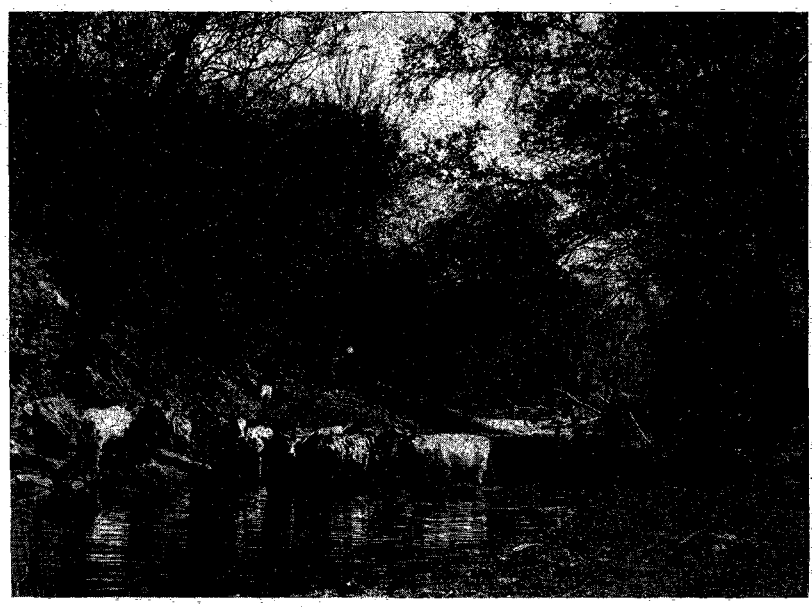
JULY, 1921 CIRCULAR 90

# AGRICULTURAL EXPERIMENT STATION

KANSAS STATE AGRICULTURAL COLLEGE
MANHATTAN, KANSAS

DEPARTMENT OF DAIRY HUSBANDRY



AYRSHIRES ON A KANSAS FARM

# DAIRY FARMING[1]

J. B. FITCH

## DAIRYING IN KANSAS

During the last five years the interest in dairying in Kansas has increased to a marked extent. This has been noticeable in the increase in number of requests for help in subjects pertaining to dairying. The strong demand for dairy stock and the large number of dairy animals brought into Kansas from the dairy districts of the northern and eastern states, are

[1] This circular is a revised edition of circular 45, "Dairy Farming" by O. E. Reed, issued January, 1915.

also indications of the increased interest in the dairy industry among Kansas farmers.

The federal government estimate for 1920 places Kansas among the 20 leading dairy states. Kansas ranks ninth with a total of 935,000 dairy cows for 1920 as compared with 736,107 for 1910. The United States Department of Agriculture also places Kansas fourth in the increase in the number of dairy cattle since 1910. Wisconsin, Minnesota, and North Dakota each gained more cows than Kansas during this 10-year period. Kansas shows a gain of 198,893 or a 27 percent increase in 10 years.

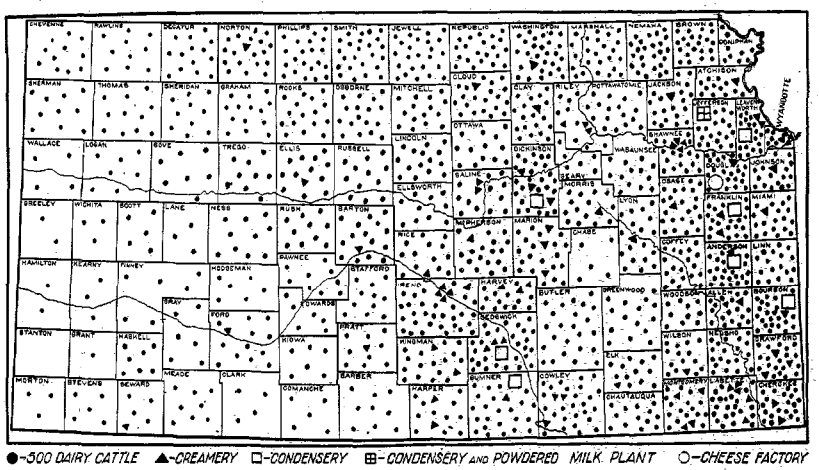



FIG. 1.—Map showing the approximate number of dairy cattle in each county in Kansas; also the location of 81 creameries, 8 condenseries, 1 powdered milk plant, and 1 cheese factory in the year 1919

In 1910 the value of dairy products sold from Kansas farms was $16,751,643; in 1919 this value had increased to $46,768,907 according to the Kansas State Board of Agriculture. The interest in dairying in Kansas is not confined to any one part of the state. (Fig. 1.) It is true that the eastern half of the state is perhaps better adapted to dairying on account of feed and market conditions, but there is not a county in the state but what has shown increased interest in milk cows during recent years. The eastern half of the state may be better suited to dairying but a good system of agriculture in the western half makes dairying more necessary.

Kansas has advantages in the raising of feed for dairy cows that many dairy states do not have. Alfalfa hay and corn,

cane, or kafir silage will make the cheapest and best balanced ration obtainable. The growing use of sorghums for silage will put the Kansas feed supply on a more certain basis. This fact, coupled with the greater use of silos in all parts of the state, is making dairying and livestock farming more profitable and more popular.

### MARKETING DAIRY PRODUCTS

The common market for the produce of the dairy cow in Kansas is the cream station. There are between 1,500 and 2,000 cream stations in the state which represent about 70 creameries. There are 81 creameries in the state, a few of which do not have cream stations but receive cream shipments direct. The cream stations receive cream, pay for it on the butterfat basis, and ship it to the creameries. These stations provide a good market for cream in nearly all of the small towns of the state.[1]

In addition to the cream stations there are eight condenseries, one powdered milk plant, and one cheese factory in the state. The location of these plants is shown in figure 1.

The sale of whole milk from the farm brings in the largest amount of money, but in many cases where whole milk is sold the calves and perhaps other livestock on the farm are underfed. The marketing of sweet cream to ice cream factories or hotels brings 5 to 10 cents more per pound for butterfat than the sale of sour cream. Sweet cream or whole milk should be marketed daily. Sour cream should be marketed three times per week in the summer and twice per week in the winter. In cases where the distance from market makes it impossible to deliver sour cream, butter can be made on the farm and marketed once a week. The average farm butter, however, is of poor quality. In most cases persons making butter on the farm would save themselves time, work, and money by selling the butterfat and buying butter.

### ADVANTAGES OF DAIRYING

A farm used for dairy purposes does not need to lose in fertility, but can gain, and may be used for dairying almost indefinitely. On a well-managed dairy farm practically all the feed grown is marketed through the cow. Concentrated pro-

[1] For further information regarding the handling of cream and the Kansas cream station system, write to the Agricultural Experiment Station, Manhattan, Kan., for a copy of the latest edition of the state dairy commissioner's bulletin on "The Permit System of Cream-Buying."

tein feedingstuffs, such as bran and oilmeal, are usually purchased to balance the ration. These feeds contain a high percentage of fertilizing ingredients, and the manure from the cows consuming such feeds is very rich in plant food.

The first method of farming practiced in a newly settled country is grain farming. This is continued until the land becomes high-priced, and the fertility of the soil is decreased, when dairying usually comes into practice. In grain farming the land is cropped year after year and these crops are sold off the land. In livestock or dairy farming the crops are harvested and fed to the animals and the income is obtained by selling the animals or their products.

Selling grain and other crops from the farm means selling soil fertility or plant food. No soil can grow crops year after year without sooner or later reaching the point where this depletion is felt. When animals and milk products are sold from the farm only a small portion of the plant food of the entire crop is sold. The greatest part of the plant food is left behind in the form of barnyard manure, and this may be returned to the soil. This is very clear when we compare the amount of plant food that is sold in milk and dairy products with that contained in the ordinary farm crops.

The amount of fertilizing constituents in a ton of each of the common dairy products and farm crops and their value at the average price at which commercial fertilizing constituents were sold in Kansas in the spring of 1920, are shown in Table 1.

TABLE I.—FERTILIZING CONSTITUENTS IN A TON OF EACH OF THE COMMON DAIRY PRODUCTS AND FARM CROPS, AND THEIR VALUE AT CURRENT PRICES

| SUBSTANCE | Pounds of fertilizing constituents in a ton (*a*) | | | Value at average price of commercial fertilizer, spring, 1920 (*b*) |
|---|---|---|---|---|
| | Nitrogen | Phosphoric acid | Potash (potassium oxide) | |
| Butter | 3.2 | 0.0 | 0.0 | $1.36 |
| Milk | 10.6 | 3.8 | 3.6 | 5.38 |
| Wheat | 47.2 | 15.8 | 10.0 | 22.94 |
| Oats | 41.2 | 16.4 | 12.4 | 20.81 |
| Corn | 36.4 | 14.0 | 8.0 | 17.90 |
| Alfalfa | 48.8 | 10.2 | 38.6 | 24.55 |

(*a*) Adapted from Eckles, "Dairy Cattle and Milk Production," p. 3, The Macmillan Company. 1919.

(*b*) Nitrogen is figured at 42½ cents per pound, based on $7 per unit of ammonia. Phosphoric acid is figured at 8¾ cents per pound, based on $1.75 per unit of phosphoric acid. Potash is figured at 15 cents per pound, based on $3 per unit of potash.

In some of the eastern states of the United States land became so unproductive, as a result of grain farming, that the owners abandoned their farms. During the more recent years attention has been directed to these farms, and some of them are now yielding large crops. This change from an unproductive to a productive state has been brought about largely through the use of the dairy cow. On these farms hay and concentrated feeds have been purchased and fed, and in this way the fertility of the soil has been and is now being increased. These same conditions exist in other countries. Much of Europe has gone through this period of soil depletion, and has taken up dairying, until now in Germany, Denmark, and Holland, where cows are handled extensively, the land is producing larger crops than it did 30 years ago.

In many parts of Kansas the soil contains a sufficient quantity of plant food, but it is so devoid of humus, or vegetable matter, that the plant food is not available. Soil lacking in vegetablematter will not retain water, and packs and bakes after rains. Such a soil is called a poor soil. By rotation of crops, by marketing the crops grown through dairy cows or other livestock, and by using the manure, it is possible to add humus to the soil and thus to render it more productive.

The dairy cow is an economical producer of human food. No other animal can produce the same quantity of digestible food as economically as can the cow. Because of this economy of production, the cow is adapted to high-priced lands and can utilize high-priced feed to advantage. That dairying is adapted to high-priced land is shown by illustrations from European countries. Land on the Island of Jersey, which is the home of the Jersey cow, rents for from $50 to $80 per acre. Land in Holland is valued at $1,000 per acre, and the chief agricultural pursuit is caring for and handling the Holstein cow and her products.[1]

The high price of food products during the last few years has caused a great demand for dairy products. When the cost of food nutrients is taken into account, milk is the cheapest food obtainable. Recent investigations have shown that milk, in addition to being an important source of ordinary food nutrients, contains certain substances which are not well understood but which seem to be essential to the growth of the

[1] Prewar figures.

animal body. These substances are called vitamines, and their presence in milk makes milk indispensable as a food where normal growth is desirable. Vitamines are complex substances in foods which are as yet unidentified. It is known, however, that they are abundant in milk and eggs and in the leaves of plants. One class of vitamines, which is soluble in water and called water-soluble vitamines, is abundant in certain seeds. Another class, which is dissolved in fat and called fat-soluble, is found abundantly in butterfat. A third vitamine, often called the antiscorbutic vitamine, has also been found in milk. The fact that these essential elements are found in milk makes milk indispensable in the ration of growing children,

In all the schools in the state where the children have been weighed, a high percent of undernourished children have been found, as indicated by their body weight. When the children have been encouraged to drink more milk at home, or when they have been given a half pint of milk at recess time, they have shown good increases in weight. This does not mean that the children had been deprived of things to eat, but it does show that they were not getting the proper food. A survey among the school children of Kansas City, Mo., indicated that a big proportion of the undernourished children came from families that were well-to-do, but good judgment had not been used in selecting food.

Too often, however, milk is considered a luxury. As the price of milk advances the amount consumed by many people is reduced. The public should be educated to the point of knowing the food value of milk and dairy products, and when this time comes, milk will occupy the place in the human diet that its value warrants.

Dairying furnishes immediate and constant returns. A man with small capital can invest his money in a dairy cow and soon begin to realize on his investment. The prices of milk and butterfat are never subject to any great fluctuations, but are more steady and uniform than the price of many other commodities.

Keeping dairy cows on the farm furnishes employment the year round and in many sections this enables one to get the better class of farm labor. The best farm hands prefer to work during the entire year, and they can usually find work around the dairy. In the sections of Kansas where wheat

farming is followed, winter dairying is becoming more generally adopted and will result in a more profitable and permanent, system of agriculture.

## THE DAIRY HERD

The first essential for profitable dairying is good cows. The profitable dairy cow is one that will make the maximum production on the minimum quantity of food. The most profit can

FIG. 2.—Owl's Design, purebred Jersey cow owned by the Kansas State Agricultural College. Record for one year: 14,606 pounds of milk, 650 pounds of butterfat

be made from special-purpose dairy cattle. A number of special dairy breeds have been developed by careful breeding and selection, covering periods of from 100 to 2,000 years. Very often good milk cows are found among ordinary herds of scrub cattle, or among the beef breeds, but the great objection to such cows is that they do not always transmit their milking qualities to their offspring.

## BREEDS OF DAIRY CATTLE

The following named breeds are now classified as dairy cattle: Jersey, Guernsey, Ayrshire, Holstein, and Brown Swiss.

**Jersey.**—The Jersey (fig. 2) is, perhaps, the most popular breed of dairy cattle in the United States. More cattle of this breed have been registered than of any other. The Jersey is small in size. The cows weigh from 800 to 1,000 pounds, when mature. The native home of this breed is Jersey Island, the largest in the group of the Channel Islands, lying between England and France. The majority of the animals are of yellow or gray-fawn color with a black nose, black tongue, and

FIG. 3.—Imported Pallas 65709, purebred Guernsey cow owned by the Kansas State Agricultural College. Record for one year: 9,713 pounds of milk, 485 pounds of butterfat

switch of solid black. There are a great many broken-colored Jerseys, the bodies of which are some color of fawn with white spots.

The milk of the Jersey is very rich in butterfat, the average test for the breed being about 5.3 percent. It has a high color and is easily churned. The color and richness of her milk makes the Jersey a great favorite as a family cow. The cows of this breed are very economical producers of butterfat.

The office of the secretary of the American Jersey Cattle Club is located at 324 West 23d Street, New York.

**Guernsey.**—The Guernsey breed (fig. 3) had its origin on the Island of Guernsey, the second largest island in the Channel Island group. Cows of this breed are somewhat larger than the Jerseys, averaging about 1,000 pounds in live weight. The characteristics of the Guernsey are somewhat similar to those of the Jersey. In color the Guernsey may be either orange fawn or fawn with white markings. The nose is buff color and the tongue and switch are generally white.

The milk of this breed is not quite as rich as that of the

FIG. 4.—Canary Bell, purebred Ayrshire cow owned and developed by the Kansas State Agricultural College. Record for one year: 19,863 pounds of milk, 744.5 pounds of butterfat

Jersey, but the cows produce more of it. The milk is especially noted for its extreme yellow color, and the butter made from it at any time of the year has a good yellow color. The average milk contains about 4.9 percent butterfat.

The office of the secretary of the American Guernsey Cattle Club is located at Peterboro, N. H.

**Ayrshire.**—The native home of the Ayrshire (fig. 4) is the County of Ayr, Scotland. The cattle of this breed are very strong and thrifty. They rank between the Guernsey and Holstein in size. The cows average about 1,000 pounds in live weight. In color they may be either a dark red and white or

light red and white. The red color in the bulls often deepens into mahogany. The color of the Ayrshire gives her an advantage over the other breeds when fattened and sold for beef, as there is still a general prejudice among stock buyers against the dairy breeds for beef, especially against the Jerseys and Guernseys. In form, the Ayrshire does not show the extreme angular dairy type exhibited by high-class Jerseys or Holsteins. They are somewhat smoother over the shoulders,

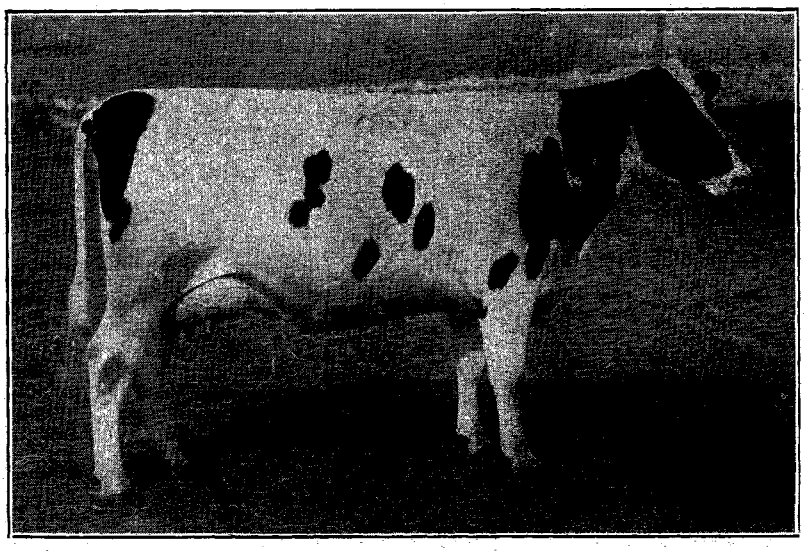


FIG. 5.—Josephine Fobes Canary Homestead 300024, purebred Holstein cow (first daughter of Canary Paul Fobes Homestead 6th to finish a year's record). Record at two years of age: 16,128 pounds of milk, 515 pounds of butterfat

back, and hips, and show slightly more of the beef type, especially in the rear quarters. The Ayrshire cows are especially noted for their symmetrical udders. Ayrshires are excellent rustlers, good breeders, and the calves are very strong and vigorous.

The milk has an average composition of 3.8 percent butterfat, which adapts this breed to the production of market milk.

The office of the secretary of the Ayrshire Breeders Association is at Brandon, Vt.

**Holstein.**—This breed (fig. 5) originated in Holland and has been bred in that region for at least two thousand years. During this time there has been very little, if any, mixing with out-

side blood. Since ancient times, Holland has been noted for its butter, cheese, and immense oxen. The Holsteins are the largest of the dairy-bred cattle. The average weight of the mature cow is 1,200 pounds, but individual cows often weigh 1,400 pounds or more. The color markings are black and white. The cows have good dispositions and are not easily frightened at any sudden disturbance. As beef producers this breed ranks high for a dairy breed. The calves are large at birth, grow rapidly, and make excellent veal.

FIG. 6.—Bertha M, purebred Brown Swiss cow owned by the Michigan Agricultural College. Record for one year: 16,225.5 pounds of milk, 695.3 pounds of butterfat

As milk producers Holstein cows are unexcelled. They produce more milk and at a less cost per 100 pounds than any other breed. The milk averages about 3.5 percent butterfat. The Holstein is well adapted to supplying milk for cities on account of the high yield and low average percent of butterfat.

The office of the National Holstein-Friesian Association is at Brattleboro, Vt.

**Brown Swiss.**—The Brown Swiss breed (fig. 6) has been developed in Switzerland, and is probably one of the oldest breeds of cattle known. In its native land it is classed as a dual-purpose breed and formerly showed both as a beef and a dairy breed in America, but is now classed as a dairy breed.

The cows weigh from 1,200 to 1,400 pounds, and the bulls often weigh more than a ton. The color is brown to silver gray, resembling the color of some families in the Jersey breed. The cows give a good flow of milk, containing about 3.7 percent of butterfat.

The office of the secretary of the Brown Swiss Association is at Beloit, Wis.

**Milking Shorthorn.**—In the development of the Shorthorn breed several noted breeders placed considerable stress on the milking qualities of the animals kept in their herds. In this way several families of the breed have become famous as milk producers. An effort has been made by many breeders to develop a dual-purpose Shorthorn one that would have superior dairy and beef qualities combined. Most Shorthorn cows producing large quantities of milk conform very closely to the dairy type shown by the breeds of dairy cattle. Their calves sell for a better price for beef than calves of the strictly dairy breeds, chiefly because of their color. It is very difficult to find any considerable number of good Shorthorn milk cows that will transmit their milking qualities with any degree of certainty. A number of cows have made records of production of over 600 pounds of butterfat, but such cows are the exception rather than the rule. Mature cows weigh from 1,200 to 1,400 pounds. The predominating color of this breed is red or red and white, but it may be roan or white.

Shorthorn cattle were developed in northeastern England, especially along the River Tees, and formerly were known as Tees Water cattle. The exact origin is not known but their development began early in the eighteenth century. In England today Shorthorns of the nonpedigreed type furnish a large percent of the dairy products used.

The milk of the Shorthorn contains from 3.5 to 4 percent of butterfat and resembles the milk of the Holstein in color.

The office of the secretary of the Milking Shorthorn Association is 13 Dexter Park Ave., Chicago, Ill.

## THE BREEDS COMPARED

In a comparison and classification of the four principal breeds of dairy cattle, they rank as follows:

1. With reference to amount of milk produced: Holstein, Ayrshire, Guernsey, Jersey.

2. With reference to richness of milk produced:. Jersey, Guernsey, Ayrshire, Holstein.

3. With reference to yellow color of milk: Guernsey, Jersey, Ayrshire, Holstein.

4. With reference to size: Holstein, Ayrshire, Guernsey, Jersey.

5. With reference to early-maturing qualities: Jersey, Guernsey, Ayrshire, Holstein.

With reference to the amount of butterfat produced, there is very little difference among the breeds. There is more difference among individual cows. of the same breed than among the breeds. High-producing individuals are common among the Jersey, Guernsey, Holstein, Ayrshire, or Brown Swiss breeds. The names and yearly records of the cows holding the highest butterfat records, in each of these breeds are as follows:

| *Breed* | *name of cow* | *Pounds milk* | *Percent fat* | *Pounds fat* |
|---|---|---|---|---|
| Holstein.. ..... | Bella Pontiac ..... | 29,000 | 4.31 | 1,252 |
| Guernsey.. ..... | Countess Prue ..... | 18,626 | 5.92 | 1,103 |
| Jersey.. ..... | Plain Mary ..... | 15,255 | 6.82 | 1,040 |
| Ayrshire ..... | Lilly of Willowmoor.. ..... | 27,596 | 4.23 | 965 |
| Brown Swiss. ... | College Bravura 2d.. ..... | 19,460 | 4.10 | 798 |

In selecting a breed of dairy cattle it is well to choose the breed in which animals are most plentiful and can be purchased most easily in your locality. Another factor that may enter into the selection of a breed is the access to markets. For a whole milk market the Holsteins or Ayrshires are best adapted, while those who are farther away from markets will perhaps choose Jerseys or Guernseys for the production of butterfat and butter.

In addition to being registered in the herd books of the different breeds, purebred cows are eligible to the Advanced Registry of the different breeds when they produce the requirements specified by the different breed associations.[1]

## SELECTION OF THE DAIRY COW

The points commonly referred to in describing a dairy cow are shown in figure 7.

In starting a dairy herd the first thing to consider is the selection of the cows. There are two methods which can be

[1] For further information on advanced registration, write to the Agricultural Experiment Station, Manhattan, Kan., for circular 82, "Rules for Testing Dairy Cows for Advanced Registration."

used. The first is selection by conformation or type of the cow; the second is the selection of cows according to records of milk production. The first method is the one most generally used. The second method can not be followed very extensively, because only a small percent of the cows have records.

There is no doubt that there is a certain type or form that is associated with large milk production, and in conformation the dairy cow is quite the opposite of the beef animal. The

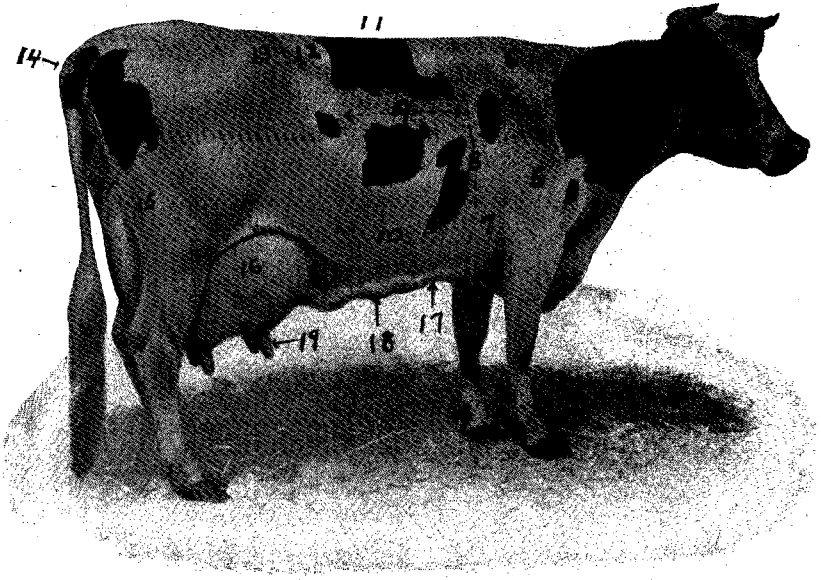



FIG. 7.—Location of points on cow:

| | | | |
|---|---|---|---|
| 1. Face | 6. Withers | 11. Back | 16. Udder |
| 2. Muzzle | 7. Chest | 12. Loin | 17. Milk wells |
| 3. Forehead | 8. Heart girth | 13. Hips. | 18. Milk veins |
| 4. Neck | 9. Ribs | 14. Pin bones. | 19. Teats |
| 5. Shoulder | 10. Barrel | 15. Thigh | |

dairy cow is angular, spare in flesh, and is usually referred to as being wedge-shaped, while the beef animal has a square blocky form. The score card given below may be used somewhat as a guide in selecting dairy cows according to type or conformation. It shows the relative importance of the different parts of the body.

SCORE CARD—DAIRY CATTLE

SCALE OF POINTS

| GENERAL APPEARANCE—18 Points | *Possible score* |
|---|---|
| *Form*, inclined to be wedge-shaped | 6 |
| *Quality*, hair fine, soft; skin mellow, loose, medium thickness; *secretion* yellow; bone clean, fine | 6 |
| *Temperament*, nervous, indicated by lean appearance when in milk | 6 |

| HEAD AND NECK—7 Points | Possible score |
|---|---|
| *Muzzle,* clean cut; mouth large; nostrils large | 1 |
| *Eyes,* large, bright, full, mild | 1 |
| *Face,* lean, long; quiet expression | 1 |
| *Forehead,* broad | 1 |
| *Ears,* medium size, yellow inside, fine texture | 1 |
| *Horns,* fine texture, waxy | 1 |
| *Neck,* fine, medium length, throat clean; light dewlap | 1 |
| **FORE QUARTERS—5 Points** | |
| *Withers,* lean, thin | 1 |
| *Shoulders,* light, oblique | 2 |
| *Legs,* straight, short; shank fine | 2 |
| **BODY—26 Points** | |
| *Chest,* deep, low; girth large, with full foreflank | 10 |
| *Barrel,* ribs broad, long, wide apart; large stomach | 10 |
| *Back,* lean, straight, open-jointed | 2 |
| *Loin,* broad | 2 |
| *Navel,* large | 2 |
| **HIND QUARTERS—44 Points** | |
| *Hips,* far apart, level | 2 |
| *Rump,* long, wide | 2 |
| *Pin Bones,* high, wide apart | 1 |
| *Tail,* long, slim; fine hair in switch | 1 |
| *Thighs,* thin, long | 4 |
| *Udder,* long, attached high and full behind, extending far in front and full, flexible; quarters even and free from fleshiness | 22 |
| *Teats,* large, evenly placed | 5 |
| *Mammary Veins,* large, long, tortuous, branched, with double extensions; large and numerous milk wells | 5 |
| *Legs,* straight; shank fine | 2 |
| Total | 100 |

**General Appearance of the Cow.**—The first impression one gets when viewing a high-producing cow, or a photograph of a high producer, is the marked angularity and thin, loose-jointed, appearance. The thin appearance is not a condition caused by lack of feed, but the animal is well-muscled and neat, with the hair and skin in good, healthy condition. The angular conformation is best described by the term wedge-shaped. The dairy cow has three wedges. A wedge is noticed when the cow is viewed from the front, from the side, and also from above. The first wedge mentioned is formed by the withers being sharp at the top and the chest being wide at the base. The depth through the rear part of the barrel and udder, tapering to the neck and head forms the wedge as viewed from the side. The wedge, as seen from above, is formed by the extreme width through the hips gradually tapering to the sharp withers. The wedge shape is not extremely pronounced in all dairy cows but is usually found in the best animals.

**Quality.**— The dairy cow should have plenty of quality. High production of milk and butterfat is associated with this characteristic. Quality is indicated by fine hair, soft, loose,

mellow skin of medium thickness, and a fine, clean bone. Dairy temperament is another essential. By this is meant the ability to convert the feed into milk. A good nervous system is indicated by a neat, refined appearance, spareness in flesh when in milk, and a large, full, mild eye. The dairy cow should be healthy and in good condition; should be spare in flesh while in milk; but may be allowed to carry considerable flesh when not giving milk.

**The Head.**—The head should be clean cut, of medium length, quiet expression, and of feminine appearance. The eye should be large, bright, and full. A mild expression in the eyes indicates a good disposition. The forehead should be slightly dished and broad. The jaw should be strong and wide, tapering somewhat to a strong, broad muzzle. A good-sized muzzle and strong jaw are indications of a good feeder. The ears should be of medium length, good texture, and fine quality, with an abundance of orange or yellow color inside. The neck of the cow should be moderately long, thin, and muscular, with clean throat and light dewlap. The neck of the typical dairy cow does not join the body as neatly as does the neck of the beef animal, but is long, lean, and free from fleshiness.

**Body.**—The heart girth should be large, indicating lung and heart capacity. The back should be long, straight, and open-jointed. The ribs should be long, wide, and far apart. The abdomen or barrel should be long, wide, and deep, especially just in front of the udder. A cow must have capacity of barrel to be able to handle large amounts of food. Often a cow will not show a great depth of barrel but may have a large capacity for food by having a greater width of barrel and wide spring of ribs. A strong jaw, keen eye, large muzzle, and capacious barrel are the indications of ability to consume and digest large quantities of food, which is necessary for high production. The loin should be broad and strong, with roomy coupling.

**Hind Quarters.**—The hind quarters should show the leanness characteristic of other parts of the body. The hip points should be far apart, prominent, and level with the back. The rump should be long and wide with a roomy pelvis; the pin bones high and wide apart. Such a conformation of this region affords plenty of room for the generative organs and reproduction. The thighs should be long, thin, and wide apart, with

plenty of room for the udder. The legs should be fine, straight, and far apart.

**Udder.**—The udder and mammary veins of the cow constitute one of the most essential organs, and are largely used as a determining factor of the ability of the cow as a producer. The udder should be capacious, free from flesh, and when empty should be soft and flexible. Capacity of the udder should be gained by length and width rather than depth. It should be attached to the body high behind and far forward toward the navel and show plenty of width throughout. This conformation permits of more surface for the blood vessels to spread over as they pass through the udder. The quarters should be even in size and not cut up; but the base or sole of the udder should be flat. The teats should be even, of good size for milking conveniently, and set squarely on each quarter of the udder. The hair on the udder should be fine and soft, indicating quality.

The udder is the milk factory, where the nutrients are taken from the blood and made over into milk. By some unknown process, in the udder the food materials taken from the blood are changed to the substances found in the milk. The milk veins serve as an index to the amount of blood that flows through the udder. These veins carry the blood from the udder back to the heart. They can be noticed leading from the four quarters of the udder and running forward just underneath the skin and entering the abdomen near the center of the body. The milk wells, through which the milk veins enter the body, should be large. There may be more than one milk well on each side of the body. In some cases, the milk veins branch as they leave the udder and enter the body in several places, Cows have been known to have as many as five milk wells on each side, and it is not uncommon to find cows with two or three milk wells on each side of the body.

## KEEPING RECORDS OF THE COWS

After one has a herd there is no excuse for not knowing the records of each animal in it, for this is the only sure way of selecting profitable cows. A cow may score very high according to the score card, and still not be a very profitable producer. By selecting cows on their records, discarding the unprofitable ones, using good sires, and raising heifer calves

from the best cows, one is sure to increase the productiveness of the herd.

In keeping records of the cows one must consider the disposition made of the milk and keep the records necessary to figure the profit or the loss on the product sold. One who sells milk, either wholesale or retail, regardless of the fat content, need keep a record only of the amount of milk produced and

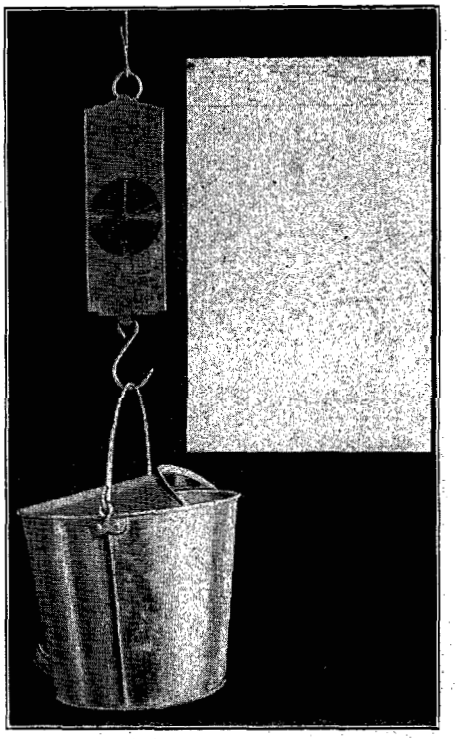


FIG. 8.—Outfit for keeping complete milk records

feed consumed. The milk of each cow should be weighed at each milking and the records kept. An outfit for keeping complete milk records is shown in figure 8. The essentials of the monthly milk record sheet, shown fastened to the board by thumb tacks in figure 8, are shown in detail in figure 9.

Where the product of the herd is sold as cream and payment made on a butterfat basis, or where butter is made and sold, a record should be kept of the butterfat production of each cow. The best method to follow in keeping such a record is to

weigh the milk of each cow at each milking, as previously provided, and test each cow's milk at regular intervals with the Babcock tester. In this way the actual record of each cow's production can be ascertained. This information will also be of value in the feeding of the herd.

**Milk**-record sheets may be obtained by writing the Department of Dairy Husbandry, Kansas State Agricultural College. A Babcock testing outfit (fig. 12) may be obtained from any firm handling dairy supplies.

KANSAS STATE AGRICULTURAL COLLEGE
DEPARTMENT OF DAIRY HUSBANDRY

MILK RECORD For the Month ending _____ 19__

NAME OR NO. OF COW

| DAY | TIME |
|---|---|
| 1 | A.M. |
| | P.M. |
| 2 | A.M. |
| | P.M. |
| 3 | A.M. |
| | P.M. |
| 30 | A.M. |
| | P.M. |
| 31 | A.M. |
| | P.M. |
| TOTAL MILK | |
| PERCENT BUTTERFAT | |
| TOTAL BUTTERFAT | |

FIG. 9.—Essentials of a monthly milk-record sheet

It is not practical to make a butterfat test of each milking; testing the milk for several milkings once a month will be sufficient. The fat content does not vary as much as the quantity of the milk. A composite sample, representing the milk given during two days, will give very accurate results. The percent of fat obtained from this sample multiplied by the pounds of milk given during the month will give the estimated butterfat record for the month. The method of testing milk for butterfat is given on page 30.

In giving the records of cows breeders often use the term BUTTER, while others speak of BUTTERFAT. Butterfat is the basis on which cream is sold to the cream stations or creameries, and butter is the finished product. The amount of butterfat in butter varies with the method of churning, the amount

of moisture, and many other causes. In general, 80 pounds of butterfat will make 100 pounds of commercial butter. To change butterfat to 80 percent butter, divide the number of pounds of butterfat by .8, or increase the number of pounds of butterfat by one-fourth.

The advantage and value of having complete records of the production of the cows may be shown by the records of practically any cow-testing association. The records of the Dickinson County Cow-Testing Association for 1913 may be taken as typical.[1]

Table III gives the yearly records of the 10 best and the 10 poorest cows in the Dickinson County Cow-Testing Association for 1913, the first year of its work.

TABLE III.—RECORDS OF THE 10 BEST AND THE 10 POOREST COWS

(Dickinson County Cow-Testing Association, 1913)

| Months milked | Pounds of milk | Pounds of fat | Value of products (*a*) | Cost of feed | Profit or loss (*b*) | Return for $1 in feed |
|---|---|---|---|---|---|---|
| *Ten Best Cows* | | | | | | |
| 11 | 13,689 | 546 | $201.12 | $55.91 | + $145.21 | $3.60 |
| 12 | 8,094 | 449 | 152.58 | 49.00 | + 103.58 | 3.11 |
| 11 | 10,258 | 386 | 144.44 | 50.35 | + 94.09 | 2.67 |
| 11 | 7,229 | 384 | 131.90 | 48.49 | + 83.41 | 2.72 |
| 10 | 8,191 | 377 | 133.92 | 26.16 | + 107.76 | 5.12 |
| 11 | 7,290 | 376 | 180.00 | 49.89 | + 80.11 | 2.61 |
| 9 | 8,042 | 375 | 131.77 | 37.42 | + 94.35 | 3.52 |
| 11 | 7,926 | 372 | 131.50 | 37.17 | + 94.33 | 3.54 |
| 10 | 6,573 | 368 | 124.86 | 41.30 | + 83.56 | 3.02 |
| 10 | 6,973 | 365 | 125.70 | 47.77 | + 77.93 | 2.81 |
| Average..... | 8,427 | 400 | $140.78 | $44.35 | $96.43 | $3.11 |
| *Ten Poorest Cows* | | | | | | |
| 5 | 1,418 | 59 | $21.58 | $33.23 | — $11.65 | $0.65 |
| 7 | 1,260 | 66 | 22.83 | 25.11 | — 2.28 | .91 |
| 7 | 2,796 | 117 | 42.49 | 27.35 | + 15.14 | 1.63 |
| 10 | 3,405 | 121 | 46.16 | 30.15 | + 16.01 | 1.53 |
| 9 | 3,102 | 125 | 45.89 | 26.63 | + 19.26 | 1.72 |
| 7 | 2,784 | 125 | 44.62 | 35.47 | + 9.15 | 1.26 |
| 7 | 3,801 | 138 | 52.25 | 22.14 | + 30.11 | 2.36 |
| 8 | 3,222 | 142 | 50.95 | 27.25 | + 23.70 | 1.87 |
| 8 | 4,102 | 149 | 56.04 | 34.73 | + 21.31 | 1.61 |
| 12 | 3,584 | 148 | 53.92 | 22.32 | + 31.60 | 2.86 |
| Average..... | 2,942 | 119 | $43.67 | $28.44 | $15.23 | $1.54 |

(*a*) Butterfat was figured at 28 cents per pound and skimmilk at 40 cents per hundred.

(*b*) The profit or loss is the difference between the value of the butterfat and skimmilk, and the cost of feed. The manure and the calf are a liberal offset for other items of expense.

The best cow produced 546 pounds of butterfat in a year, and made an average return of $3.60 for each dollar's worth of feed consumed. The poorest cow produced only 59 pounds of butterfat in a year and made a return of only 65 cents for each

[1] Reed, O. E. The Dickinson County Cow-Testing Association. Kan. Agr. Expt. Sta. Cir. 35: 1-8. Figs. 3. 1914.

dollar's worth of feed consumed. The 10 best cows made an average production of 400 pounds of butterfat and an average return of $3.11 for each dollar invested in feed. The 10 poorest made an average production of 119 pounds of butterfat and the return for each dollar's worth of feed was $1.54. A herd of 10 cows such as the 10 best cows in this association would have returned the owner a yearly profit of $964.30, while a herd of 10 cows such as the 10 poorest in this association would have required the same amount of the owner's attention for the year and returned a profit of only $152.30.

The man who owned the best cow, as well as the man who owned the poorest cow, did not realize that he had such animals in his herd. All the good cows were not found in one herd, but there were poor cows as well as good ones in all the herds. This condition is undoubtedly the same as is found in the average herds of the state. The only way that one can determine the differences there are among the cows in a herd is to keep records of their production.

The summary of the work of the Dickinson County Cow-Testing Association for the five-year period, 1913 to 1917 inclusive, is given in Table IV.

TABLE IV.—SUMMARIES OF THE PRODUCTION RECORDS FOR FIVE YEARS

(Dickinson County Cow-Testing Association, 1913 to 1917)

| YEAR | Number of cows tested | Average per cow | | | | |
|---|---|---|---|---|---|---|
| | | Pounds fat | Pounds milk | Income | Cost of feed | Profit |
| 1913 | 134 | 246.0 | 6,019.0 | $90.48 | $35.59 | $54.89 |
| 1914 | 151 | 247.5 | 6,414.0 | 87.95 | 41.01 | 46.94 |
| 1915 | 154 | 247.7 | 6,299.5 | 98.25 | 42.72 | 55.53 |
| 1916 | 144 | 254.7 | 7,067.3 | 109.19 | 48.43 | 60.76 |
| 1917 | 154 | 281.8 | 7 169.5 | 150.91 | 59.88 | 91.03 |

On March 1, 1920, 14 cow-testing associations were in operation in that many Kansas counties. They represented 278 different herds of cattle containing 3,746 cows. The cow-testing associations are demonstrating to dairy farmers the fact that it pays to keep records of the production of their animals.

## THE SELECTION OF THE HERD SIRE

The future development of the herd depends to a great extent upon the kind of sire used with the herd. It has been said that the sire is half the herd. The herd sire should be a pure-bred of the breed he represents and be backed by good ancestry.

If possible he should be a sire whose mother and other close female ancestry have shown high records of production. A yearly record is to be preferred to one of shorter duration.

Figure 10 shows an excellent Holstein bull. He is the senior herd bull in the college Holstein herd. His sire is Canary Paul Fobes Homestead 65751, a bull that has 50 daughters in the advanced registry; his dam is Leah Campbel Fobes De Kol 164680, that produced 13,101 pounds of milk and 447 pounds

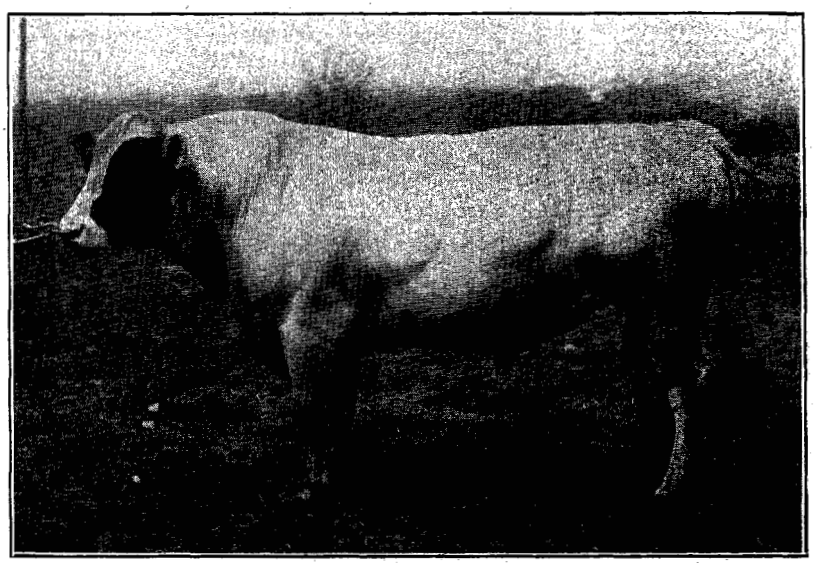


FIG. 10.—Canary Paul Fobes Homestead 6th 117086, senior herd sire of the Holstein herd of the Kansas State Agricultural College

of butterfat at two years of age. His first daughter (fig. 5) to freshen produced 16,128 pounds of milk and 515 pounds of butterfat at two years of age. His daughters are excellent individuals and promise to be good producers.

If it is not possible to know the record of production one should by all means see the mother of the animal in question and note how closely she conforms to the dairy type. If the sire's father has daughters that have proved to be good producers he is more certain to transmit the dairy qualities desired. Very often it is possible to buy an old sire who has proved to be a good breeder. Good results from the use of such an animal are almost certain. The objection to buying

an old bull is that he is high-priced, if his value is known, and one runs a chance of getting an unruly animal. A bull calf is usually selected. A calf can be purchased for less money and the owner can train him as he chooses.

Too much attention cannot be given to the selection of a sire, for future successes depend largely upon the head of the herd. In addition to having good records back of him, a bull should be a good individual. If good cows are wanted, the sire must have the desirable characteristics that are to be transmitted to them. In addition to showing a strong, resolute, masculine character, he should also have good quality, large barrel capacity, a strong constitution, a straight top line, a good, level rump, and good breed type.

It is more desirable to use a proved sire than to take a young calf with a good pedigree and trust to his being a sire of high-producing daughters. Too many breeders are discarding bulls when their heifers are ready to breed. A man with a small herd cannot be expected to keep two bulls, but an effort should be made to trade bulls for a few years and in this way save the expense of a second bull and give the daughters of the first bull a chance to develop before the bull is slaughtered. The value of a bull is measured by his ability to sire animals that are higher producers than their dams, and it is a well known fact that the higher the production is, the greater the difficulty in obtaining a bull that will increase it.

### FEEDING AND MANAGEMENT

In order to reap the highest and most economical returns from a properly bred and selected herd, the animals must be fed intelligently. One of the principal reasons for the low average production of the Kansas cow is that she is not properly fed. By weeding out the poor cows and feeding the best ones more intelligently, it would easily be possible to double the production of the cows of the state.

A factor that is important in obtaining the best returns from dairy cows, is the time of the year at which they freshen. A cow calving in the fall of the year will produce from 30 to 40 pounds more butterfat than the same cow calving in the spring of the year. A cow calving in the fall gives the maximum production on dry feed, and as the production declines in the spring she is turned on grass and this causes her to produce

more milk. As a result she keeps up her production longer and is ready to be turned dry during the hot summer months when pastures are short and the flies bad.

Even if the cow calving in the fall did not produce a pound more fat than the cow calving in the spring, she would be more profitable because dairy products are highest in price in the fall and winter months, while in the spring during the flush season they are generally lowest. It is not only more profitable to have the cows calve in the fall, but it is also better for the calves. A fall calf can be handfed during the winter, and when spring comes will be ready to be turned on pasture and will give little trouble beyond that time. A calf dropped in the spring has hot weather and flies to contend with, and is frequently turned on grass too early for the best development. A farmer has more time to spend with the cow and calf when the cow freshens in the fall, and the cow and calf will also give him the least trouble during his busy season.

If the cows are to make their maximum production it is essential that they be properly fed and cared for before they freshen. Each cow should be given four to six weeks rest each year. During the time the cow is dry she must be well cared for, and not turned out on a poor pasture or stalk field to care for herself. The cow needs this rest in order to repair and build up her body. She should also be allowed to gain in weight. The cow that freshens poor in flesh can not be expected to milk well during the following milking period. But the cow that is in good flesh when she freshens will start off giving a large flow of milk and will keep it up for a long time.

For several days, or a week, before the cow is due to freshen her grain should consist of bran. The bran will act as a laxative and thus the digestive system of the cow will be brought into good condition before calving. Immediately after she freshens the cow does not need, and should not be fed, a heavy grain ration. A ration of bran, fed dry or as a mash, is sufficient for several days. If the cow has surplus flesh at this time she will draw on the store and produce a large amount of milk from the start. The cow should be given a small quantity of grain at first, this being gradually increased as the milk flow increases. After all swelling and inflammation is gone from her udder she may be given a heavier grain ration. At the end of three or four weeks, she will reach her maximum milk

production, and should then be on full feed. From this time on the ration should be regulated according to the quantity of milk given. The ration given the cow will depend upon the kinds of feed available. This will vary according to location; Thus a general discussion of the feeding question is necessary.

### MAINTAINING SUMMER CONDITIONS

Economic feeding resolves itself into a study and execution of the lesson which Nature teaches. Under natural conditions the average cow makes her greatest production in milk during May and June, or early summer. When she is turned to pasture in the spring, after having received a dry ration, she will invariably increase in milk flow. The ration the cow receives at this time is Nature's ration, grass in its choicest form. There is plenty of food at hand, it is palatable, succulent, easily digested and contains plenty of food nutrients, and the cow is comfortable. The intelligent feeder, therefore, will strive to maintain these conditions as nearly as possible throughout the year.

While the average cow does her best on pasture and receives sufficient nutrients at that time, the high-producer will require additional feed while on pasture and should be given all the grain for which she will make returns. A high-producing cow on pasture will for a time make up the deficiency by drawing on her body for the necessary nutrients required, but she will soon exhaust this supply and will then decline in milk production. As the season advances the pastures dry up or get short, and they should then be supplemented with other feeds. Silage or green crops such as corn, alfalfa, oats, and peas may be fed at that time. Perhaps that is the most critical time in the milking period of the average cow. The majority of cows in the state freshen in the spring, and when the pastures are not supplemented they decline very rapidly in milk production or "go dry" entirely.

### A BALANCED RATION

As winter approaches the conditions prevailing in early summer must be provided for by the feeder. The feed supply should be plentiful and be so combined as to make the ration a balanced one. It is highly essential that the cow owner know something of the composition of the various feeds and know how to combine these feeds in a ration to get the best results.

There are three substances which must be considered in making up the ration of the dairy cow. These substances are contained in almost all feedingstuffs to a greater or less extent. They are protein, carbohydrates, and fat. Some feeds contain a high percent of one of these substances and other feeds contain a high percent of another substance. The protein or nitrogenous substance is the most expensive of the three. It is used by the animal in the production of hair, hoof, hide, horn, blood, and muscle. Such feeds as alfalfa, cowpea and clover hay, cottonseed and linseed meal, bran, oats, and gluten feeds contain a high percent of this substance. The carbohydrates (sugar and starches) and fat are used for the same purpose and may be classed together. These substances are used by the animal to produce heat to keep the body warm, to furnish energy, and to make the fat that is stored up in the body and in the milk. Such feeds as corn, cane, kafir and the silage and fodder from these plants; timothy hay, millet, oat and wheat straw all contain a high percent of carbohydrates. All of the feeds mentioned in the above groups contain some fat.

A balanced ration must contain both protein and carbohydrate foods. In sections of the state where alfalfa, clover, peas, or other legumes can be successfully grown for hay they should be depended upon to furnish the protein in the ration, and since the protein is furnished in the roughage it is best to feed a grain ration that is rich in carbohydrates in order to balance the ration. Thus if alfalfa hay is available for roughage, corn is the logical grain ration. Where legumes can not be grown the roughages usually are depended upon to furnish the carbohydrates, and under this condition the grain ration should be made up of some food rich in protein. If the roughage consists of cane or kafir hay or fodder, or prairie hay, the grain ration should be made up of such feeds as bran, oilmeal, oats, etc. The protein feeds are the most expensive feeds on the market; hence a cheaper dairy ration can be obtained in localities where the protein is produced in such home-grown feeds as alfalfa, pea, and clover hay.

### COWS MUST BE FED AS INDIVIDUALS

To feed cows economically they must be fed as individuals and not as a herd. It is often the case that cows in a herd are all fed the same quantity, regardless of the quantity of milk

produced. By such a practice some cows are overfed, while others are underfed. The amount of milk a cow will produce can be influenced by feeding, and in this way the amount of butterfat produced can also be affected. The percent of fat in milk, however, cannot be directly increased by feeding. It is to a certain extent a breed characteristic, but also varies with the amount of milk produced by the individual.

In feeding animals it should be understood that the animal uses a certain amount of the food it receives to maintain the body. This is called food of maintenance and it is the first use to which the animal puts its food, whether producing milk or not. The feed given in excess of this amount is used for producing milk, storing fat on the body, or for growth in the case of the young animal.

Of the two common mistakes in feeding, perhaps underfeeding is the most common. It is a poor practice and a serious mistake to feed a cow only the amount required to maintain her body and to deprive her of sufficient additional feed to produce all the milk she is capable of producing. The effect of underfeeding may not be noticed at once, as a cow will produce milk for a time at the expense of her body. That is, she will take the surplus flesh off her body and convert it into milk. Hence, if a cow declines in weight while producing milk it shows that she is not receiving enough feed. In the case of a cow being overfed, it may be detected in a short time by the fact that she will put fat on her body, or she may get off-feed.

### THE VALUE OF SILAGE

Another condition of the early summer ration that should be maintained or imitated during the winter, is that of feeding a succulent ration. By the term succulent feed is meant feed having that property possessed by green grass. Such a feed has a value in addition to the nutrients it furnishes. It serves to keep the digestive organs in goad condition. This succulence may be secured in the winter ration by feeding silage or roots. Where roots can be grown successfully they serve the purpose well. In this state silage is the cheapest succulent feed, because it is possible to obtain large yields of corn, cane, or kafir, and such feeds make excellent silage. Aside from supplying an excellent feed, the silo furnishes a

means of handling the whole forage plant in the most convenient and best way possible.

### A FEW RATIONS

The main object in formulating a ration, after selecting the feeds to be used, is to provide a sufficient bulk at all times to satisfy the appetite and feeding capacity of the animal and to furnish the amount of nutrients needed for the work the cow is doing. If the ration lacks bulk the cow will be discontented. An animal may be fed enough nutrients in the form of grain to perform her work, but may receive too little of bulk to be satisfied. The roughage should form the foundation of the dairy ration. A cow should have all the roughage she will clean up at all times and the grain ration should be regulated by the amount of milk produced. A cow will generally eat one pound of alfalfa hay and three pounds of silage per 100 pounds of live weight. A cow giving rich milk should be fed one pound of grain to each three pounds of milk produced per day, while for a cow giving less rich milk, such as a Holstein or Ayrshire, one pound of grain to four pounds of milk is sufficient.

As the winter-feeding period comes on the animals comfort should be considered. Shelter and clean quarters should be provided. A cow will respond readily to warm and comfortable stables, well lighted and properly ventilated. If exposed to cold, a large portion of the feed ration which otherwise would be turned into milk goes to supply the necessary warmth. This makes economic feeding impossible, since the feed of the dairy cow is expensive fuel.

The following rations contain enough nutrients for a cow weighing 1,000 pounds and producing 26 pounds, of 4 percent milk daily. If a cow gives more or less than 25 pounds, mix the grain in the same proportion as given and feed in proportion to amount of milk produced. Cowpea hay may be replaced by alfalfa, clover, or soybean hay. Corn may be replaced with kafir. Linseed meal may be replaced by cottonseed meal or gluten meal. Silage is considered a roughage, and when added to any of the rations, three pounds of silage in bulk is equivalent to one pound of hay. Silage made from kafir, cane, or other sorghums is almost equivalent to corn silage.

| | *Pounds* |
|---|---|
| Alfalfa | 10 |
| Silage | 30 |
| Corn chop | 4 |
| Bran | 2 |
| Linseed meal | 1 |
| Timothy hay | 18 |
| Barley (ground) | 6 |
| Linseed meal | 3 |
| Alfalfa hay | 18 |
| Corn-and-cob meal | 8 |
| Clover hay | 12 |
| Corn stover | 5 |
| Corn chop | 5 |
| Linseed meal | 2 |
| Sorghum fodder | 15 |
| Wheat bran | 5 |
| Kafir corn | 5 |
| Linseed meal | 2 |

| | *Pounds* |
|---|---|
| Wheat bran | 5 |
| Wheat shorts | 5 |
| Cowpea hay | 18 |
| Corn chop | 5 |
| Linseed meal | 4 |
| Prairie hay | 18 |
| Oats (ground) | 8 |
| Linseed meal | 2 |
| Clover hay | 12 |
| Alfalfa hay | 10 |
| Dried beet pulp | 5 |
| Corn chop | 4 |
| Gluten feed | 1 |

## THE DAIRY BARN

A cow will not produce the maximum flow of milk unless she is comfortable. The barn does not need to be expensive but must provide a comfortable tie, a substantial floor that can be kept clean, and plenty of fresh air and sunlight, and it should be warm enough for comfort in severe weather.

There must be plenty of windows to admit fresh air and sunlight. A dark barn affords an ideal place for the growth of bacteria. Sunlight is the greatest enemy of bacteria and it does not cost much. A barn must be ventilated by dropping the windows in from the top, or a system of ventilation, such as the King System, can be installed for this purpose.

The stalls should be adjusted to the size of the cows. For Holsteins, or other large cows, the stalls should be at least three and one-half feet wide, and five feet long, measured from the stanchion to the manure gutter. For cows of the size of the Jersey, the stall should be three feet wide and four and one-half feet long. It is advisable to make the platform wider at one end of the barn than at the other, so that the largest cows may be accommodated at the wider end and the smaller cows at the other. When the platform is accurately adjusted to the size of the cow it is much easier to keep the cows clean. The manger should be at least two and one-half feet wide and the manure gutter at least sixteen inches wide and from six to ten inches deep.

The floor of a barn may be made from almost any building material, but a cement floor (fig. 11) will give more general satisfaction than will any other, because it is more durable and easier to keep clean. Objection is raised to a cement floor because of its coldness, and some claim that the cow's knees are injured because of the hardness of the cement. If plenty of bedding is used these objections are easily overcome. In cold climates, or where bedding is scarce and expensive, a wooden platform can be built over the cement floor to protect the cows.

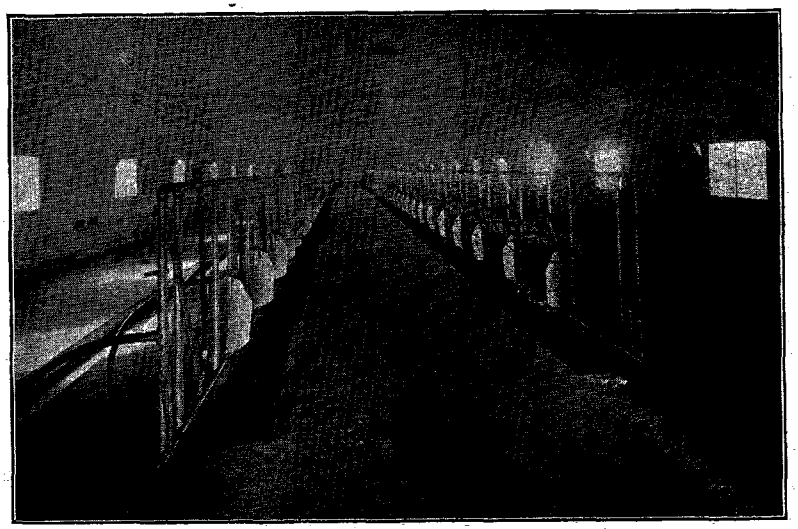


FIG. 11.—Interior view of dairy barn, Kansas State Agricultural College

The cement floors on which the cows are expected to walk should be made rough to prevent the animals from slipping and falling. Too often the floors are made smooth for the reason that they are easier to keep clean, but the cow's comfort and safety should have first consideration.

## DIRECTIONS FOR MAKING THE BABCOCK TEST

Apparatus: 17.6 c.c. pipette, 17.5 c.c. acid measure, test bottles, dividers, waterbath, centrifuge, and sulphuric acid, specific gravity 1.83 to 1.84. (Fig. 12.) The milk to be tested and the acid used should be brought to a temperature of

[1] For detailed information on the testing of milk and cream, write to the Agricultural Experiment Station, Manhattan, Kan., for a copy of the latest edition of the state dairy commissioner's bulletin on "The Permit System of Cream-Buying."

about 70 degrees; this can best be done by the use of the hot waterbath.

1. Pour sample of milk to be tested from one vessel to another at least five times.

2. Take pipette between thumb and second and third fingers, leaving the index finger free. Draw milk into pipette immediatley after stirring, and place the index finger over the top of the pipette; now release the finger very slightly until top of the milk column is even with the mark on the pipette.

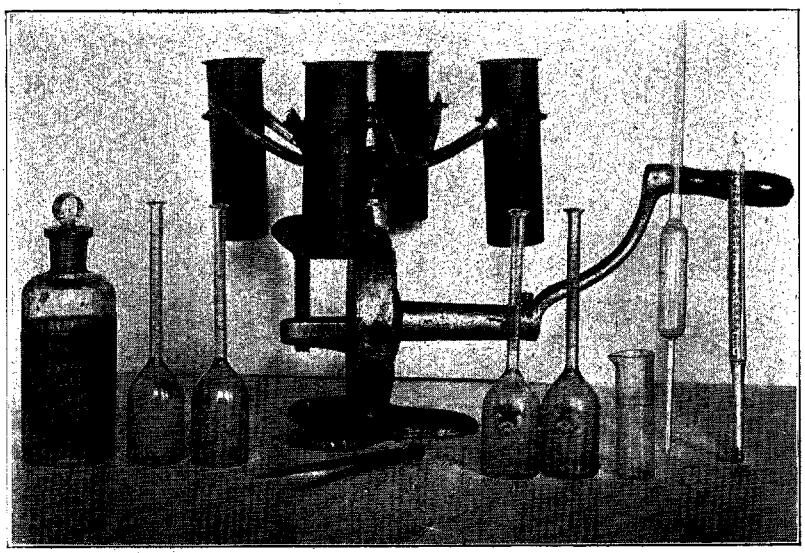


FIG. 12.—Babcock testing outfit

3. Hold milk bottle on a slant and place end of pipette in the neck of bottle, leaving an opening for air, so that air bubbles can not form and throw milk out of neck, and release finger and allow the milk to flow into the bottle, blowing the last drop from the pipette.

4. Fill acid measure to mark *(never draw acid into pipette),* take milk bottle by the neck between thumb and fingers of the left hand, so that the bottle can be turned; now bring the lip of acid measure to mouth of bottle, and pour acid into the bottle, rotating the bottle so that all the milk will be washed from the neck into the bottle. Hold the bottle at a slant so that the acid will not fall directly on the milk and form pieces of charred curd.

5. Give bottle a rotary motion in order to cause a gradual mixing of milk and acid; sudden mixing will cause large amounts of heat and gas and will throw the material out of the bottle.

6. After the bottle has been stirred thoroughly and the curd is dissolved, place the bottle in centrifuge and whirl five minutes.

7. Place bottles in waterbath of 180° F. for five minutes and fill with hot water to neck.

8. Whirl for two minutes.

9. Place in waterbath for five minutes and fill with hot water to within one-half inch of the top of bottle.

10. Whirl for two minutes.

11. Place in waterbath, 130° F., for five minutes.

12. Measure fat column by placing one point of dividers at bottom and the other at the top; then, keeping dividers at that spread, place one point on the zero mark and note where the other point falls on the scale. That number will correspond to the percent of fat in the milk.

In testing cream, regular cream-test bottles must be used, and the samples of cream for testing should be weighed instead of being measured. Only sufficient acid is used to dissolve the milk solids. In reading the cream test read from lower edge of fat column to a point that includes one-half of meniscus.

PRINTED BY KANSAS STATE PRINTING PLANT
E. E. KELLEY, ACTING STATE PRINTER
TOPEKA, KAN. 1921
8-7150

□