough, is often considered to be an indication of tuberculosis but is not a conclusive symptom. When tuberculosis is suspected it is always advisable to apply the tuberculin test without delay.

As the disease often involves the lymphatic glands in various parts of the body, an examination of such glands as can be felt in the living animal is sometimes helpful in diagnosing the disease. The glands of the throat, udder and point of the shoulder often present an abnormal condition, such as an enlargement or hardening, as shown in figure 4. Animals affected with tuberculosis in advanced stages often show a "staring" coat and a generally unthrifty condition. When the throat glands of an animal are affected, it often holds its head in an abnormal position in order to relieve the pressure which causes difficult breathing. Increased respiration is often noted when the lungs or lymphatic glands of the thoracic cavity are affected. When some of the glands of that cavity are extensively diseased, the animal often develops bloat. Diarrhea is often evident in some cases in which infection has extended to abdominal cavity. The symptoms mentioned, though typical, must not always be expected when animals are tuberculous; animals that are extensively diseased are often in apparently perfect physical condition.

Methods of Diagnosis.

Microscopic examinations of sputum, milk, and bowel discharges of an animal are sometimes made to determine the presence of tubercle bacilli and to diagnose tuberculosis, but after many years of experience the tuberculin test is now considered to be the most practicable and satisfactory way of discovering the disease in the living animal. The inoculation of guinea pigs with emulsions made from milk or discharges from the living animals is sometimes resorted to as a means of diagnosis, but that method of examination is technical and requires special scientific training and equipment. Besides, cases of tuberculosis may be overlooked when laboratory methods are used, because tuberculous animals do not always discharge the tubercle bacilli.

The Tuberculin Test.

Testing animals with tuberculin is the process of introducing tuberculin into the animal and interpreting results according to well-known standards. Tuberculin is a laboratory product prepared scientifically and, when of standard potency and in the hands of skilful persons, it is a reliable agent for detecting tuberculosis in animals. It contains no living tubercle bacilli but is a product of the growth of tubercle bacilli properly mixed with a substance on which it has grown and properly diluted and preserved. No harm can result to healthy animals from the proper application of tuberculin even if doses many times greater than the regular ones are used.

The use of tuberculin by untrained persons is to be discouraged for the reason that in many cases its effect on tubecrulous animals is unobserved and not understood by those unfamiliar with its action. Tuberculin, by its immunizing property, can cause tuberculous animals to fail to respond to its application at another time; therefore it may be misused by unscrupulous persons.

The Subcutaneous Test (Under the Skin).

The subcutaneous test is made by injecting the proper quantity of tuberculin underneath the skin into the subcu-

taneous tissue. If an animal is tuberculous, the action of the tuberculin causes a fever, which is indicated by a rise in temperature. This rise, under ordinary conditions, may occur any time between the eighth and twentieth hours after to measure the temperature before the eighth hour and continue to the twenty-fourth hour or longer.

The temperatures are measured at least 3 times in advance of the injection, at 2-hour intervals, to learn whether the animal is in proper condition to receive the test. The temperatures after injection are taken every 2 hours until the test is completed. The proper interpretation of the temperatures is made by the person applying the test, and a careful observance of any cilinical changes is always important in determining the result. It can not be set forth too strongly that the test, including the two following methods, should be attempted only by those who are properly qualified to do the work.

The Intradermic Test (Into the Skin).

The intradermic test for detecting tuberculosis is used to a considerable extent because of its convenience. When made by those who have become skilled in its application, it is very accurate. In this test the tuberculin is injected between the layers of the skin, only a few drops being used, and it is usually applied in the region at the base of the tail, where the skin is soft and nearly hairless. The intradermic test is satisfactory also for the diagnosis of tuberculosis in swine, and when so used the tuberculin is applied into the skin of the ear near its base.

The reaction from the intradermic test consists of a swelling at the point of injection and is usually observed from 72 to 120 hours after the injection. The character of the swelling varies, and a proper diagnosis of tuberculosis by this test can be made only by an experienced person.

The Ophthalmic Test (Into the Eye).

Still another method, known as the ophthalmic, is used to some extent and has been found to be of considerable value in what is known as "check" testing; that is, it is

used in connection with either of the previously described methods. Sometimes a tuberculous animal that fails to react to those tests shows evidence of the disease upon the application of the ophthalmic test. The ophthalmic tuberculin is placed in one eye and the other eye is used as a check. A reaction is indicated by a characteristic discharge from the eye receiving the treatment, which may occur in from 3 to 10 hours after the application or even later. Some swelling and inflammation of the eye and lids are often noted.

Reliability of the Principal Tuberculin Tests.

The subcutaneous test is made by injecting, under the skin, a small quantity of tuberculin. Carefully and conscientiously applied, with good judgment exercised in both its administration and interpretation, it is wholly effective.

The intradermic test is especially suitable for range cattle or animals whose movements are difficult to control, and in area work. In this test the tuberculin is injected between the layers of the skin.

The ophthalmic test, or so-called "eye test," is not at present accepted for testing cattle for inter-state shipment, though it has value as a check test and is recognized for that purpose. It is applied by placing the ophthalmic tuberculin in one eye, using the other as a check. The ophthalmic test has given best results under farm conditions or in other cases where the eyes are normal. For testing cattle in transit or in the stockyard the test is less dependable, owing to the fact that the eyes may be abnormal as the result of irritation or injury from dust, cinders, or other results of transit. In all cases the tests, used either alone or in combination, should be applied by capable persons familiar with tuberculin testing.

Post-Mortem Appearances.

Animals affected with tuberculosis may show the effects of the disease in almost any part of the body. In advanced cases the lesions are easily found, but when the dis-

ease is of recent origin or if a slightly diseased area has been encapsulated or closed up, it is often very difficult to find evidence of the disease. Lesions in advanced cases generally appear as nodules or lumps, which are tubercles formed as a result of the disease. These lumps may be found in great numbers in the lungs and abdominal organs. The lesions are of various sizes and may contain pus, either soft or hard; many times it is gritty. Tubercles are often found in various numbers attached to the walls of the thoracic and abdominal cavities. Lesions of the disease also occur in the lungs, liver, and spleen. The lymph glands, to some extent, are usually affected, and, when cut into, show diseased areas characteristic of tuberculosis.

Lesions of the disease may be found also in the skin and in or on the bones. In animals only slightly diseased, the lesion may be hidden so that it is impossible for even the most skilful person in post-mortem work to find it. A microscopic examination of the lymphatic glands or other tissues often reveals the presence of tubercle bacilli when no lesion can be seen by the naked eye, a condition showing that the disease is just starting. When animals have reacted to the tuberculin test, a very careful post-mortem examination should be made. The action of tuberculin is often discredited when on post-mortem the lesions are not plainly seen, but experience of many years has shown that very few animals reacting to the test were not affected with tuberculosis to some extent even though some were very slight.

Methods of Eradication.

Cattle owners who do not know whether tuberculosis exists among their animals should ascertain the fact by having them tuberculin-tested and physically examined by a qualified veterinarian. In many cases thousands of dollars and very valuable breeding animals might have been saved by taking up tuberculosis-eradication work in time. Three main projects comprise the general campaign of eradication, as follows:

1. Eradication of tuberculosis from pure-bred herds of cattle.

2. Eradication of tuberculosis from circumscribed areas.

3. Eradication of tuberculosis from swine.

It is important to eradicate tuberculosis from pure-bred herds of cattle at the earliest possible date because the spread of the disease is greater among such animals than among grade cattle. The reason is plain; pure-bred animals are shipped extensively to every part of the United States for breeding purposes. A pure-bred bull or cow may be shipped from Main to Texas, or from the State of Washington to Florida. If it is diseased and is introduced into a healthy herd, it not only fails to fulfill the purpose for which it was intended—the upbreeding of the herd—but it actually causes heavy damage by spreading the disease to healthy animals.

Accredited-Herd or Honor-Roll Plan.

The breeders of pure-bred registered cattle full appreciated the above-mentioned fact when, together with the live-stock sanitary officials of practically all the States, they adopted what is known as the accredited-herd plan, the principles of which are that herds found to be free from tuberculosis on two successive annual tests are placed on the Honor Roll, and a certificate is given to the owner by the State and the Federal Government. The certificate entitles animals of that herd to be shipped interstate without further tuberculin testing for a period of one year. This plan is becoming well known to breeders through the United States.

The methods of eradicating tuberculosis from grade herds are, of course, the same as for pure breds. No owner can rest assured that his herd is free from tuberculosis unless it has been properly tuberculin tested. To make a satisfactory test all the cattle should be in normal condition and, so far as practicble, the cattle should be stabled under usual conditions and among usual surroundings. Feeding and watering should be conducted in the customary manner, with the exception that feed and water should be given only after the temperature has been taken. Careful phys-

ical examination of each animal should be made before or during the application of the test. If animals react to the test they must be separated from the rest of the herd.

Principal Benefits of Complete Eradication of Tuberculosis.

Increased value of individual animal and increased herd value.

Ability to ship interstate from accredited herds without further testing for a period of one year.

The owner's name being listed in pamphlets published by various States and live-stock associations.

Confidence by those who desire to purchase cattle to add to their herds.

Satisfaction of knowing that the dairy products offered for sale are free from diseased germs.

Elimination of economic losses caused by the disease.

Eradication from Areas.

The unit territory to be worked will depend mainly upon the extent to which the disease has spread. In some States practically every county contains numerous tuberculous herds, so that, to control the disease effectively, all the herds must be tuberculin tested. In other States, however, the disease is confined to the beef and dairy herds recently established or to which new animals have lately been added. In the latter case it would not be necessary to test all the cattle, but the examination of the herds should be sufficient to demonstrate most satisfactorily that no diseased herds are overlooked. This can be done by testing several herds in each section of the county wherever there is a suspicion that the disease may exist.

As a general plan, it is best to take up the work by counties, and substantial co-operation should be obtained from the county government. Each county should pay (1) part of the expense of exterminating the disease by employing inspectors to make the tests, (2) part of the indemnities paid for tuberculous animals, and (3) its share of the cost of cleaning and disinfecting barns, stables and sheds. When a large percentage of the herds of a county are diseased, it is advisable to clean up the herds within a township or

possibly one-third or one-half of the area. The progress depends upon the degree of infection found and the co-operation furnished by the owners.

In 1910 the Bureau of Animal Industry took up the eradication of tuberculosis from the herds in the District of Columbia, which has an area of 60 square miles. At that time 1,701 cattle were found. Every animal was tuberculin tested; of the total number, 321 cattle, or 18.87 per cent, were tuberculous. The reactors were removed from the herds and, in most instances, were slaughtered. The infected barns, sheds, and premises were cleaned and disinfected.

Each year since the inauguration of the campaign all the cattle have been tuberculin tested with the result that the infection has almost disappeared.

There are States in which tuberculosis exists to less than 1 per cent among all the bovine population. The plan of carrying on eradication in several counties at the same time in those States is practicable and is being conducted in a number of States.

Before undertaking the work in any area, large or small, the cattle owners should be consulted, and unless they are willing to lend their earnest co-operation and know the sacrifice they may have to make, it is inadvisable to start. The better the organization and the more nearly perfect the plans are made, the more efficiently the work should progress.

The larger herds, especially around cities and those supplying milk locally and for shipment to other cities, should be tested before the small lots. If it is known that the herds are but slightly infected, the intradermic method should be employed, as faster progress can be made with it than with the subcutaneous test. If reactors are found in using the intradermic test, the entire herd should be tested subcutaneously within a short time. The ophthalmic test may also be used in conjunction with the subcutaneous in "check" testing herds. General experience shows that it is sound practice, if there is any doubt, to use all three methods of testing with tuberculin. Such a policy is especially

applicable to cattle which have been tested frequently, and among herds which are or have been extensively diseased.

Eradication From Swine.

With the gradual elimination of tuberculosis from cattle, the disease among swine will grow correspondingly smaller. It is not necessary to tuberculin test all the swine herds because, with the exception of valuable breeding animals, it is more economical to slaughter the diseased ones when fat than to undertake to exterminate the disease in any other way.

In the case of suspected, valuable pure-bred swine, their freedom from tuberculosis can be determined definitely by the intradermic method, which is practicable and reliable.

The injection is near the base of the left ear; the other ear acts as a check or comparison. A reaction is manifested by a swelling in the region where the tuberculin was injected. The swelling may appear any time from the 24th to the 104th hour after injection and will remain for several days. As in the case of cattle, diseased swine should be removed from the farm, and the sheds, farrowing houses, and the lots should be thoroughly cleaned and disinfected.

Measures of Prevention.

Since, after many years of study and experience, no satisfactory cure for tuberculosis among animals has been found, prevention of the disease is extremely important. State and Federal Governments have made vigorous efforts to stop the spread of the disease by regulating the movements of cattle, and recently, with that object in view, action has been taken in some localities to regulate the movement of cattle from one county to another. Regulation of inter-county movement should be encouraged because it brings the matter nearer home to the live-stock owner. It is he who must take a very important part all through the campaign of tuberculosis eradication, and if he is in favor of measures to prevent the spread of the disease

and faithfully abides by those measures, eradication will be accomplished more speedily.

From what has been said already about the dangers of shipping diseased cattle, it is plain that the movement of tuberculous cattle, except for immediate slaughter or to quarantine, must be stopped whenever possible. After diseased animals are found and removed from the premises, a **very thorough** cleaning and washing of the inside of the barn and other buildings where the animals have been should be made. This must be followed by the proper application of some approved disinfectant. The use of disinfectants without first doing the necessary and proper cleaning is ineffective for the reason that the germs of the disease must be exposed. All utensils or anything else that may have become contaminated by use around the diseased animals should likewise be cleaned and disinfected. The manure and refuse must be hauled from barnyards or lots to plowed fields, spread thin, and exposed to the sunlight. The yards and lots, including feed troughs, water troughs, and fences can then be sprayed properly with the disinfectant.

All this means much work but it must be done to prevent infection from spreading to the healthy animals. Proper sanitary conditions on premises where live stock are kept is of great importance in keeping the animals healthy and able to resist disease. Sanitation, in its broad sense, includes the admission of abundant sunlight and fresh air properly regulated.

Disposal of Reactors.

The disposal of reactors depends largely upon the State laws and live-stock regulations of the State in which the herd belongs. If the animals are pure bred and registered and of unusual merit, they should be segregated, preferably on farms set aside by the State or by the pure-bred cattle associations, for the purpose of retaining tuberculous cattle in quarantine. If the condemned animals are grade cattle, or pure breds not specially valuable for breeding, it will probably be more economical to have them slaughtered

than to hold them in quarantine. Of course the fact is recognized that in States and communities where tuberculosis exists extensively the slaughtering of all reactors is impracticable. In such instances the infection can be reduced on all the farms by keeping the tuberculous animals separate from the healthy ones. The tuberculous cattle are kept under quarantine restrictions until no longer profitable; meanwhile the healthy animals are safe from the danger of infection.

The Accredited-Herd Plan—Every Cattle Owner Eligible.

A tuberculosis-free accredited herd is one which has been tuberculin tested by the subcutaneous method or any other approved method under the supervision of the Bureau of Animal Industry, or of a regularly employed veterinary inspector of the State in which co-operative tuberculosis eradication is being conducted.

It is a herd in which no animal affected with tuberculosis has been found upon two annual or three semi-annual tests, made as described, and by physical examination.

Owners of tuberculosis-free herds receive a certificate issued by the bureau and the State livestock sanitary authorities. The certificate is good for one year from the date of the test, unless revoked at an earlier date.

Retesting.

It is rather uncommon for tuberculosis to be eradicated from an infected herd after one tuberculin test. After the removal of reactors the herd should be retested at the expiration of six months, and a second retest may be advisable six months later, but the practice of testing herds more frequently than that is not usually advised. After two or three semi-annual tests the herd should not be tested oftener than every 12 months. While the subcutaneous test is considered preferable for gentle cattle, the ophthalmic and intradermic methods of testing may be employed to advantage as adjuncts to it; and it is believed that in some instances herds may be freed of tuberculosis earlier by the

judicious use of all three methods. No general outline can be given as to when all three tests should be employed; the matter should be left to the judgment of the veterinarian under whose direction the work is carried on.

Marking Animals for Identification.

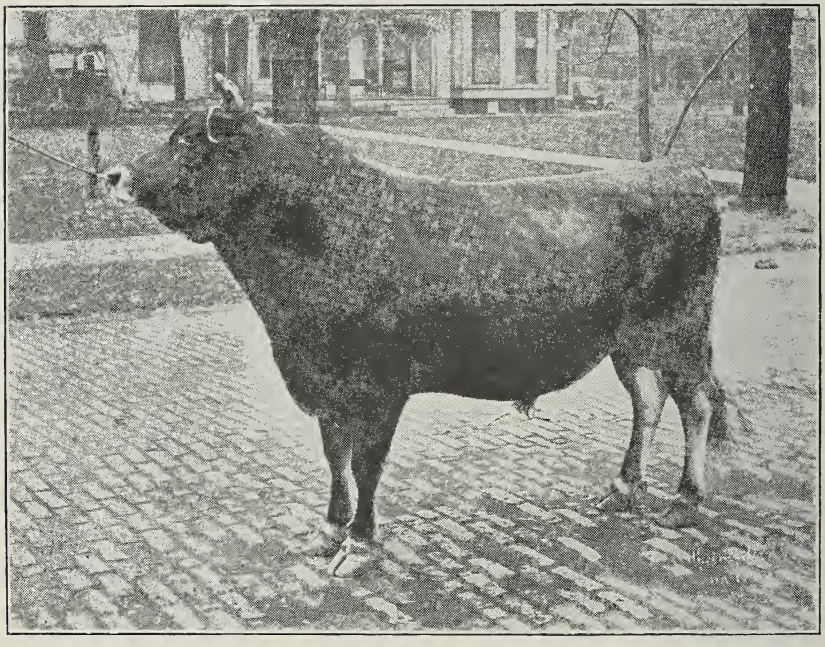
It is very important to mark properly all cattle which react to the tuberculin test, so that they may be easily identified as affected with tuberculosis. One method that is quite generally used is that of branding. a letter "T" about 2 inches high is branded on the lower jaw, or sometimes it is placed on other parts of the body where it can be seen readily. In addition to the branding it is advisable to take the reacting animals so that one may be identified from another, and in that way the results of the post-mortem examination can be connected up with the reporting of the tuberculin tests. The tag is usually placed in the ear of the animal and contains a serial number as well as the word "Reactor."

Another method that is sometimes used is the punching of a letter "T" out of the ear, and it has been quite satisfactory.

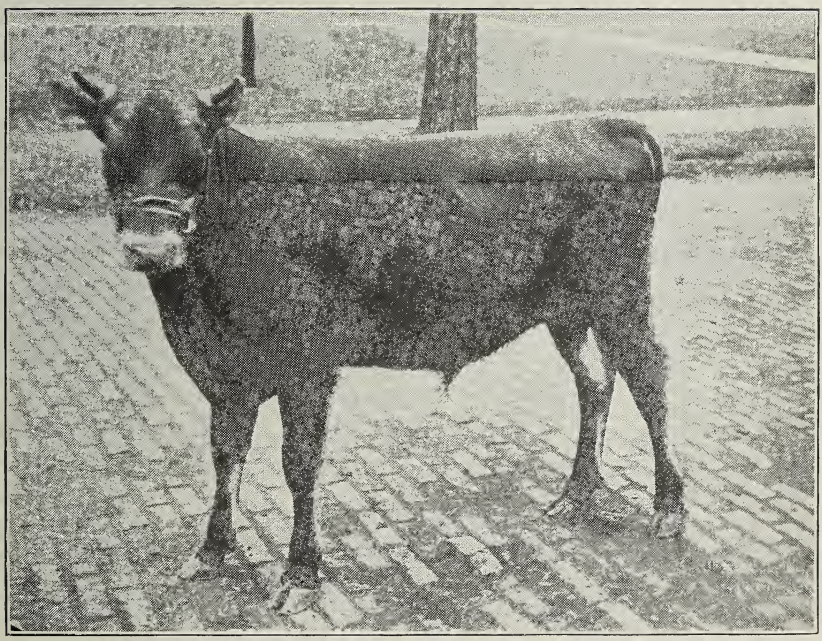
The marking of cattle that have passed the tuberculin test is a matter that is being handled in different ways throughout the United States, and it is believed that the present methods of marking will be improved. In some cases a metal ear tag is used and in others certain marks of identification are tattooed in the ear. Tattooing has an advantage over the tagging in that it is less expensive and probably more permanent.

It is not often necessary to require special marks on pure-bred registered cattle, as the owner usually has a method of identification, and this method of marking can be used in connection with the tuberculin test as a record; but on grade animals it is desirable to use some system of marking that will show that the cattle have been tested and found apparently free from tuberculosis.

A system of marking swine so that the origin of those found to be tuberculous on post-mortem efiamination can



CARLISLE'S TORMENTOR
3-Year-old. W. S. O'Hair, Paris, Ill.



ZANDER'S TORMENTOR
1-Year-old.

found to be tuberculous on post-mortem examination can work along this line is now being conducted by the bureau in co-operation with owners and packers. The results so far obtained indicate that the tattooing of a number or some mark of identification into the skin of the hog is the most practicable method, but of course it entails additional labor and expense which would amount to a great deal if carried on throughout the country. It is hoped a more practicable and economical means of marking swine for identification will be developed in the future, as much good in the campaign for the eradication of tuberculosis in live stock can be accomplished in that way.

Many shipments which contain tuberculous swine are traced back to the farm by a system of reports kept by the Bureau of Animal Industry. By developing the methods of tracing tuberculous cattle and swine from the abattoir back to the farm where they were raised, efforts can be directed in eradicating the disease from these herds.

Why The Tuberculin Test is Harmless.

Tuberculin contains only the sterilized products of the tubercle bacilli. It does not contain any living germ; therefore it is harmless to any animal whether healthy or diseased.

Only diseased animals give typical reactions to the test. The test does not injure animals in a condition of advanced pregnancy, and will not cause them to react if they are free from disease.

Likewise, it does not produce reactions in disease-free animals which have recently calved.

Appraisement and Indemnity.

In addition to the various benefits derived from eradicating tuberculosis, provision for the appraisement of diseased cattle with indemnity for those slaughtered is a further incentive. Federal legislation and supplementary laws in numerous States now divide the burden of loss, so that the Government, the State, and the owner of the cattle all

bear a share of it. Briefly, the Federal law provides that the Secretary of Agriculture may reimburse partly owners of animals destroyed on account of tuberculosis in co-operation with states, counties, and municipalities. The bases upon which Federal indemnities are paid are:

1. No payment shall exceed one-third of the difference between the appraised value of such animal and the salvage value.

2. No payment shall exceed the amount paid or to be paid by the State, county, or municipality.

3. In no case shall any payment be more than $25 for any grade animal or more than $50 for any pure-bred animal.

4. No payment shall be made unless the owner has complied with all lawful quarantine regulations.

Legislation regarding indemnities for tuberculous cattle varies somewhat in different States and, for detailed and current information on the subject, the reader is referred to his State live-stock sanitary officials or to the inspector in charge representing the Bureau of Animal Industry in co-operative tuberculosis-eradication work. The names and addresses of these officials may be obtained by addressing the Bureau of Animal Industry U. S. Department of Agriculture.

How the Work of Eradciation is Divided Between State and Government Officials and Others.

Tuberculosis eradication is a co-operative work of the Bureau of Animal Industry of the U. S. Department of Agriculture, the live-stock sanitary officials of the various States, and individual cattle owners. The bureau and the State officials send veterinary inspectors to apply tuberculin tests to the herds of those owners who sign a co-operative agreement, which places their herds jointly under supervision for the control and eradication of the disease.

UDDER DISEASES OF DAIRY COWS. CARE AND MANAGEMENT OF DAIRY BULLS.

Two Recent Bulletins from United States Department of Agriculture.

A fundamental axiom of horse husbandry is well expressed in the statement "A horse is no better than his four feet." Translated into terms of dairy husbandry, it would sound much like this: "A dairy cow is no beetter than her udder."

Implied or expressed, this rule largely governs the desirability of animals considered for a dairy herd, or the fitness of any animal to remain in the herd. The attention of the stock judge is focused on the udder conformation as a guide to a cow's excellence, and the dairyman ultimately rates her value to him according to the evidence of the milk sheets and the butterfat test.

The dairy cow's udder is an abnormally developed gland, the result of centuries of careful selective breeding It is complex in its physiology. Functioning as it does, under high tension, for maximum milk production during most of the adult life of the cow, this marvelous structure is subjected to a very great physical strain, with small opportunity for rest or repair. The extra tax on the udder which is involved in the birth of calves and shortly thereafter often counterbalances the rest allowed between milking periods.

The great development of this organ, as well as its complexity, are factors which render most difficult the treatment of abnormal conditions of the udder of the dairy cow. All things considered, it is usually advisable, when a disease or injury is observed, to undertake treatment only under the advice of a qualified veterinarian.

Prevention of Diseases and Injuries.

Many of the udder conditions which occasion pain and peril to the dairy cow are avoidable. Deviation from regu-

lar and established practice in the care of the animal is the frequent forerunner of serious consequences. Lack of care in the use of milking machines, teat dilators, and milking tubes may result in the permanent injury of one or more quarters of the udder. Brier cuts, barbed-wire cuts, and the bruising or crushing of the teats by other cattle stepping on them (often due to bad stall construction, are usually avoidable. These injuries may lead to leaky quarters, fistulous teats, mammitis, and other troubles, with possible loss of function. Udder troubles of cows are sometimes directly or indirectly traceable to brutal treatment by attendants who, in driving the animals to and from pasture, stone them or beat them with sticks, clubs, or whips. Vicious horned animals also inflict injury on their fellows, which may involve the udder as well as other parts of their bodies.

Drying Off the Cow.

Damage may result from attempting to dry off a cow too suddenly before calving, especially when the animal is on succulent pasture or a rich concentrated ration. In some cows the instinct for milk production is so highly developed that the function seems difficult to repress, even during advanced pregnancy, and efforts to terminate a milking period forcibly in such animals possibly does more harm than good.

To dry off a cow, it is advisable first to regulate her ration. Allow well-cured hay in place of succulent pasture, silage, or beet pulp. By stages eliminate all concentrates, for at this time they tend to excite a congested condition of the udder, as well as to favor the continuance of milk production. Bran may be given alone or with some middlings. For about a week omit every third milking, and then milk once daily for another week, without stripping. Afterwards it may be necessary to milk only a few streams daily to relieve the tenseness of the udder. A few days later, when it is evident that milk secretion has subsided, no further attention will be required, as a rule. This system may be varied to suit individual cases, as some animals may be dried off in less time, while others may require longer.

Separation of Cow and Calf.

Although there are excellent reasons for the common practice of promptly removing the newborn calf from its dam, it is sometimes advantageous to leave them together. The cow often comes to her milk more naturally and easily with the calf present. The calf discovering its own appetite and then the maternal fount at which it is to be satisfied, begins punching and bunting the udder in a manner well calculated to stimulate the flow of milk and at the same time "break up" the congestion of the organ. Possibly many a case of mammitis in fresh cows might have been avoided had the calf been left beside its dam until the udder was well "broken up."

Vices.

Some calves acquire the habit of sucking the udders of other calves, a prank which should never be tolerated, despite the apparent harmlessness of it. The possibility of damage is twofold. In the first place it tends to the formation of an ill-shaped and pendulous udder, and hence may seriously detract from the beauty and value of the animal in after life. Furthermore, there is the danger that the heifer, especially if of well-bred dairy stock, may become stimulated to a virgin milk secretion. In the course of events this milk secretion, the presence of which is not suspected, may be left to dry up of its own accord, without the necessary care on the part of the owner, with a ruined udder as the possible result. This fact may, indeed, account for many of the cases of hardened udder, reported among virgin heifers, since the description of that condition is strongly suggestive of chronic garget of adult cows. To overcome the vice the milk ration of calves may be followed by a handful of grain fed before they are turned out. This tends to remove the desire to nurse.

Cows sometimes acquire the habit of sucking their own teats. While this practice may not harm the cows it is unprofitable for the owner.

There are several more or less effective ways of breaking cows of the habit of sucking their own udders or the

udders of other cattle. Some herdsmen have used the com mon calf weaner, which is a small, biblike attachment for the nose, or the muzzle basket type of calf weaner, either of which contrivances is so arranged as not to interfere with eating or drinking, but which covers the mouth when the head is slightly elevated. Others have resorted to the use of the spiked halter, which is made by perforating the muzzle strap of an ordinary leather halter at intervals of about 1 inch and passing sharpened wire nails through the holes, from within outward, lastly lining the barbed strap to hold the spikes in place. This method, however, borders on the barbarous and may be attended with danger to the wearer or to other stock in the same pasture. A crib, or rigid collar, is more humane, and may be made by lacing together a number of stout sticks in barrel-stave fashion, and tying them around the animal's neck, thus preventing her from bending sidewise and yet permitting her to graze. This apparatus is mainly effective for animals that rob their own udders. Another type of apparatus which is effective in preventing a cow from robbing her own udder, consists of a halter, to the chin strap of which a stout stick is attached by means of a short chain. The stick is passed between the forelegs and is fastened at the other end by a large metal ring to the lowest point of a girdle fitted comfortably around the animal's body.

If mechanical contrivances fail to correct the vice, the culprit may be isolated for a while, or, better still, pastured for a limited time daily under observation or isolation, immediately after milking, and then stanchioned for the rest of the time. After a few weeks of this manner of restraint she should manifest no inclination to return to the habit.

DISEASES AND CONDITIONS AFFECTING THE UDDER
(Inflammation of the Udder (Mammitis, Mastitis, Garget)

By far the most important disease of the udder is that known as mammitis, mastitis, garget, or inflammation of the udder. The disease assumes three forms, namely, catarrhal, parenchymatous, and interstitial. The first attacks the mucous lining of the udder, the second the milk-secreting structures, and the last the framework of the udder. These differ in some of their characteristics, and in an individual case all may appear at various stages of the disease.

Causes—Inflammation of the udder may be due to any cause or combination of causes, such as exposure to cold or wet weather, sudden change of temperature, blows, kicks, bruises, or abrasions of the udder, an injudicious allowance of rich feed, the retention of milk, infrequent or irregular milking, the introduction of contaminated instruments into the udder, local infection, indigestion, or any serious disturbance of the animal's health.

The disease sometimes appears in a mild form which soon passes off, to recur at more or less regular intervals. Although the condition usually occurs about calving time there is no part of the milking period in which it may not appear.

Symptoms—In different forms or stages of the disease there may be variation in the symptoms—the usual ones are general depression and discomfiture. There is sometimes chill, but it may escape notice. Among the most conspicuous symptoms are a rough coat, dull eyes, loss of appetite, suspended rumination, and possibly constipation. The animal stands in an awkward, straddling position, and moves about or lies down with reluctance and great difficulty, owing to the soreness of the udder, which will usually be found to be hot and tense, very hard, and tender. The fever, though sometimes local, is more likely to be general. A dropsical condition under the skin of the abdomen is sometimes observed.

The secretion of milk if partly or entirely suspended.

The milk itself is lumpy or stringy, or its consistency may be altered to that of a serous fluid containing yellowish clots, caused by the coagulation and separation of the casein. The secretion may even become purulent and offensive. Severe inflammation of the udder may also bring about a rupturing of some of the capillaries, which makes the milk bloody.

Recovery may be slow or rapid, complete or incomplete. When the disease passes into a chronic stage there is small likelihood of complete restoration of function. Among the unfavorable results of the chronic condition are hardening of some of the udder tissues, abscess formation, milk fistula, and gangrene of the udder.

Treatment—Chill, if observed, may be treated by the administration of large quantities of warm drinking water, or of cordial drenches, or by hot bathing, or the use of hot blankets.

To reduce fever, give 1 ounce of spirits of nitrous ether three times daily. A full dose of Epsom salt (1 to 2 pounds may be given at the onset of the disease, to be followed by daily doses of saltpeter, 1 ounce, and bisulphite of soda, 2 drams, in 1 quart of water, as a drench.

The udder should be completely emptied every two hours if possible, using extreme gentleness in the operation, especially if there are blood tinges in the milk. The presence of blood indicates a rupture of some capillaries. If the udder is very tender, it may be necessary to use a sterile milking tube so as to empty the organ with the least pain.

Twice daily, after milking, the udder should be bathed for about 20 minutes with water as hot as the hand can bear, and meanwhile the attendant should continue gently but firmly to massage the udder in a downward direction. All material brought down into the milk cistern by this manipulation should then be thoroughly be stripped out, after which the udder should be dried and anointed with warm comphorated oil or an ointment composed of the fluid extracts of belladonna and phytolacca, 1 part each,

and lard or lanolin, 8 parts. An excellent ointment may be prepared after the following formula:

Petrolatum	2 pounds.
Spirits of camphor	2 ounces.
Spirits of turpentine	2 ounces.
Oil of peppermint	½ ounce.
Carbolic acid	½ ounce.
Powdered extract of belladonna leaves	6 ounces.

This is to be mixed thoroughly and applied with massage daily after bathing the udder with warm water. The ointment may be rubbed in thoroughly and the udder should be supported by a dry suspensory bandage having holes cut in the lower part for the teats. The udder may be irrigated daily by means of a sterile milking tube attached to a sterile fountain syringe containing a 1 per cent solution of table salt, or a 4 per cent solution of borax, or boric acid, sterilized by boiling and cooled to blood heat. The irrigating fluid may then be milked out with further massage.

In infectious mammitis beneficial results have been reported from the administration of one-half ounce of sodium salicylate and 2 drams of boric acid in 1 quart of water morning and night as a drench, and one-half to 1 ounce of formalin in 1 quart of milk or oil at noon for several days. Very frequent milking is also here recommended.

At every stage of the treatment of infectious mammitis a mild but effective antiseptic solution should be applied to the udder and adjacent parts of the affected cow, and also to the hands of the milkers and to the udders of other animals likely to be exposed in any way to the infection.

Affected animals should be separated from the herd, and hand-milked last, or better, by a separate attendant. They should be maintained under sanitary conditions in dry, comfortable quarters, with frequent change of clean bedding, and other attentions given in the proper care of sick animals. The ration should be regulated so as to in-

clude a sufficient allowance of nutritious roughage, such as clover, alfalfa, cowpea hay, and to reduce the concentrate ingredients, such as corn meal, cottonseed meal, linseed meal, gluten, and middlings. Clean drinking water should be accessible at all times and should be slightly warmed in cold weather. A moderate amount of bodily exercise is beneficial provided it is taken voluntarily by the cow. Compulsory exercise may be positively detrimental as well as painful to the animal.

Induration, or Hardening of the Udder.

Probably the most common of the results of mammitis, or inflammation, in induration, or hardening of the udder. This condition is due to structural changes in the udder tissue. During mammitis the secreting portion of the udder is in a diseased and wasting condition and the inflammation present appears to establish an increase of the connective-tissue cells which go to make up the supporting framework of the organ. The result is likely to be a large, ill-shaped and pendulous udder. In a well-established case of induration the milk secretion is usually very greatly diminished for that period. Sometimes the secretory function is permanently lost, or decreased to such extent that the animal no longer will be profitable in a dairy herd.

Treatment—Treatment consists mainly in prolonging hot bathing of the udder twice daily after milking, accompanied by gentle rubbing of the parts affected. After drying the udder thoroughly, apply an ointment composed of lanolin or lard into which has been incorporated 2 per cent of iodin.

A rich diet, or one likely to stimulate milk secretion, should be avoided until inflammation has subsided, after which time the animal should be brought by degrees to a full, milk-producing ration. Maintain throughout a rather laxative condition of the bowels by an occasional dose of Epsom salt (about 1 pound).

Abscess of the Udder.

Abscess is also one of the possible results of infectious mammitis, and is due to infection of the organ by pus-producing germs. The abscess may work toward the surface

of the udder, where it can be assisted to a head and lanced by the veterinarian, or it may be ruptured internally and discharge its creamy, liquid pus through the teat. In the event of both external and internal rupturing of an abscess of the udder, there is danger of establishing a milk fistula.

Treatment—The abscess may be hastened to a head by hot fomentations or poultices. It is then ready to be opened and drained. The after-treatment usually consists of simple cleanliness in the general care of the animal and the dressing of the part twice daily with a watery solution containing 5 per cent each of glycerin and phenol.

Gangrene of the Udder.

Gangrene is caused by a serious interference with the blood circulation, as in some cases where the inflammatory swelling or distension with milk is so great as to produce intense pressure on the blood vessels of this region. The resulting slow, necrotic process causes the death and sloughing off of the affected quarter or quarters. This condition sometimes leads to fatal consequences, due to blood poisoning.

Treatment—The raw surfaces should be thoroughly and frequently sponged with some good antiseptic, such as a one-half per cent solution of chloride of zinc. If amputation of the gangrenous area becomes necessary, it should be undertaken only by one skilled in surgical procedure.

Tuberculosis of the Udder.

Usually tuberculosis infection of the udder may be distinguished from other udder infections by its gradual onset and chronic course, as well as the fact that it rarely occasions the animal any pain or inconvenience. Tuberculosis of the udder usually commences well up in one or both rear quarters, and may involve the lymph glands situated above and back of the two rear quarters of the udder. The organ itself becomes progressively hard and swollen, sometimes acquiring enormous size. Milk secretion appears normal until the infection has progressed considerably,

when the milk becomes thin, watery, and scanty, and contains flaky and stringy material, and possibly blood and pus.

This disease, however, may go on unrecognized for years; meanwhile the animal continues to yield milk containing tubercle bacilli, thus endangering the health of other livestock as well as human lives. In case of mammitis that is considered possibly of tuberculous origin, it is advisable to isolate the individual and have the tuberculin test applied at once.

There is no known cure for this disease. In the diagnosis of tuberculosis of the udder no single method is completely satisfactory. The tuberculin test may be relied upon to demonstrate the presence of the disease in the animal, but it is impossible by this means to detect the location of the infection. If a physical examination of the udder corroborates the positive tuberculin reaction, added significance may be attributed to the suspicion of udder tuberculosis. Finally, milk samples from suspected udders may be submitted to a bacteriological laboratory for examination.

Actinomycosis of the udder, caused by the same organism as lumpy jaw, is not so common as tuberculosis, but is sometimes mistaken for it. Definite diagnosis requires a bacteriological examination.

Cowpox.

Cowpox is an acute, contagious disease accompanied by a slight fever and a typical eruption which is usually confined to the teats and udder of the cow. The lesions first appear as small, red papules or nodules, which later resemble blisters and are filled with a clear fluid. The third or pustular stage is marked by the change in the character of this fluid to a puslike appearance and consistency. The fourth stage is that of drying or dessication of the pustules.

The disease is usually spread by the hands of the milker and may break out on the cow about seven days after exposure. Cowpox is so mild and so lacking in serious consequences that in many herds its presence is either totally ignored or at least is taken for granted. Nevertheless

the presence of the sores on the udders and teats renders milking somewhat painful to the cow. To avoid aggravating and prolonging the condition, therefore, the operation of milking should be accomplished with great gentleness, and may be facilitated by the use of the milking tube. The milk should be discarded.

Treatment—The animal so affected should be isolated and milked last, with usual antiseptic precautions to protect the hands of the milker from the infection. Twice daily the affected area should be bathed with a 3 per cent solution of granular hyposulphite of soda. Once every day or two the pustules may be touched with tincture of iodin or a 5 per cent solution of silver nitrate.

Chapped Teats.

Chapped teats are caused by any irritation, such as sudden chilling after the sucking of the calf, "wet milking and prolonging the condition, therefore, the operation stable, wet bedding, overstocking, exposure of tender skin to sun rays in summer, or freezing in winter, etc. The skin is first rough and inclined to scale, and later wrinkles are formed, which become hard and deep and presently break into raw fissures.

Treatment—Favorable conditions, such as dry quarters and bedding, cleanliness of the udder, and "dry milking," should be assured. Some reliable antiseptic wash may be used, after which the chapped surface should be painted (once daily) with compound tincture of benzoin or a mixture of 1 part of tincture of iodin and 4 parts of glycerin. It may be advisable to anoint the teats with petrolatum before milking, and to use a sterile milking tube so that the milk may be drawn with the least pain to the animal.

Warts.

Warts on the teats and udder form an annoying disfigurement as well as an obstacle to milking. While perhaps harmless themselves, they may lead to abrasions or fissures, thus exposing the skin of the animal to the invasion of blowflies or infections.

Treatment—Long warts may be removed by twisting or tying a silk thread tightly about the base of the growth. The wart will eventually slough off.

Repeated applications of glacial acetic acid or other caustic to the body of the wart have been successfully used in the removal of such growths. Care must be observed, however, to restrict this treatment to the objectionable growth, as these chemicals are very injurious to healthy skin. As a precaution, the normal area around each wart may be previously coated with petrolatum or tallow. A safer treatment is to paint the warts with collodion containing 15 per cent of salicylic acid. The collodion film is removed every 3 days and the growth is recoated until it finally sloughs off. The simple application of castor oil at two-day intervals is also said to be effective in killing warts.

Some warts require surgery for their removal. In such cases the after-treatment consists in painting the wound once or twice daily with tincture of iodin until well healed.

Tumors.

Tumors in the teat or milk cistern may be harmless growths, or simple connective-tissue enlargements due to interstitial mammitis or to a degeneration of the gland accompanying age. As a rule these growths are better not interfered with unless they become so large as to obstruct the milk flow or otherwise inconvenience the cow. Sometimes they may be reduced by the persistent external application of the tincture of iodin or an iodin ointment. If their surgical removal becomes necessary it should be undertaken only by one skilled in the principles of veterinary surgery, and not until the cow has been dried off. Under the most favorable circumstances, surgical treatment of the udder involves the danger of a serious infection of the organ.

Tumors within the body of the udder, and sometimes in the milk cistern, may be tuberculous. Such a suspicion may be dispelled only by the animal's failing to react to the tuberculin test. A tuberculous growth in the udder is be-

yond remedy and constitutes a real menace to the health of persons and livestock. Seek veterinary advice.

Stricture, or Hard Milking.

Hard milking is due to an obstruction or stricture, sometimes within the milk duct, but usually at the teat orifice. It may be brought about by a tenseness of the teat orifice, or by scar formation following an injury of the teat.

Treatment—There are on the market several types of teat dilators, any one of which may be of benefit in correcting this condition. The dilator may be inserted an hour or two before milking, but the instrument should be sterile and the teat thoroughly cleansed before its insertion. After milking the affected teat should be massaged with petrolatum into which 10 per cent of the fluid extract of belladonna has been incorporated. The alternate use of the ointment and the dilator should be continued until the condition appears to be corrected.

When this treatment fails it may become expedient to resort to surgical measures for the relief of the stricture, but this is done to better advantage after the cow has been dried off, involving a better prospect of prompt healing, and less likelihood of causing a dangerous infection or a leaky teat. The instrument used for this operation is known as a teat bistoury, consisting of a small shaft containing a concealed blade. After the bistoury is thrust well into the teat the blade is uncovered and the instrument is rapidly withdrawn thus severing the obstructing tissues at one stroke. This procedure is usually repeated three or four times in each teat that is hard to milk, turning the blade in different angles each time. Great care must be exercised to have the instrument sterile for this operation, to avoid introducing infection into the udder. A word of caution to be taken into consideration is that this operation may result in an excessive large teat orifice, and is sometimes productive of the unfortunate condition known as leaky quarter.

Atresia (Blind or Imperforate Teats).

Atresia is a defect existing from birth, and is seldom, if ever, discovered until after the heifer has freshened.

The owner's suspicion is first aroused when one or more quarters become abnormally large, hot, and painful, while the efforts of the calf to obtain nourishment are evidently unsuccessful. Examination usually reveals the fact that the teat orifice is wanting, but there will be seen clearly a distinct ring surrounding the slight depression where the teat orifice should be.

Treatment—Treatment is obviously surgical. The orifice may be artificially established by means of a large, sterile needle or a small-bladed knife thrust through the sterilized skin perpendicularly at the center of the depression.

To prevent closure by healing, it is advisable to insert a milk tube, with usual precautions as to sterilization, at milking time, and to replace it between milkings with a sterile teat dilator, or even a strand of antiseptic tape, to act as a seton.

Healing may be promoted by the application of an ointment of the balsam of tolu, or the fluid extract of belladonna and glycerin. Should the opening become sealed during the healing process, it will become necessary to repeat the process already described.

Insect Stings.

Cattle are more or less liable to the stings of bees, wasps, or hornets while grazing among clover, alfalfa, or other blossoms. The udder is a frequent point of attack because it is not so well protected by hair as other parts of the body, and, on account of its pendulous position, is more readily accessible to the aroused insect. The sting injects beneath the victim's skin an actively poisonous secretion which is highly irritating and which may eventually prove detrimental to the health and life of the skin. Insect stings, when inflicted in sufficient numbers, have been known to produce a severe, nervous depression, or even the death of the victim.

Treatment—The injured area should be bathed in a 4 per cent solution of amnonia or a potassium permanganate solution. Internal stimulants may be administered in the

form of fluid extract of nux vomica, one-half dram, three times daily.

Snake Bites.

The symptoms of snake bites are local swelling and inflammation, suppression of milk, fang wounds, systemic weakness, depression, blue membranes, and later coma or convulsions and possibly death. In the event of survival, abscess formation or sloughing of tissue at the point of injury may develop later.

Treatment—Thoroughly cleanse the wound with dilute ammonia or a 1 per cent potassium permanganate solution. Endeavor to prevent the absorption of venom by the excision of the wound, cauterizing it, or painting it freely with tincture of iodin. The effect of the toxin on the system should be combated with internal administrations of alcohol, coffee, digitalis, strychnin, or aromatic spirits of ammonia. An antitoxin for the counteraction of snakebites has been placed on the market.

Wounds or Contusions.

Wounds of the udder may be caused by barbed-wire cuts, brier cuts, nail snags, long and jagged finger nails of milkers, bites of dogs, the trampling of teats under the hoofs of other cattle, high barn doorsills, fence jumping, goring, etc.

Treatment—Cleanse the wound and keep it clean. If the skin is laid open or the wound is gaping, the underlying tissue should be thoroughly cleansed with an antiseptic solution, the hair should be shaved or clipped from around the injury, and the lips of the wound should be brought together and held in position by means of sutures or strips of adhesive tape. Tincture of iodin should be applied at intervals. In case of pus formation, suitable drainage should be provided, and the wound dressed frequently to prevent the germ-laden discharge from reaching the teat orifices, as such a contingency might involve the infection of one or more quarters, with disastrous consequences.

Leaky Quarter and Fistula.

When a heavy-milking cow comes up to the barn with milk dripping or streaming from one or more of her distended quarters, the wise keeper realizes that the animal should be milked three or even four times daily instead of twice. Cows of only moderate production may likewise leak milk at times if their milking is long delayed or their capacity of retention is otherwise abnormally taxed. Persistent loss of milk through teat leakage, however, is not only annoying but very unprofitable for the owner.

Chronic leaking is probably due in most cases to weakness of the teat orifice, to a fistula of the teat, or to the effects of a previous operation for the relief of stricture or other teat obstruction.

Weakness of the teat orifice may be overcome sometimes by the local application of tincture of iodin or saturated alum solution twice daily. The common practice of stopping a leaky teat with a rubber band or tape, or inserting a plug between milkings, is inadvisable, as it only tends to aggravate the weakness of the part or to increase the size of the opening. Flexible collodion, into which has been incorporated 1 or 2 per cent of metallic iodin, may be used to seal the teat orifice, twice daily, or immediately after milking.

Teat fistula, due to injuries, constitutes a common and annoying form of teat leakage. Efforts to reduce a teat fistula, however, had better be postponed, if possible, until the milking period of the animal has been terminated. The procedure, which is a surgical one, consists in scarifying the edges of the fistulous opening, bringing the lips together, and suturing them into place to establish a closure of the aperture by healing. This operation should not be attempted by one unfamiliar with the principles of surgery, however, as skill and surgical cleanliness are absolutely necessary, while at the best there always remains the danger of establishing a serious infection of the gland. The after care consists in bathing the wound several times daily with a sterile 1 per cent solution of table salt or a mild antiseptic solution.

If a cow in full flow of milk should receive a barbed-wire cut or other injury to the teat which would probably develop into a fistula, the correct procedure would be to suture the wound immediately rather than to await the drying off of the animal and risk the consequences of a leaky quarter. The milking tube under these circumstances should always be inserted before attempting to draw milk from an injured teat.

Rudimentary extra teats should never be removed surgically unless for a compelling reason, as it is a very common source of leaky udders.

Bad Flavors and Odors of Milk.

Bad flavors and odors of milk are multitudinous in their nature and origin. Some cases are unquestionably brought about by unsuitable feed in the stall or pasture, others probably result directly from a diseased condition of the gland, while in many cases bad flavors and odors are caused by contaminated milk pails.

Occasionally a cow that is within from one to three months of calving yields milk that imparts a bitter taste when made into butter. Cattle on an impoverished pasture may yield bitter, bad-smelling milk as a result of consuming large quantities of some acrid or pungent weed. An excessively rich stall feeding, if long continued, may in time bring about undesirable flavors in the milk.

In case the milk of all cows in the herd is bad flavored, the probability is that the feed is the cause. If on inspection only a few individual animals are found to be yielding milk that is off in flavor or odor, it is the condition of these animals that is most likely responsible. If, however, the odor and flavor are at first normal, and after the milk has been allowed to stand for awhile become objectionable, the explanation will probably be found in infected milk pails or cans rather than in unsuitable feed or diseased udders.

To overcome such conditions it is first necessary to detect and remove the cause. If due to diseased udders, the animals may be isolated for treatment. If due to errors in feeding, the errors must be rectified. If due to bacterial contamination, it must be prevented by the thorough ster-

ilization of receptacles, and other measures of sanitation in the routine operation of milking.

Bloody Milk.

Bloody milk is a symptom of any of the following conditions: Mammitis, injury to the udder, hardening or induration, tuberculous infection of the udder, the eating of acrid or irritant feed, or an excessive allowance of protein feed. The operation of milking also may aggravate a tendency to hemorrhage if the udder is injured or inflamed.

Treatment consists in determining the cause, if possible, and in applying the remedial measures found elsewhere in this bulletin. The application of the following general treatment may be sufficient to afford relief in mild cases:

Completely milk out the udder at least four times daily, at regular intervals; bathe the udder with cold water, then dry and apply camphorated oil to the quarter with gentle massage; avoid an excessively rich diet; encourage the animal to utilize as bulky a ration as is consistent with her milk production; administer an occasional dose of Epsom salt (about 1 pound) as needed, also a half ounce of saltpeter once daily. Should the hemorrhage persist, inject several ounces of a sterile 2 per cent tannic acid solution at blood heat into the affected quarter by means of a milking tube attached to a fountain syringe.

Redness of milk which does not appear until several hours after milking is probably due to contamination of the milk with some one of the chromogenic (color-producing) organisms.

Ropy Milk.

Milk sometimes is ropy, stringy, or slimy. The cause may be in some irritant forage to which the cattle have access, or other error of feeding, or the condition may be of bacterial origin.

Treatment—Affected animals should be stall-fed on a properly balanced ration, or pastured on an abundant, suitable growth in a well-drained meadow. Each animal may receive a daily drench of Epsom salt, 2 ounces, and bisulphite of soda, 2 drams, in 1 quart of water.

If the unnatural condition is found to be acquired after the milk is drawn, it is probably due to lack of cleanliness at some stage of the handling of the milk. In this event, efforts should be directed toward the disinfection of utensils, and other sanitary measures.

The prompt pasteurization of new milk at a temperature of 140° F. for 30 minutes should protect it from becoming viscous or assuming other undesirable properties ordinarily attributable to bacterial action.

Milk Stone, or Calculus.

Milk stone, or calculus, is a term loosely applied to concretions in the udder. Some stones are formed by coagulated casein and may be an indirect result of udder inflammation, while others are simply accumulations of lime salts from the milk, which sometimes may be distinguished by the occasional discovery of gritty particles in the bottom of the milk pail or on the strainer cloth.

Treatment—After a prolonged, gentle massaging of the teat extremity with an ointment containing 10 per cent of the fluid extract of belladonna leaves, the concretions, if not very large, may be passed with the aid of a sterile spring teat dilator. The injection of a small quantity of sterile olive oil into the teat may assist materially in the removal of the obstructions. In case the stones can not be removed in this way it may be necessary to remove them by means of an opening in the side of the teat. This operation should not be undertaken by the inexperienced layman, as the danger of seriously infecting the udder by insanitary procedure can not be overestimated, as well as the extreme likelihood of leaving a fistulous, leaky teat. Unless the concretions are sufficiently large to constitute an obstruction, their surgical removal, even by a veterinary surgeon, had far better be postponed until the cow has been dried off.

Agalactia, or Suppression of Milk.

The disease known as agalactia, or suppression of milk, is not infectious in cattle, as it is in sheep and goats. Neither is it so common. Occurring, as it usually does, at calv-

ing time, agalactia seems to be unfavorably influenced by such predisposing causes as indigestion, loss of appetite, mammitis, insufficient or unsuitable feed, plant poisoning, severe insect stings on the udder, thirst, enforced driving, fear or excitement, or the removal of the calf. Incidentally, agalactia is a reliable symptom seen in rabies in the cow.

Treatment—The animal, if a heifer, should first be examined for the possibility of atresia, or imperforation, of the teats. Eliminating this possibility, the attention should be directed toward determining, if possible, the contributing cause or causes, which should receive prompt attention.

The animal should be surrounded with an environment most conducive to her comfort and complete satisfaction. She should be supplied with an abundance of fresh, clean, drinking water, and have a generous allowance of a ration, preferably in the form of a warm mash, calculated to stimulate milk secretion. Milk secretion may be assisted by the repeated administration of strychnin, one-half grain, and pilocarpin, 1 grain, in water at five-hour intervals, until six doses have been given. Massaging the udder with lard or an ointment containing extract of belladonna leaves may assist in bringing her to her milk. Efforts should be made to milk her twice daily, at regular milking time, even though the efforts are unrewarded. If the calf is brought to her side shortly before milking time, this additional appeal to her maternal instinct may have the desired effect.

Milk Fever, Puerperal Fever, or Parturient Apoplexy.

Milk fever sometimes follows calving in fleshy or heavy-milking dairy cows. It is characterized by its sudden appearance and its acute course. The animal becomes paralyzed and passes into a semi-conscious or unconscious condition, which may terminate in death. The cause of the disease is unknown, but that it is predisposed by such causes as a highly developed milk production, an excessively nourished condition, and lack of exercise, is beyond question.

The symptoms of milk fever are characteristic and

easily recognized. Soon after calving, the cow may exhibit signs of excitement and anxiety, after which constipation and colickly symptoms may be manifest. The owner hay notice a staggering gait, and weakness, especially of the hind quarters. Eventually the cow, no longer able to maintain the standing position, goes down and assumes the posture so characteristic of this disease, with the hind legs extended forward and the head thrown back toward the flank. A comatose condition may ensue, during which there is danger in attempting to administer medicine by the mouth, as the throat muscles are temporarily paralyzed and the material may pass into the windpipe and lungs. Pulse and respiration are weak and the temperature is more frequently subnormal than other wise. Death or recovery will occur within two or three days, or even less.

Prevention may be favored by the following measures. When the cow is dried off prior to calving she should be placed on a light ration of bran and a little oatmeal, supplemented with suitable hay and possibly some succulent roots or an occasional feed of silage or beet pulp. She should be housed in a dry, comfortable, well-ventilated stable, amid sanitary surroundings, properly bedded, and given sufficient and regular exercise daily up to the time of calving. Several days prior to calving she should receive a full dose of Epsom salt.

Treatment—This consists in the inflation of the quarters of the udder with sterile air and tying the teats with broad tapes until several hours after the animal regains its feet. The operation must be performed with the utmost regard for cleanliness. A clean cloth should be laid beneath the udder, which is then washed clean and sterilized with 5 per cent carbolic-acid solution.

The apparatus consists of a rubber-bellows arrangement attached to a rubber tubing, which in turn is connected with a hollow-metal cylinder containing sterile cotton for the filtration of the air. Another rubber tube is attached to the other extremity of the metal cylinder, and at the other end of the rubber tube is the metal teat catheter. The last tube and metal catheter should be thoroughly sterilized by

boiling and the hollow-metal cylinder should be loosely packed with sterile cotton.

The catheter is then inserted into one of the teats of the previously disinfected udder, and the rubber bulb is operated by repeated compressions until the quarter is well inflated. Massage of the quarter during inflation will assist in filling the recesses of the gland with the sterile air. The catheter is then withdrawn and the teat tied with broad tape. After the inflation of all four of the quarters the veterinarian will have opportunity to attend to any complications which may have arisen, or to administer hypodermic doses of strychnin, caffein, or other stimulants which may be indicated. Medicinal treatment is usually superfluous, however, in uncomplicated cases of milk fever. Following the sterile-air treatment alone, it is no uncommon experience to find the cow on her feet from 30 to 60 minutes later, eating hay as though there had never been the slightest disturbance of her normal condition.

Should the first treatment fail to give relief, the procedure should be repeated, as the air previously injected may have escaped or become absorbed. Following recovery, the tapes may be removed in about 5 hours. The air should remain in the udder for 24 hours, after which time it should be completely extracted by the manipulation used in milking. It is then safe to permit the calf to suck.

The milk-fever apparatus described above may now be obtained from many sources, as, for instance, dairy supply houses and mail-order concerns. Every herd owner should possess such an outfit as a matter of insurance.

STORING SOFT CORN

Live-stock feeders agree that the best plan for storing soft corn is to put it in the silo. Farmers who do not have enough silo capacity to handle all their corn crop in this way can save the most valuable part of it by making silage out of the ears. Silos can be used for storing and drying ear corn for commercial use, as will be described later.

Pit Silo Has Possibilities.

The pit silo offers a possibility whereby farmers without standard silos may be able to save part or all of their soft corn. This type of silo can be built cheaply and has been used successfully in many localities. The use of it, however, is limited to a well-drained location. It is best adapted to dry regions and gives the most satisfactory results where there is loess soil, which does not cave in to any great extent. If the place where the silo is to be located meets these requirements, it is only necessary to dig a hole similar to a cistern, plaster the walls, put on a top, and the pit silo is complete. In the loess section of Illinois, such a silo would be worth considering for the storage of soft corn.

The pit silo sometimes is made in the form of a trench. This type has not been used in Illinois, but is used in the dried sections of the country and has been recommended for soft corn by the Minnesota Experiment Station. The use of this sort of silo in Illinois is advocated only in an emergency.

Under ordinary soil conditions two men with four horses can dig a trench silo of 200 tons capacity in five days. A trench ten feet wide, eight feet deep, and eighty feet long should hold about 100 tons of silage. If the trench silo is being built in soil that has a tendency to cave, the danger of this may be lessened by giving the walls of the trench a slight slope. Silage that is put in a trench of this kind is spread in the usual way and thoroly packed by leading a horse back and forth on it.

The octagonal silo, shown in Fig. 1, is a cheap emergency silo that can be built easily. When carefully built

this silo will preserve corn in good shape. The cost of it is slight compared with the saving in feed.

Silage Best Made Before Frost.

Soft corn that is to be made into silage should be put up before it freezes, if this is at all possible. It is difficult, however, to anticipate killing frosts, and sometimes corn is badly frozen before cutting. In such cases the crop should be cut just as soon as possible after the frost. Frosted leaves soon dry out, winds blow them off, and the consequent loss of feed is heavy. Even if the corn cannot be put into the silo immediately, it should be cut as soon as possible after frost.

It is advisable to wilt very immature corn for a period of one to four days, depending on the weather, before putting it in the silo. This may be done without injuring the corn by leaving it on the ground, provided the crop is cut with a corn binder and thrown off in bundles. If the cutting is delayed for some time after the corn has been frozen, the wilting will not be necessary.

When corn is badly dried out after freezing, some water may have to be added to the silage to get enough moisture in it to pack and exclude air.

As has been pointed out, farmers with limited silo capacity can save the most valuable part of their soft corn crop by making silage out of the ears. They can be husked out and put in the silo alone, or merely snapped and the ears and husks both made into silage. In either case the ears are run thru the silage cutter. Those having approximately 60 percent of moisture will not need additional water, but silage containing less than this percentage should be given all the water that the cut mass will absorb. This water can be handled thru the fan.

Cheapest to Dry Ear Corn in the Field.

Because of the lack of enough live stock for quick feeding and the limited number of silos, the big problem in saving soft corn on grain farms is to store it and dry it out to a point where it will not spoil.

Grain that is cribbed will not be safe from spoilage until the water content in it has dropped to 25 percent or less. The cheapest and best way to dry it out this much is to leave it in the field on the standing stalk. This method of handling soft corn is highly recommended in northern states. In fact, unless the corn is so immature that the silo would be the only practical means of handling the crop, it may be wise for those who intend to feed their grain to avoid the storage question entirely and let the corn stand in the field until it is needed in the feed lot, or else hog it down in the field.

In line with the plan of leaving soft corn in the field on the standing stalk, the Minnesota Experiment Station recommends that the crop be cut and put into small shocks when the ears have reached the milk stage. One advantage in doing this is that the shocked corn can be used during the late winter to fill silos for a second time, thereby doubling the yearly capacity of available silos. This may be a highly profitable practice in case of an emergency. Silage made from shocked corn is not so valuable as that made at the usual time, but is to be preferred over spoiled corn a little later in the season. When silage is made from shocked corn, from three-fourths to one pound of water must be added for every pound of corn.

Crib Drying May Be Necessary.

On some farms it may not be possible to leave the corn in the field until it has dried out enough to be safe for storage. When this is the case, the excess moisture must be removed, either by natural ventilation or by forced air circulation, with or without heat, after the grain has been cribbed.

Anything which will hinder the circulation of air thru corn in the crib will check drying and cause spoilage. For this reason special attention should be given to clean husking of the ears and to the way in which the crib is filled. The importance of this is brought out in a report made by a farm adviser during the last soft corn emergency:

"In many cribs the loss was caused largely by the pil-

ing up of silks, husks, and shelled corn," he reported. "Many farmers on examining a crib of soft corn find a cone-shaped pile of spoiled corn directly under the elevator chute where the silks and husks have collected. Where the air circulates freely, they find the corn in good condition."

Crib Ventilators Aid Drying.

Ventilators built from floor to ceiling thru the center of a large crib, which take air from the ends of the crib and the drag trench under it, virtually make two narrow cribs and are very effective in drying out corn. Mr. C. W. Raymond, of Watseka, is one farmer who has successfully used such a shaft in his crib. The shaft is built of two-by-fours about a foot apart, with boards nailed on them about two inches apart.

A vertical shaft, resembling a flue but not connected to the outside, is excellent for drawing the air out of the corn. The air in all parts of the crib can be kept moving by having air ducts lead into this vertical ventilating shaft. Many farmers have arranged such ducts by using strings of drain tile hung on wire, or held in place with slats. These ducts can be arranged, not only to carry the moist air out of the corn, but also to bring in drier air from the outside.

This particular ventilator is built of two-by-sixes placed two feet apart thru the middle of the crib. The frame made in this way can be covered either with slats or with woven wire. The plan shows tile leading to the ventilator to take out the moist air and additional tile extending to the outside wall of the crib to bring in drier air. The slanting pieces on which these tile are supported are one-by-threes. By placing the inlet tiles across the crib at intervals of four feet and the outlet tile one foot above and between them, an effective method of natural ventilation is provided.

The use of tile to ventilate corn cribs is practiced rather generally. Mr. Guy H. Husted, Scott county farm adviser, reports that farmers have used rows of tile two feet apart thru their cribs with good results. Still better results, no doubt, would be secured, by putting the tile in on a slight slope and connecting them with a ventilating flue.

Several Ventilators Easily Made.

Several types of ventilators, either in a horizontal or a vertical position, can be used effectively in drying corn. The type to use will depend on the material available. The ventilator can be made by placing two-by-eights from 8 to 12 inches apart and nailing slats across. The fact that air can enter freely at all four corners makes a very desirable ventilator.

In using ventilators in a horizontal ventilator scheme, the bed of the crib should first be covered about two or three feet deep with corn, and the first tier of ventilators then placed on the corn, lengthwise of the crib. More corn should then be added for two or three feet and more ventilators placed, this process being continued until the crib is filled. These ventilators should be spaced from two to four feet apart, depending on the softness of the corn.

When the ventilators in the second set are being placed, they should be put midway between those in the first set and not directly over them. The ventilators in the third set go directly over those in the first set.

A-Shaped Ventilator is Good Type.

An A-shaped ventilator not only is giving satisfactory results in Illinois but also is being used with success in some of the other corn-belt states. The chief point to keep in mind in building such a ventilator is to build it high enough so that the distance thru the corn is about the same at all points.

Artificial heat can be used with such a ventilator to hasten the drying of the corn. The heater or stove can be placed outside the crib and the heat brought in thru the end of the ventilator, or the heater placed right in the ventilator. If the latter is done, it is essential that the ends of the ventilator be closed, so that the heat will pass up thru the corn. The heater also would have to be at least partially incased with sheets of asbestos or tin to prevent fire. Where a boiler is available, steam pipes would be satisfactory for heat.

In addition to the different methods for vetilating corn, there are several simple schemes for aerating it in the crib. Mr. R. L. Eyman, farm adviser of Jersey county, suggests the use of rails. By sloping the rails, posts, or whatever timbers are used, to the outside, an air passage is formed with the settling of the corn, making it possible for the moisture and heated air to discharge from the center of the crib.

Forced Heat Best for Rapid Drying.

For rapid drying, artificial forced heat is much better than either natural ventilation or aeration. It is not necessary, however, to heat air that is forced thru the cribs, so long as the outside air is reasonably warm and dry.

The Iowa Experiment Station found that the moisture content of cribbed corn can be reduced from more than 30 percent to less than 10 percent at a cost of about three cents a bushel for fuel and power. These results have been secured by forcing air heated to temperatures varying from 160 to 180 degrees Fahrenheit up into the middle of the crib.

The air is first forced into the chamber of a furnace, where it is heated, and is then forced into the crib with an exhaust fan or blower. The Iowa Station reports that an average crib 48 feet long can be equipped with conduits and ventilators at a cost of less than $40 for material and labor.

DeWitt Farmer Has Heating Plan.

A plan used some years ago by Mr. E. M. Thorpe, of DeWitt county, in heating an ordinary crib, makes it possible to use an old furnace, an ordinary heater, or a stove.

Mr. Thorpe placed his stove at one side of the crib and surrounded it with a sheet-iron jacket similar to a warm-air furnace. A 12-inch pipe connected the stove with the ventilator, and an upright pipe at the far end of the ventilator was used in getting the air moving. After the air started circulating, this pipe was closed and all the warm air allowed to pass thru the corn. Mr. Thorpe re-

ported good results with this plan, but would have secured better results had the stove been placed three feet lower, or under the crib.

If the stove is placed under the crib, the floor should be slatted, or else have a slatted sub-floor thru which the heat can enter. Since the heated air will pass out thru the points of least resistance, it is necessary to take proper precautions, so that all warm air will pass thru the corn.

Drying the corn by merely forcing air thru it is practiced generally by seed-corn men and to a certain extent by farmers. Some farmers have successfully used a silage-cutter blower for forcing air thru bins of ear corn. Where electric power is available, a small electric fan could be operated at little expense with considerable benefit.

Value of Salt Doubtful.

Salt nas been recommended for a long time as an aid in preserving soft corn in the crib and has been used with varying degrees of success by Illinois farmers. In some communities, all those who have used salt on soft corn recommend it, while in other communities there is no enthusiasm for the practice. If salt is to be placed on soft corn when the crop is being cribbed, from a half to one pound of salt for each 100 pounds of corn is enough. The salt should be distributed evenly thruout the crib. All ribbons, silks, and badly rotted ears should be discarded.

Ear Corn Can Be Stored in Silos.

Some have advocated storing and drying ear corn in silos. This can be done if a slatted floor is put in the silo about six or eight feet from the bottom. The corn can then be stored in it and dried out either by a heater of some sort placed in the bottom of the silo or by forcing the circulation of air with a fan. This method of drying corn has been patented.

FEEDING SOFT CORN.

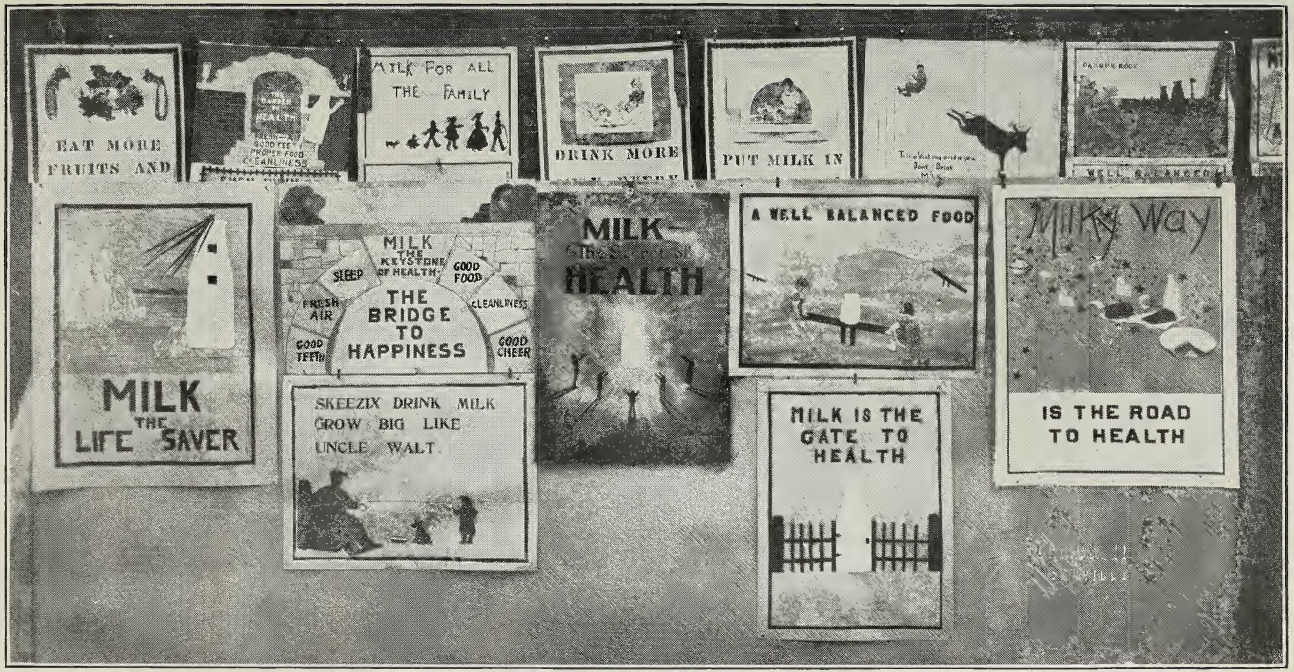
The general opinion among experienced livestock feeders is that the most satisfactory method of marketing soft corn is thru feeding it to live stock. They are agreed, however, on only one point when it comes to deciding the relative feeding value of soft and mature corn. On a pound-for-pound basis, they are agreed that soft corn is decidedly inferior to mature corn in fattening operations. The extent of the inferiority depends upon different factors, chief of which are the stage of maturity, the moisture content of the corn at the time of the first killing frost, and the condition of the corn at the time it is fed.

So far as the dry matter is concerned, chemical analyses of the entire ear show that the percentage of different nutrients in soft corn is about the same as the percentage in mature corn. These analyses, however, do not prove that there is no difference in the quality of these nutrients and cannot be cited as conclusive evidence that the dry matter of soft corn is on a par with the dry matter of mature corn in actual feeding value. For one thing, the more immature the corn the larger will be the proportion of these nutrients in the husk and cob and the smaller the proportion of them in the grain.

Can Determine Worth of Soft Corn.

There should be no hesitation about feeding soft corn when it is in good condition, but its feeding value should not be overestimated. To determine this value, it is necessary to know the percentage of water in the corn in question. Elevators usually have the necessary equipment for determining this percentage, and there shuold be no trouble in making the calculation.

After the moisture content of the corn is known, the relative value of it, which will be an indicator of its feeding value, can be determined by placing a ruler (transparent if available' on the page in such a way that it will connect a point on the left-hand perpendicular, where the moisture



PRIZE WINNING POSTERS

Out of the Hundreds Submitted by School Children of Danville and Vermillion County.

content of the corn is shown, and a point on the inclined line, where the prevailing price of No. 1 corn is shown. The highest value that can be placed on the soft corn without making the dry matter in it cost more a pound than the dry matter in No. 1 corn will be shown at the point where the ruler intersects the right-hand perpendicular.

It should be pointed out that this figure is not necessarily the price at which the soft corn in question **could** be sold. From a practical standpoint this figure might be greatly reduced, because of factors other than moisture content, such as spoilage that has occurred or the risk of spoilage in storage.

Ear Silage Makes Good Feed.

Should the corn crop be soft this year, a big percentage of it no doubt will be made up into ordinary silage. The value of silage made in the ordinary way and the best methods of feeding it are so well known that this method of utilizing soft corn needs no comment here. Limited silo capacity, however, will no doubt force many farmers to ensile only husked or snapped ear corn. The Iowa Experiment Station reports satisfactory results from the ensiling of husked ears, while a number of tests have been made with snapped ear corn silage at the Illinois Station.

Satisfactory results were secured in three out of four feeding trials at this Station in which snapped ear-corn silage formed the basis of the ration. In two successive seasons this type of silage produced satisfactory gains when fed to fattening calves, and a third season it gave satisfaction when fed to yearlings. Very poor results were obtained the fourth season with calves. It should be pointed out that the snapped ear-corn silage was not definitely proved to be the cause of the poor showing made by the calves in the fourth trial. In fact, the cause may have been entirely aside from the ration fed, as satisfactory results were obtained with two other lots of calves on similar rations.

Despite the poor showing made by the calves on the snapped ear-corn silage during the last year of the test,

the results obtained in the three other trials indicate that silage made from snapped ear corn is a satisfactory and economical feed. It was concluded after the four tests that the ensiling of snapped ears is one of the best methods of storing soft corn. The grain is no better preserved than in normal silage, but more of it can be stored. When the snapped ears alone are ensiled, from two to three times more grain can be stored in the same space than could be stored if normal silage were made.

Extra Grain Feed May Be Needed.

One of the main points that should be kept in mind in the feeding of silage made from snapped ears is that the green husks and silks, which are roughage, make up about one-fourth of the weight of the snapped ear and that a big percentage of its remaining weight is water. For this reason, it may be hard for cattle to eat enough of the silage alone to get the proper amount of dry matter for the most rapid and economical gains. When this is the case, it may pay to supplement the silage with some other grain. Oats may be used for this purpose when shelled corn is not available. This plan works out nicely, for a typical soft-corn year usually is a good oats year. Such is the case this season.

In order to increase the consumption of dry matter when soft corn is being fed, some feeders recommend frequent feeding. This may pay where the cost of the extra labor used does not run too high.

This problem of getting live stock to consume enough dry matter for the most rapid and economical gains can be partially solved by the way in which the soft corn is stored. In the case of ear corn, for instance, well-ventilated cribs and cribs with special drying equipment aid in drying out the corn, thus increasing the percentage of dry matter consumed when the grain is fed.

Corn that is to be used in finishing off hogs and cattle during the latter stages of the fattening period had best be stored in cribs and dried out instead of being ensiled. It should be remembered, however, that the problem of pre-

serving the grain in a wholesome condition is much simpler with the silo than with most other methods.

Hogging Off Should Start Gradually.

If corn is left standing in the field and hogged down, or fed in the same way to cattle and sheep, special care must be taken to get the animals accustomed to the feed before allowing them free access to the field. In fact, it always is in order to make changes in fattening rations gradually, and the need for care in adding large amounts of soft corn to the ration is generally recognized.

In the light of what is known at the present time, it does not seem safe to recommend soft corn in any amount or form for horses.

More Protein Needed with Soft Corn.

Feeding trials in Iowa indicate the advisability of using more protein supplements with soft corn than is necessary for best results with mature corn. In one trial where self-feeders were used in comparing soft corn and tankage with mature corn and tankage, the hogs receiving soft corn ate 50 percent more tankage than those receiving mature corn.

Another study made in Iowa of the utilization of soft corn for fattening steers led the investigators to recommend that from 10 to 20 percent more protein supplement be fed with soft corn than with mature corn for cattle feeding. A safe rule is to feed a little more than would be used with the same class of live stock receiving mature corn.

THE TOLL OF TUBERCULOSIS.

By J. A. Kiernan and L. B. Ernest,

Tuberculosis Eradication Division, Bureau of Animal Industry.

The practicability of eradicating tuberculosis of cattle and swine has been demonstrated in a number of herds in practically every state. Herds which have contained a very high percentage of diseased animals have been freed of tuberculosis by systematic testing and the removal of reactors, and afterwards have been maintained on a healthy basis. Likewise, herds which at the outset of the control work were but slightly affected have been cleaned up and kept as healthy herds.

Responsibility of Owners.

Many owners pay as strict attention to their healthy herds as though tuberculous animals had been found in them. Such owners have had their animals regularly tested and have not permitted animals from outside sources to be brought into the herds until they have been proved free from tuberculosis. This is the proper attitude for the owners of herds to take.

The responsibility for free herds and for keeping them free from tuberculosis rests on the owner and not on the State or Federal authorities. Obviously there is not a sufficient number of State and Feedral inspectors to test all the cattle in the United States, nor is it desirable to try to conduct the campaign on that basis. There should be a sufficient corps of State and Federal inspectors to assist the owners in eradicating the disease, but the greater part of the work should rest on those whom it will benefit most. In practically every section of the United States there are qualified veterinarians who will test cattle with tuberculin

and who can advise how to handle the herd so as to free it from the disease or to keep it free.

The Accredited-Herd Plan.

The accredited-herd plan, by which owners of tuberculosis-free herds receive State and Federal recognition, has met the approbation of breeders of cattle all over the United States, and it is reasonable to expect that this plan will be followed until most of the purebred herds of the country are under supervision. The accredited-herd plan has been conducted only in a general campaign, without concentration of effort in any particular locality; but it would be advantageous for a county having a large number of purebred herds to make an effort to have the tuberculin-testing work extended to every herd in the county.

The advantages of such a plan are readily understood. It would call the attention of prospective buyers all over the United States to the possibility of a wider field for choice of purebred cattle in the numerous herds accredited, and there can be no doubt that cattle in such a locality would sell at better prices because buyers would save a great deal of time by not having to look up animals from scattered accredited herds.

Facts Regarding Losses Due to Tuberculosis.

No discussion of a better and larger live-stock industry of the Nation can be complete without consideration of live-stock losses directly attributable to tuberculosis. It is imperative that these losses be reduced. A campaign for the control and eventual eradication of this disease was started in May, 1917, by forming the Tuberculosis Eradication Division of the Bureau of Animal Industry. The results obtained by 2½ years of systematic control effort indicate that there has been an appreciable effect on the losses sustained from the disease.

The records kept by the department show that about 65 per cent of cattle and swine slaughtered in the United States annually are killed at official establishments where

Federal meat inspection is maintained. The number of cattle and swine slaughtered at official establishments during the fiscal years 1917, 1918 and 1919 and the number of carcasses condemned on account of tuberculosis were as follows:

Federally inspected cattle and swine carcasses condemned on account tuberculosis.

	Cattle			Swine		
Fiscal year	Slaughtered	Condemned	Pr. ct. condemned	Slaughtered	Condemned	Pr. ct. condemned
1917	9,299,489	46,351	0.50	40,210.847	76,807	0.19
1918	10,938,287	40,792	.37	35,449,247	59,740	.17
1919	11,241,991	37,600	.33	44,398,389	65,838	.15

The figures show a noteworthy improvement in the situation, yet the losses from condemnation are still large —much larger than they would be if every owner of cattle and swine were vigilant in combating the disease. It is known also that the per cent of tuberculosis among animals slaughtered at uninspected abattoirs is greater than that at federally inspected establishments. In addition there are other important though less conspicuous losses. The feed, for instance, given to diseased animals is practically wasted, because when they are slaughtered a considerable percentage of them must be disposed of for purposes other than food.

Besides the condemnation of cattle for tuberculosis at abattoirs, there is each year a considerable number of deaths among mature cattle directly attributable to tuberculosis. Likewise there is a considerable mortality from this disease among calves.

Had the spread of tuberculosis been allowed to continue at the same rate that it progressed from 1907 to 1917, by 1937 the disease would undoubtedly have exacted an annual toll from the live-stock producers of this Nation of one hundred million dollars, and this would have been only a part of the loss. Our splendid purebred and grade herds of cattle and swine would have been undermined by tuberculosis, and in consequence the reputation of the United States as a producer of high-class cattle and swine would have received an irremovable stigma.

In addition to the losses which can be rather accurately estimated from available records, there is an enormous loss due to this disease which can not be specifically determined. Many herds of cattle from which the owners derive a considerable revenue through the sale of the products are so badly affected that when they are submitted to an official tuberculin test from 50 to 90 per cent of the animals react to the test. The salvage obtained from these animals does not compensate for the loss, because, except in rare instances, cattle known to be diseased can be sold only for immediate slaughter. There is of course a wide difference between the beef price of an animal and its value as a producing or breeding animal. In most States part of this difference is met by indemnities paid the owner through the co-operation of the State and Federal Governments under the accredited herd plan.

However, the greatest loss in these cases is the loss of the milk and milk products which have been previously a source of income to the owners. The writers know of herds bringing a net profit of from $600 to $700 or more per month which were necessariily destroyed by reason of an unusually heavy infection. Such losses as these can not be accurately estimated for the country at large.

The breeder of purebred cattle is in an especially unenviable situation when a large percentage of reactors is found as a result of the test. Among a number of instances known to the bureau is that of a breeder who owned a herd of about 70, and as the result of the test lost 62 head. A majority of these reacting cattle were valued extremely high, but as he had no facilities for maintaining all of them under quarantine, it was necessary that 45 head be sent to a slaughtering establishment. This man estimated his loss at from $20,000 to $30,000.

Many instances of serious losses due to tuberculosis occur also in swine. A report was recently received showing that of 68 hogs shipped from a certain point in Illinois all were affected with the disease, and 33 of them were entirely condemned as unfit for food. Cases of this kind are not unusual.

Finally, the losses react upon the original owners, since most buyers of live stock know the infected areas and offer prices in accordance with that knowledge. In fact, such buyers will purchase animals only subject to a test, when they are from some areas known to be especially heavily infected.

How to Avoid Serious Losses.

The campaign to eradicate tuberculosis from live stock is now being conducted in 45 States in co-operation with the live-stock owners and the respective State live-stock sanitary officials. Arrangements are being made to have other States engage in the work. However, State and Federal officials can not prevent losses from the disease without the assistance and hearty co-operation of the owners.

The first step is for the owner to sign an agreement placing his herd under the joint supervision of the State and the Bureau of Animal Industry for the control of the disease; then skilled operators are detailed to conduct the test. Reacting animals should be promptly removed from the herd and either isolated or immediately slaughtered. Assistance is offered to insure a proper cleaning and disinfection of the premises formerly occupied by diseased cattle. The agreement entered into by the owner entails that he should submit his herd to a tuberculin test whenever deemed necessary by proper Federal or State officials and that no new cattle should be added to the herd after such tests unless the additions are properly tested and approved by these officials. The tuberculous cow is regarded as being the principal cause of infection in healthy herds; therefore especial care should be taken to purchase cattle only from those herds known to be free from the disease. One owner known to the writers failed to exercise this precaution and it cost him in one and one-half years 82 per cent of his fine grade herd and a revenue of several hundred dollars a month.

Cleaning Up Areas.

The individual efforts of owners to free their herds suggest the thought of entire communities or counties es-

tablishing free areas. This work is, in fact, now being taken up. If a county contains, say, 25,000 cattle and 250 of them are tuberculous, why not kill the affected ones and obtain a 100 per cent healthy county? Of course one test will not accomplish such a clean-up, but by a persistent effort a tuberculosis-free county may be attained.

This is proved by the results of the co-operative tuberculosis-eradication work in the District of Columbia. In 1909 the Commissioners of the District promulgated an order requiring a tuberculin test on all cattle within the District and on all intended for movement into this area. As a result of this co-operative work conducted by the Bureau of Animal Industry the per cent of tuberculous cattle has been reduced from 18.87 per cent in 1910 to 0.63 of 1 per cent in 1919, thus establishing an area practically free from the disease. If this area can be made free from the cattle plague, why not all the counties in States where the disease exists to a much more moderate degree than was found at the beginning of the work in the District of Columbia?

In time it will be possible so to reduce any area infected with tuberculosis in live stock that owners will find it unprofitable to keep infected animals or those suspected of being infected with that disease. Experience has shown also that the longer diseased cattle are kept in a herd the greater will be the loss when the clean-up campaign begins.

Methods of Testing.

The methods employed by the co-operating State and Federal officials include not only the application of the subcutaneous tuberculin test, to be followed by the proper cleaning and disinfection of the premises, but also include, in special cases of badly infected herds, the application of the ophthalmic and intradermal methods of tuberculin testing. The intradermal test can be and is profitably employed on range cattle or others which are difficult to restrain or on animals showing abnormal preliminary temperatures. The ophthalmic test has proved to be especially valuable

as a check test and has revealed a considerable number of cases of tuberculosis which had escaped other methods of diagnosis. In its application a disk containing the diagnostic tuberculin is placed in the eye of the animal. If the animal is not diseased no disturbance is indicated, but if infection exists there follows a characteristic formation of pus in the treated eye.

A problem of considerable importance is the tuberculin testing of cattle at public stockyards. Such testing is aimed to check traffic in diseased animals and to protect communities which have little bovine tuberculosis from infection by cattle that are diseased or of doubtful health. This condition applies especially to dairy stock and to breeding cattle, but in preventing interstate movement of tuberculous animals live-stock sanitary officials recognize the need for doing the work in the most expeditious manner.

Benefits Derived from Tuberculosis-free Herds.

Many inquiries have been made with a view to obtaining reliable information as to the comparative value of cattle known to be free from tuberculosis and those the health of which is not definitely known. Many breeders and livestock owners will not introduce animals into their herds unless they are reasonably certain that no tuberculosis exists in the herds from which the animals are taken. To such owners an animal of doubtful health has no intrinsic value and they will readily pay a premium for animals from accredited herds. For grade cattle $10 per head is a conservative estimate of the premium on animals known to be free from tuberculosis, and $25 per animal is likewise a reasonable estimate of the premium on purebred cattle. When these figures are applied to the total number of dairy and beef creeding cattle in the United States the reader will recognize the enormous toll imposed by this insidious disease.

It is reasonable to expect that within a few years American breeders will be selling for export many more breeding animals than are being exported at the present time. The degree of success to be attained in the future

export trade will depend largely on the class of animals now sold. If a reputation for producing cattle free from tuberculosis and other infectious diseases is established, American breeding stock will be in demand all over the world.

The United States breeders have knowledge of the areas in foreign countries from which it is safe to import animals, and also have information of certain localities and even of numerous herds out of which it would be dangerous to purchase animals on account of tuberculosis. It is only reasonable to expect that precautions based on similar knowledge will be taken by breeders of other countries to protect their live-stock industry from disease. The accredited-herd list of tuberculosis-free herds indicates to the foreign as well as the domestic buyer where he may obtain cattle officially recognized as free from that disease, and the time will come when prospective buyers will be reluctant to make speculative purchases from unlisted herds.

The following table shows the number of herds and the number of cattle in each State under supervision for the control and eradication of tuberculosis. It indicates also the location of inspectors in charge of this work. Owners desiring information on the subject of tuberculosis are requested to write to the inspector in charge of the work in the State in which the cattle are located.

Tuberculosis in Swine.

Eradicating tuberculosis from cattle will practically solve the problem of controlling the disease among swine. That is the opinion of veterinary experts experienced in the handling and post-mortem examination of swine received at the principal market centers. By means of a simple and practical marker, hogs may be tattooed with distinguishing letters and figures, and when disease is found by post-mortem examination the identity of such animals is known. With a simple system of records it is thus possible to trace a shipment to the farm from which it came and stamp out infectious diseases at their source. Evidence shows that

swine become infected with tuberculosis principally from cattle, either by following them in feed lots or pastures, by receiving infected dairy by-products, or by eating tuberculous carcasses.

JUDGING THE DAIRY CALF

R. E. Caldwell.

Unfortunately it is necessary to appraise the value of the larger percentage of our dairy stock from the standpoint of their possible usefulness through points of physical conformation rather than by means of actual production records. Not that it would be possible to rely entirely upon productive ability if such was universally available, but such information in combination with a proper physical make-up is a much more reliable guide in selecting breeding stock than is either of these two characteristics when judged individually.

In selecting a dairy calf the dairyman has only two types of recommendations to guide him, viz., the productive ability of its parents, and its physical form. Therefore, in selecting calves for the purpose of growing them into mature producing cows it is important that great care be exercised in analyzing these two avenues of information. Milk and butterfat records, when available and of authentic type, may be quite easily interpreted. Not so with regard to a study of physical design as it is reflected in the dairy form. Such knowledge is merely of a speculative character at best, although through the correlation of points found in high and in low producers the science of judging has been evolved, and a mastery of this science means much to the dairyman who would be a success as a breeder. The following discussion is limited to a study of the science of judging as it applies to the dairy calf.

Breed Characteristics.

Each of the dairy breeds of cattle differs markedly from the others in general appearance, although when observed in detail a surprising similarity of form is always evident. Each of the breed associations has established a

guide for its members, which contains information so designed that they may thereby work collectively toward a common end and, generation by generation, perfect the breed in uniformity of design as well as constantly strive to improve their ability as dairy individuals.

All breeds have to fill certain peculiar specifications, although in the main the requirements are similar.

Judging Individual Points in Dairy Conformation.

The science of livestock judging includes a consideration of each and every feature of the animal judged. Obviously, not equal emphasis is placed upon each feature; however, in the composite the degree of perfection of each item must receive due consideration. The method of appraising these features of physical design differs with each judge, and they are in no way fundamental so far as the final conclusions are concerned. In the following analysis each and every feature will be discussed as a judge may pass upon an animal, beginning with the head and gradually working toward the rear and ending with a consideration of the mammary system.

The Head.

The factors to consider in passing judgment upon facial features are the mouth, nose, jaws, eyes, ears, forehad, horns, general head dimensions, and facial expressions.

The mouth should be large, possessing a thick, overhanging upper lip. A calf having a small mouth usually consumes only a small quantity of feed and tends to have a delicate appetite. The size and shape of the nostrils should next be observed. If the calf has a large mouth, indicating food consuming ability, it should also have an ample air intake. The food when taken into the body is digested and carried by the blood stream to the lungs for purification. If this function is incompletely developed the food consumed is not as efficiently utilized as if an ample supply of air was available. Therefore, if these two features are to be correlated, a large mouth should be accom-

panied by dilated or expanded nostrils. Such features are the first factors to observe with respect to an animal's ability to efficiently utilize the food it eats. An animal possessing a large- broad-cut mouth and dilated, prominent nostrils, is endowed with one general feature found almost universally on high-producing cows, viz., a bell-shaped or flaring muzzle.

The Jaws.

The jaws are the initial grinding organs of the digestive system. They, therefore, should possess strength. This is displayed in the depth or width of the lower jaw bone. Such a feature gives the lower part of the head a thick, deep appearance on a line drawn vertically through the central part of the lower jaw.

The Eyes.

The eyes should be judged with respect to two points: First—their location and placement, and, second—their expression. With regard to the first feature, they should be set well apart, and housed in an extending or overhanging eye socket. Width between the eyes, together with a dish-like face is interpreted as an indication of intelligence. Eye expressions are of various types—the small, dark, highly active, nervous eye; the large, bright, mild, contented eye; and the colorless, depressed, sickly eye. Dairy performance demands health and a maximum of nervous ability, but, most of all, a contented, mild demeanor. Therefore, in judging calves, choose the one, all other things considered, that has wide-set, prominent eyes that express health and contentment backed by a nervous system fully under control.

The Ears.

The ears are indicative of the quality of the animal. If they are unusually large, thick, and covered with coarse, wavy hair, you will, doubtless, discover on other parts of the animal correlating features of coarseness. The ear

should be small, flexible, thin almost to the point of being transparent, and covered with a fine silky hair. If the animal is in the prime of health a waxy secretion should be evident in the interior lower portion of the ear. This secretion varies in color from a light amber to a dark butter yellow. The color of the secretion may be used as an index as to the color of the fat in the milk the animal may yield.

The Forehead.

The upper part of the face, or forehead, is as useful a guide in judging quality as are the ears. Frequently coarseness of the upper part of the head is the result of delayed breeding or the feeding of a ration excessively high in protein. However, this feature may be reduced through dehorning, although, if the hair is permitted to grow normally, it may be relied upon as showing the degree of natural refinement reflected by this part. Usually a heavy upper head is correlated with a general lack of refinement in all other features of the body.

The Horns.

The horns of young cattle are of less value in judging than are they with mature individuals. However, quality is again expressed in their texture, size, and shape. In each breed a certain horn design is preferred, and, accordingly, due knowledge of this breed fancy is necessary in order to pass fair judgment.

General Facial Dimensions.

A proper dimension of the face is, of course, essential for breed conformity. Each breed has an established ideal in this particular. For example, the Jersey should have a short, broad, dished face, while the Holstein is permitted to have a much longer, straight-cut countenance. These requirements are only obtainable through continuous observation of show-ring animals and a study of refinement and intelligence as displayed by large numbers of individuals in each breed.

Facial Expression.

The countenance of each and every dairy animal, as with the human countenance, expresses or reflects in a degree the character of the individual. In judging cattle the females should radiate from their facial expression a genuinely feminine appearance. Few calves, indeed, ever develop into high producers that possess a masculine or "staggy" appearance. Conversely, the males should reflect masculinity, their every feature expressing the fact that they are the masters of the species.

The Neck.

The neck is a guide in judging the coarseness of an animal. If a dairy cow has a heavy, bull-like neck it means that she is not truly feminine and that a portion of the feed she consumes is being directed by her from her milk producing organs to the maintenance of useless, unnecessary physical structure. The true dairy calf has a light delicately constructed neck, a large windpipe, and a small silky dewlap. Bulls on the other hand, should express their power and prepotency by possessing a heavy neck and crest, this, of course, developing as the age of the individual increases.

The Fore Quarters.

The fore quarters of the dairy animal include the withers, shoulders, fore legs and brisket.

The Withers.

The withers are made up of the two shoulder blades and the spine, or back-bone. If the spine extends above the level of the shoulder blades and they fit snugly down against the spine it produces a sharp, wedge-shaped formation of the withers desirable in dairy form. If the spine sets below the two shoulder blades the result is known as an open shoulder. Usually these three parts of the shoulder are almost level on the top and when so arranged there is danger of producing coarse, broad, beef-like withers, incompatible with dairy conformation.

The Shoulders.

The shoulders should be light, free from flesh, and obliquely placed. Heavy shoulders tend to extenuate the coarseness of the withers even though they possess the correct relationship to the spine. A heavy, fleshy shoulder is merely further evidence of lack of dairy temperament and indicates the use of an excessive amount of the feed consumed for body maintenance rather than milk production. The neck and shoulders should blend into each other without evidence of coarseness.

The Fore Legs.

The fore legs should be set wide apart, straight, short, and firm shanked. Heavy bones and excessive length destroy dairy form and usefulness. The legs should be straight, the toes extending directly parallel with the body. The chief undesirable tendency in dairy cattle, so far as the front legs are concerned, is to be slightly knock-kneed and the toes pointing outward at an angle. Such formation is a distinct weakness that is magnified as age advances.

The Brisket.

The brisket should be large, broad, deep, but not fleshy. The presence of a large quantity of surplus, flabby flesh is a discount in dairy form. The brisket should not be so large as to be noticeable in casually observing the animal nor so small as to produce a cramped, undeveloped appearance.

The Body.

In judging the body of a dairy calf observe in detail the chest, barrel, hock, skin, and loins.

The Chest.

The chest, or that section of the body directly in the rear of the fore-legs, should be deep, low, girt large with a full fore flank. The floor of the chest should be broad and almost flat, the lower line of which should be nearly on a line with the lowest point of the barrel or body. In dairy form the chest should appear in cross section as an oval rather than perfectly round as is preferred in beef cattle. In other words, depth rather than breadth of chest is the ideal formation.

EFFECT OF FEEDING TURNIPS ON THE FLAVOR AND ODOR OF MILK.

By C. J. Babcock, Assistant Market Milk Specialist, Dairy Division, Bureau of Animal Industry.

Object of the Experiment.

Dairymen realize the importance of succulent feeds in the ration of dairy cows and seek methods whereby a sufficient supply will be available the year round. Although silage and soiling crops are the most common succulent feeds, root crops are often found in the ration late in the fall and winter.

Like other succulent feeds, root crops may have a tendency to impart undesirable flavors and odors to the milk. In order to determine whether such flavors and odors are imparted to the milk, feeding experiments were conducted by the Dairy Division at its experiment farm at Beltsville, Md. The specific objects of the investigation were:

To determine whether feeding turnips affects the flavor and odor of milk.

If such is the case, to determine how turnips may be fed and the milk handled so as to minimize the effect, if objectionable, on the quality of the product.

Procedure.

The Cows.

The investigation was conducted with four Holstein and four Jersey cows. The cows selected were giving milk relatively free from abnormal flavors and odors, when fed the basic hay and grain ration. They were representative of their respective breeds, the average weight of the Jerseys being 935 pounds, and that of the Holsteins 1,290 pounds.

During the experiment the average daily milk production of the Jersey cows was 16 pounds, the highest individual daily average being 18 pounds and the lowest 14.1 pounds and the lowest 19.5 pounds. The average daily milk pounds. The Holstein cows gave an average daily milk production of 22.6 pounds, the highest average being 25.7 production of all cows was 19.3 pounds.

Turnips.

The turnips fed were mostly rutabagas or "Swedes." There were, however, a few cow-horn turnips mixed with them. The turnips were stored for a short time before feeding.

Feed Other Than Turnips.

In addition to turnips the cows received, in proportion to the amount of milk produced, varying amounts of the following grain mixture: Hominy feed, bran, and oats, 100 pounds each; cotton-seed meal and linseed meal, 50 pounds each. The ration was completed by feeding the cows all the cured alfalfa hay they would readily consume. This varied considerably, ranging from 9.7 pounds to 16.6 pounds, depending on the amount of turnips the cows were receiving. The average daily amount of alfalfa consumed was 13.8 pounds.

Method of Feeding.

The cows were divided into groups of two each. One group received only the basic hay and grain ration, and were known as checks. The other three groups received, respectively, in addition to the hay and grain ration, the following amounts of turnips:

15 pounds 1 hour before milking.

30 pounds 1 hour before milking.

30 pounds immediately after milking.

The cows were fed these rations for six days, then for one day no turnips were fed, after which the cows in the various groups were interchanged in order to equalize any

abnormal results due to the milk of an individual animal. The feeding of turnips was then resumed.

Milk Samples.

Samples were taken from the milk of each cow at the time of milking, given a key number and cooled, but not aerated. The samples were judged for flavor and odor by experienced judges, who had no knowledge of the key. An "opinion," as this term is used in the following pages, denotes the decision of the judge in regard to one sample.

Using the terd "off" to signify flavors and odors which the judges believed to be due to turnips, the following clasification was used: Normal; very slightly off; slightly off; off. When no off flavor or odor was perceptible, the sample was rated normal; and when an off flavor or odor was perceived the sample was rated according to the degree which the judge considered it to be off. The average consumer might have no serious objection to those samples rated as "slightly off;" and it is doubtful whether the flavors and odors rated as "very slightly off" would be noticed by persons other than those accustomed to judging milk and cream.

The Experimental Feeding.

Check Samples.

The check samples were taken from the milk of the check sows, which were fed only the basic hay and grain ration. A few off flavors and odors were noted in these samples, but they were very slight, and undoubtedly were instances of the slightly off flavors and odors which are frequently found in milk from individual cows.

Out of a total of 285 opinions obtained on 50 check samples, 97.5 per cent of the opinions on flavor and 94 per cent of those on odor showed a normal condition. All the off flavors and odors, that is, 2.5 per cent of the opinions on flavor and 6 per cent of those on odor, were rated as very slightly off.

Feeding 15 Pounds One Hour Before Milking.

Feeding 15 pounds of turnips, which constitute about half of a full feed, affected the flavor and odor of the milk. In a total of 254 opinions on 45 samples of milk produced by cows receiving this quantity of turnips, 30.7 per cent of the opinions on flavor and 24.8 per cent of those on odor rated the milk as normal. Opinions on flavor were about equally divided between very slightly off and slightly off, 29.1 per cent rating the samples very slightly off and 27.2 rating them slightly off, while 13 per cent rated them off.

Off odors were more readily perceived than off flavors, a somewhat larger percentage of opinions rating the samples off in odor than in flavor. The ratings for odor were 30.3 per cent, 29.9 per cent, and 15 per cent for very slightly off, and off, respectively.

Feeding 30 Pounds One Hour Before Milking.

There was a more marked effect on the flavor and odor of the milk when the amount of turnips fed one hour before milking was increased from 15 to 30 pounds. Out of a total of 240 opinions on 42 samples of milk produced by cows fed 30 pounds, only 6.7 per cent and 4.2 per cent rated the milk normal in flavor and odor, respectively. The percentage of opinions rating the milk very slightly off also decreased somewhat as compared with feeding 15 pounds, 25.8 per cent rating the milk very slightly off flavor and 18.7 per cent giving a similar rating to the odor.

By increasing the amount of turnips from 15 to 30 pounds, the opinions rating the milk as slightly off and off on flavor were increased from 27.2 to 33.3 per cent and from 13 to 34.2 per cent; and those rating the milk as slightly off and off on odor increased from 29.9 to 37.5 per cent and from 15 to 39.6 per cent, respectively.

Feeding 30 Pounds Immediately After Milking.

Feeding turnips at the rate of 30 pounds immediately after milking has but little detrimental effect on the flavor and odor of milk. A total of 232 opinions on 41 samples of

milk produced by cows receiving this amount after milking showed that 87.9 per cent of the opinions rated the samples, taken at the next milking, as normal in flavor and 84.5 per cent as normal in odor. Of the opinions designating off flavors and odors, those rating the samples as very slightly off showed the higher percentage, 6.9 per cent representing flavor and 8.6 per cent representing odor, while 4.3 and 0.9 per cent of the opinions rated the flavor slightly off and off, respectively, and 5.2 and 1.7 per cent gave the same ratings to the odor.

Effect of Immediate Aeration.

In order to determine the effect of aeration on the flavor and odor of milk produced by cows fed turnips one hour before milking, the milk while still warm was run over a surface cooler, cooling it below 45° F., and samples were again taken.

In 251 opinions obtained on 43 samples of milk produced by cows receiving 15 pounds of turnips one hour before milking, the percentage of opinions rating the milk normal in flavor was increased by aeration from 30.7 to 51 per cent, and the percentage rating the milk normal in odor was increased from 24.8 to 46.6 per cent. Before aeration 13 per cent of the opinions rated the milk off in flavor, which was reduced to 10.4 per cent by aeration. Likewise, the percentage of opinions rating the flavor as slightly off was reduced from 27.2 to 19.1 per cent, and the percentage rating it very slightly off was decreased from 29.1 to 19.5 per cent.

Aeration had a similar effect on the odor of the milk. Before aeration 15 per cent of the opinions rated the samples off, which was reduced to 12.8 per cent, and 29.9 per cent rated the milk slightly off, which was reduced to 20.7 per cent, while those rating it very slightly off were reduced from 30.3 to 19.9 per cent.

When 30 pounds of turnips were fed one hour before milking, aeration had a still more marked effect on the flavor and odor of the milk. In 249 opinions obtained on 42 samples of milk produced by cows receiving 30 pounds of

turnips before milking, the percentage of opinions rating the milk normal in flavor was increased from 6.7 to 28.9 per cent, and those rating the milk normal in odor were increased from 4.2 to 22.9 per cent.

The percentage of opinions rating the samples very slightly off in flavor was increased from 25.8 to 35.7 per cent, and the percentage rating the samples very slightly off in odor was increased from 18.7 to 35.3 per cent by aeration. Before aeration 34.2 per cent of the opinions rated the samples off in flavor, which was reduced to 15.7 per cent after aeration. Likewise the percentage of opinions rating the milk as slightly off in flavor was reduced from 33.3 to 19.7 per cent.

A similar effect took place with the odor. Before aeration 39.6 per cent of the opinions rated the milk off in odor of the milk very slightly off and slightly off, respect- slightly off which was reduced to 23.7 per cent by aeration.

Effect of Feeding Turnips on the Flavor and Odor of Cream.

After aeration, some of the milk produced by cows receiving 30 pounds of turnips one hour before milking was set aside for 24 hours, after which samples of cream were skimmed off by hand and judged for flavor and odor. A higher percentage of off flavors and odors was found in this cream normal in flavor and 24.7 per cent rated it normal in obtained. Very slightly off and slightly off flavors and odors, however, were less frequent in the cream than in the milk.

Out of a total of 81 opinions on 15 samples of cream skimmed from the aerated milk, 32.1 per cent rated the cream normal in flavor and 24.7 per cent rated it normal in odor. This is practically the same as the milk from which it was skimmed, as 30.9 per cent rated the milk normal in flavor and 25.9 per cent rated it normal in odor. Of the opinions designating very slightly off and slightly off flavors and odors, the greater percentage rated the milk in these groups: 40.7 and 21 per cent rated the flavor of the milk very slightly off and slightly off, respectively, while 23.5 and 18.5 per cent gave similar ratings to the cream. Likewise, 39.5 and 24.7 per cent of the opinions rated the

odor of the milk very slightly off and slightly off, respectively, while 24.7 and 18.5 per cent gave similar ratings to the cream. The opinions rating the cream off in flavor and odor showed a higher percentage than those giving a similar rating to the milk; 25.9 and 32.1 per cent rating the cream off in flavor and odor, respectively, while only 7.4 and 9.9 per cent gave similar ratings to the milk. It appears, therefore, that when off flavors and odors are present in milk, these flavors and odors are more pronounced in the cream from such milk.

Conclusions.

Feeding turnips to dairy cows at the rate of 15 pounds one hour before milking produces objectionable off flavors and odors in the milk.

Increasing the amount of turnips fed one hour before milking from 15 to 30 pounds, increases to a very marked degree the intensity of the off flavors and odors produced in the milk.

Feeding turnips at the rate of 30 pounds immediately after milking has but little detrimental effect on the flavor and odor of the milk.

Proper aeration reduces strong off flavors and odors in milk, caused by feeding turnips, and some of the slight off flavors and odors may be eliminated.

The off flavors and odors produced by feeding turnips are more pronounced in the cream than in the milk.

ECONOMICAL RATIONS FOR DAIRY CALVES

R. S. Hulco, F. B. Morrison and G. C. Humphrey, Wisconsin Agricultural Experiment Station.

Where there is an abundance of skim milk for calf feeding, the raising of vigorous dairy calves is relatively simple. Various experiments have shown clearly that as thrifty calves can be raised when changed to skim milk at but a few weeks of age as those which are fed whole milk until weaning time. However, when a liberal supply of skim milk is not at hand, the problem is a more complicated one.

Over increasing areas of our country dairymen do not have an abundance of skim milk for feeding their calves. They may sell cream to the creamery, but may wish to use part of the skim milk for feeding swine or poultry. In several large districts dairymen now sell their milk to condensaries or ship it to city market, thus having no skim milk whatsoever available. In cheese-producing districts plenty of whey is available for calf feeding, but such poor results have been secured by most farmers with this dairy by-product that probably the majority make no attempt to use it for this purpose.

Three Trials Conducted.

To secure information on the most economical rations for calves under various conditions, trials have been carried on during the past three years. Each year high grade Holstein and Guernsey heifer calves have been purchased and placed on experiment when two to three weeks of age. Up to this time they had received whole milk, as is the universal practice in feeding dairy calves. The calves were continued on experiment for 24 weeks, or until they were about 6 months of age. The trials thus cover the entire period during which skim milk or milk substitutes are ordinarily fed.

The third trial has now (October 24th) been in progress 5 months, and will be concluded next month.

In each of the the three trials two Holstein and two Guernsey calves were assigned to each lot. These two breeds were used so that the results would apply to both types of calves. Each calf was kept in a separate pen and an accurate record was kept of all the feed and water consumed by each animal. Live weights were taken weekly and on three consecutive days at the beginning and end of the experiment.

Skim Mlik Fed Calves Make Excellent Gains.

Each year Lot 1, the check lot, has been fed the sort of a ration used by dairymen who have plenty of skim milk. The calves were fed whole milk until 21 days of age at the rate of about 1 lb. of whole milk daily to each 10 lbs. of live weight. When a calf became 21 days of age, a week to 10 days was taken to gradually substitute skim milk for the whole milk. The allowance of skim milk was then gradually increased to a maximum of 14 lbs.

This lot was fed a concentrate mixture consisting of 3 parts by weight of ground oats, 4 of ground corn, 2 of wheat bran, and 1 of linseed meal. The calves were allowed to eat all of this mixture they wanted up to 5 lbs. a head daily. They also had all the hay they would consume (clover hay in the first two trials, and mixed clover and timothy hay in the present trial). Care was taken to provide salt, and the calves were watered twice daily.

The calves in this check lot made excellent gains each year, in fact, better than is considered normal. The average daily gain for the two trials completed was 1.72 lbs. and the feed cost per head to 6 months of age was $23.80 with feeds at present farm prices. The amounts of feed consumed and the prices at which feeds are valued are shown in the summary table.

Good Gains on Limited Allowance of Skim Milk.

In each of the first two trials another lot was fed similarly, except that the allowance of skim milk was limited

to 10 lbs. a head daily, to represent conditions on farms where the supply of skim milk available for the calves is limited. These calves made very good gains, though somewhat less than Lot 1, which was fed 14 lbs. of skim milk a head daily. They gained 1.52 lbs. a head daily in comparison with 1.72 lbs. for Lot 1. Owing to the lesser amount of skim milk fed the feed cost up to 6 months of age was $21.32, compared with $23.80 for Lot 1. The calves receiving 14 lbs. of skim milk daily were slightly more growthy, although there was no apparent difference in the vigor of the two lots, and the gains of the calves limited to 10 lbs. of skim milk a day were actually a trifle larger than is considered normal. These results show that good thrifty calves can be raised on an allowance of skim milk limited to 10 lbs. daily, if a good concentrate mixture and good hay are fed in addition. When an abundance of skim milk is at hand, it is best to feed the larger allowance given to Lot 1. However, sometimes it may be advisable to limit the allowance of skim milk fed the calves in order to have more skim milk for young pigs.

A Ration for Market Milk and Condensary Districts.

Each year a third lot has been fed no skim milk, but has been raised on a minimum amount of whole milk, which did not exceed 400 lbs. for each calf from birth, or about 375 lbs. from the fourth day after birth, when the dam's milk was salable. This was supplemented by a simple concentrate mixture, rich in protein, consisting of equal parts ground oats, ground corn, linseed meal, and wheat bran. These calves were allowed to eat up to 6 lbs. of this mixture a head daily. Of course when the calves were small the amount of concentrates eaten was relatively small. On the average during the whole trial this lot ate 3.6 lbs. of concentrates a head daily, while Lot 1 fed the liberal allowance of skim milk was fed on the average only 3 lbs. a day. After the calves were 7 to 9 weeks old, they were fed only this mixture with hay, water, and salt, no expensive calf meal whatsoever being fed. In the two trials completed, these calves have made an average daily gain of 1.43 lbs. at a

feed cost of $22.64 per head to 6 months of age. This lot gained slightly less than Lot 2, fed 10 lbs. of skim milk a head daily, but did remarkably well considering the small amount of milk fed. In fact, the gains would be considered nomral for well-reared dairy calves.

These results show plainly that good thrifty calves can be raised on market milk in condensary districts at a reasonable cost by following this simple method, and without the use of any expensive commercial mixtures. In raising calves by this method, if a calf is delicate and not making good gains, it will be necessary to continue the feeding of whole milk longer than otherwise. In these experiments, however, little difficulty has been experienced in getting the calves entirely off milk at 7 weeks of age in the case of Holstein and 8 to 9 weeks in the case of Guernseys.

The following schedule of feeding the whole milk is suggested when this method is to be followed:

Holsteins: With dam for 3 days. Then feed whole milk, increasing to 9 lbs. daily at end of first week and continue this amount until 6 weeks of age. Gradually reduce allowance until at end of the 7th week no milk is fed.

Guernseys. With dam for 3 days. Then feed whole milk at the rate of about 6 lbs. daily for 2 weeks, increase to 7 lbs. and continue 5 weeks. Reduce allowance of milk gradually until at end of 9 weeks no milk is fed.

Good Calves Raised on Whey.

In 1921 and 1922 two lots were fed whey supplemented by a concentrate mixture rich in protein, consisting of 3 parts of ground corn, 3 of standard middlings, and 4 of linseed meal. The whey was pasteurized skimmed whey and no attention was paid to variations in sourness after the calves were used to this feed. In making the change from whole milk to whey somewhat more care was necessary than in changing from whole milk to skim milk. The change was not begun until the calves were about 3 weeks of age and then 10 to 14 days were taken to get the calves entirely off whole milk. As soon as possible the whey allowance was increased to 14 lbs. a day. This was continued during the rest of the trial.

Lots thus fed whey gained on the average 1.49 lbs. per head daily, or nearly as much as the calves fed 10 lbs. of skimmed milk a day. This satisfactory gain was due in all probability to the fact that the whey was never allowed to stand in a filthy tank or can, but was fed with reasonable care and under sanitary conditions. Furthermore, a concentrate mixture rich in protein was used to make good the casein which had been removed from the milk in the cheese making process. The average feed cost of raising these whey-fed calves to 6 months of age was $21.58. These results show that thrifty calves can be raised on whey readily and cheaply when simple precautions are taken.

Yellow vs. White Corn for Calf Feeding.

Each year one lot of the whey-fed calves was fed yellow corn and another lot white corn in the concentrate mixture. This was done as it had been recently found by Dr. Steenbock of the Agricultural Chemistry Department that yellow corn was rich in fat-soluoble vitamines, while white corn contained little or none. It had also been found in experiments with growing, fattening pigs carried on by the Animal Husbandry Department that this made white corn much inferior to yellow corn when fed with such supplements as skim milk or tankage to pigs not on pasture.

The calves fed white corn in these trials did fully as well each year as those fed yellow corn. This result, which was expected, was undoubtedly due to the fact that the hay the calves consumed supplied considerable of these fat-soluble vitamines. These results correspond to those secured in the trials with pigs. Though yellow corn has been superior to white corn when fed to pigs in dry lot with supplements like skim milk or tankage, which are not rich in these vitamines, white corn is just as good as yellow corn for pigs on pasture or for those receiving alfalfa or other legume hay.

For additional information on yellow vs. white corn, see the special circular, "Which, Yellow or White Corn?"

Do Not Neglect Watering Calves.

The importance of supplying plenty of water to dairy calves even when fed a fairly liberal allowance of skim milk is not appreciated by many dairymen. To gain definite information on this matter, in the 1922 trial a lot was fed the same ration as Lot 1, except that no water was given these calves. Both lots received a liberal allowance of skim milk, the good concentrate mixture mentioned previously, and common salt. Lot 1 received what water they would drink twice daily, while the other lot had no water except that occuring naturally in the skim milk and the trifle in the "dry" concentrates and hay.

The calves not given additional water gained only 1.39 lbs. a head daily, while Lot 1, watered twice daily, gained 1.75 lbs. This experiment is being repeated at the present time, and during the first 5 months the calves which are receiving water in addition to their other feeds have made an average daily gain of 1.76 lbs., while those not receiving additional water have made an average daily gain of only 1.29 lbs.

Lack of water in the ration results in a lower grain and hay consumption. During the first trial 25 per cent less concentrates and 43 per cent less hay was consumed by the lot not receiving water and up to date in the present trial 22 per cent less grain and 59 per cent less hay has been consumed per calf by the lot receiving no additional water.

The lack of water, therefore, causes a surprising difference in the appetites of calves. No farmer who wishes to grow his calves rapidly and well can afford to neglect supplying them with plenty of water—the cheapest item in the ration.

Semi-Solid Buttermilk; Dried Skim Milk.

Since the trials during the first two years proved that thrifty calves can be raised on only 400 lbs. of whole milk from birth, with a simple concentrate mixture, water and salt, attempts are now being made to find whether this ration can be improved. This year one lot is being fed limited amounts of semi-solid buttermilk, and another lot has

received low grade dried skim milk powder. As only one experiment on each of these rations has been carried on and since the trials are still in progress, it is too early to decide whether the use of these feeds will either increase the rate of growth of the calves or reduce the cost of feeding them.

This year one lot is also being fed only ground corn as the concentrate with a liberal amount of skim milk, hay, water, and salt. This lot is being fed in comparison with Lot 1, which receives the concentrate mixture of corn, oats, bran, and linseed meal. Skim milk is very rich in protein. Therefore it is doubtful whether any better results will be secured when protein-rich feeds like wheat bran and linseed meal are included in the concentrate mixture for calves fed plenty of skim milk than where only corn or other grain is fed. In the trial now in progress the lot fed corn as the only concentrate has thus far done just about as well as the calves fed the purchased protein-rich feeds as part of their concentrate mixture.

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REMINGTON, S. H., Clinton.
RUNDLE, FRANK, Clinton.
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REINDEHL, WILBUR, Robinson.
ROSS, Charles, Robinson.
ROBERTS, CLYDE A., McLean.
ROGERS, S. L., Clinton.
REYNOLDS, A., Clinton.
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REDMON, WILLIAM, Paris.
RYAN, EDWARD, Lawrenceville.
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SPAINHOUR, RUSSELL, Clinton.
STOLTZ, A. C., Lawrenceville.
STANIGER, P. B., Lawrenceville.
SEITINGER, G. B., Lawrenceville.

S

STORER, C. A., Lawrenceville.
SANDERS, CLARENCE, Lawrenceville.
SUMNER, MRS. BESSIE, Lawrenceville.
SWARTZ, JIM, Mt. Vernon.
SPITLER, J. CLYDE, Effingham.
SCHUMAKER, FRANK, Altamont.
SCHULTZ, MRS. M. A., Elgin.
STOLTZ, GEO. J., Sumner, R. 3.
SMITH, W. F., Flat Rock.
SMITH, IRA, Albion.
STEPHENS, F. A., Robinson.
SARGEON, F. C., Mt. Vernon.
SCHULINE, EDW., Bluford.
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SHECKLEY, L. C., Willisville, Willow Farm.
STANARD, S. J., Springfield.
SMITH, BERT, Rossville.
SAVOY & PLAZA HOTELS, Danville.
SECOND NAT'L BANK, Danville.
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THOMPSON, PAUL, Lafayette.
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TICK, JACOB, Clinton.
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VIEHVE, W. A., Ewing.
VAN HOOREBECKE, LOUIE, Mt. Vernon.

W

WALROD, GEO., Clinton.
WILSON, J. B., Clinton.
WILSON, F. D., R. F. D. No. 7, Clinton.
WADE, FRED, Clinton.
WEGER, R. R., Lawrenceville, R. 3.
WILEY, E. J., Springfield.
WARD, P., Clinton.
WRIGHT, W. D., Clinton.
WOMPLER, T. C., Clinton.
WADE, CLYDE, Clinton.
WILTON, JOHN A., Medora.
WOODEN, W. T., R. 2, Mt. Ver-
WEBB, H. H., Mulkeytown.
WELEN, O. M., Mt. Vernon.
WOODBURN, G. A., Charleston.
WOODWARD, H. N., Odin.
WILSON, GEO. O., Sandoval, R. 1.

W

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WILLIAMSON, MADELINE, Nat'l Dairy Council, St. Louis, Mo.
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WINKLER, W. E., 1839 Railway Exchange, St. Louis, Mo.
WEBER, W. W., Danville.
WALTER, H. F., 614 Wayne St., Danville.
WILEY, E. J., 427 N. Vine, Springfield.
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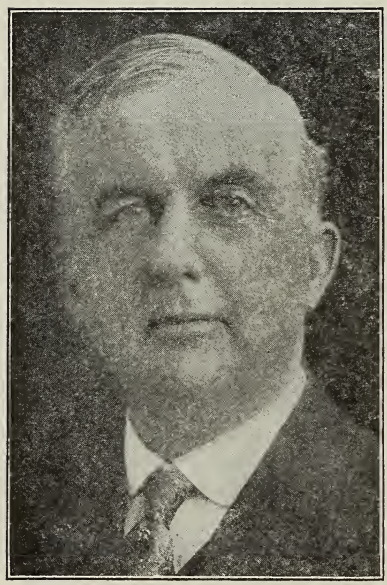
Y

YOUNG, J. S., Lawrenceville.

WILLIAM WILBERFORCE MARPLE.



In the death of William Wilberforce Marple, Illinois State Dairymen's Association lost one of its most active and progressive members, and an earnest worker for the good of the association as a member and official. Mr. Marple was a director and vice-president of the association at the time of his death.

He was a country-wide character in the dairy field, famous as a toastmaster at dairy banquets, and a constant worker for the good of the dairy industry not alone in his own state but in other states. He was as well known and admired in Missouri, Indiana, Michigan, Kansas and Nebraska as in Illinois, having worked in those states.

He was a lovable character with a world of friends, charitable and forgiving, always looking on the bright side, always ready to help, an exponent of and one who practiced the Golden Rule in all his affairs.

Mr. Marple was for years with the Beatrice Creamery Co., and that company gives the following notice of his death in its Beatrice Service Bulletin:

The Beatrice family received quite a shock when informed of the death of our dearly beloved friend and coworker, William Wilberforce Marple.

The most noted exponent of the Golden Rule, most loved because he practiced what he preached, left this

earth for his higher home May 4, 1924. Death came unto him at Battle Creek, Michigan, on this day.

W. W. Marple was a member of the Beatrice Creamery organization for about twenty-five years. Although a vital part of this company, he was nevertheless one of those great loving characters whose conception of service could not be limited to any one organization.

We prefer to think of Mr. Marple as a friend of mankind. To refer to him as one loved by friends and foe alike would be to do him a grave injustice. He was loved by everyone. He was the only man we ever knew who did not have an enemy.

From his great loving countenance there radiated kindness. From his mouth came words of good cheer and inspiration to all with whom he came in contact. His every movement was actuated by a high and unselfish motive.

In his elevating presence you felt at home. Simplicity was the dominating part of his makeup.

The real test of man's greatness is whether or not the world has been benefited through his having lived in it. We are content to judge men on this basis. Future generations will honor W. W. Marple far more than the present if that be possible. This because the world is gradually becoming a better place in which to live.

As the smoke of competitive battles rises from the fields of industry, and human trust becomes a greater part of each and every one of us, posterity will scan the names of those whose lives were devoted to the great cause of friendliness and brotherhood and they will find at the top of the list written in golden letters, the name of W. W. Marple.

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