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The Management of Dairy Herds

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THE MANAGEMENT OF DAIRY HERDS

E. V. ELLINGTON *

INTRODUCTION

Dairy farming in its various phases is an industry that is making a steady, conservative growth in Idaho. The development of the various irrigation projects and the gradual elimination of the ranges have necessarily brought about a different type of agriculture. For various reasons dairy farming has proven to be an especially efficient method of handling irrigated farms. It is particularly adapted to high-priced lands and sections where intensive agriculture is practiced.

As a rule a sparsely settled country is not well adapted to dairy farming. As the value of the land increases and it is necessary to secure a correspondingly larger income, the dairy cow is used. Dairy farming is intensive farming and is adapted to thickly settled communities where the size of the farm unit is relatively small.

One of the advantages of dairy farming that appeals to the small farmer is the certainty of the returns at regular intervals. It brings in a cash income each month, where, with certain other types of farming, the income is received only once or twice a year, or after the harvest season.

The 1910 census shows that Idaho has 92,437 cows being used for milk production, with an average of 3,087 pounds of milk and 118 pounds of butterfat. These figures on production appear very low. But when this census was compiled a great majority of the cattle were range cattle, there being at that time very few cattle in the state of strictly dairy type. There has been a rapid development of dairying during the past seven years, and while the total number of cows has not materially increased there has been a decided increase in the average production due to improved methods of breeding, the introduction of a large number of dairy cattle, and the elimination of the old range cattle that were used for milking purposes.

The greater part of the agricultural land of the state is very well adapted to dairy farming. The success of any system of farming, and especially dairy farming, depends upon certain factors. The most important of these are climate, distance to railroad, soil as affecting the growing of crops, and marketing facilities.

The larger percentage of the dairy products comes from the temperate regions. A high-producing cow is not well adapted to extremely hot temperatures. Likewise, extreme or sudden variations in temperature are

*Now with the Dairy Division of the Bureau of Animal Industry.

not conducive to economical milk production. In sections where long, severe winters are common, a large outlay of capital is required for extensive systems of housing. Where cattle are housed for a considerable portion of the year and where proper sanitation is not considered, oftentimes contagious diseases like tuberculosis are prevalent. In most sections of Idaho, climatic conditions are such that the open system of housing is much in use and tuberculosis among the native cattle is practically unknown. There have been some tubercular cattle imported into the state but at the present time, according to the statement of the State Sanitary Board, less than two per cent of the cattle are diseased; if precautionary measures were taken, this disease could be absolutely stamped out in the state.

The soil and feed factors are always to be considered. Cattle raising is coordinate with the raising of hay and forage crops. To make an economic success of dairying, the greater part of the feed should be raised on the farm and fed there. Of course, it may be advisable to grow some cash crop that may be sold and to purchase some other concentrate such as oil meal or bran to be used in balancing the ration. Where alfalfa and corn for silage can be successfully grown, or where permanent pastures can be established, such a section is adapted for live-stock and dairy farming, as these are the basis for the successful ration.

The third important factor, and one which is closely coordinated with transportation, is that of markets. While the success of operating a dairy farm depends largely on the quality of the cows and their ability to convert feed into milk the profits are greatly increased by a study of markets and market conditions. The demand for all dairy products should be considered and it should be ascertained which will give the greatest returns. At times perhaps market milk sold to the condenser or cheese factories will pay and at other times butter and sweet cream will give the greater returns. The manager should at all times be prepared to take advantage of any fluctuations on the market of any form of dairy products.

It is often possible to establish a private trade for the dairy products of the farm to good advantage. Oftentimes inhabitants of the city welcome a regular supply of high class butter, buttermilk, skim milk, cottage cheese, and sweet cream. Retail prices might thus be obtained, and a permanent market established. In the effort to establish a trade of this kind the following rules should be strictly observed to insure success: 1st, the products must be of the best, and of uniform quality; 2d, the delivery must be regular and prompt. Nothing will ruin a trade of this kind quicker than an irregular supply or an occasional bad lot of goods.

A few years ago Idaho, in common with the other western states, was a large importer of dairy products, but at the present time Idaho is

supplying the home demand and is entering the eastern markets with marked success in the sale of butter, cheese, and condensed milk.

Idaho will always market her dairy products in the form of butter, cheese, and possibly condensed milk, rather than in the form of market milk for city consumption. Butter, cheese, and condensed milk are concentrated and can be shipped long distances. On the other hand, cream and milk for market purposes are very bulky and must be produced near the sections where they are consumed. Where immense amounts of milk are consumed, New York City for instance, special milk trains make runs of 300 miles or more. Those farms that are situated so that the production of market milk is possible cannot afford to produce butterfat for sale on the wholesale market, for the nearer the cities the higher the price of feed. Under such conditions butter and cheese must be produced where the feeds are cheap and can be grown in abundance. Because of this, the center of butter production has moved west within the past ten years and is now west of Chicago. Census figures show that the manufacture of butter has decreased nineteen per cent in the past ten years in the extreme eastern states, including New York, the change being not away from dairying, but in the nature of the product sold. This has not proven true in this state. One manufacturer of dairy products doing business in Idaho increased the value of his output over $1,000,000 in 1916 and is making preparations to handle a $5,000,000 business in 1917. The same percentage of increase will hold true with most of the creameries doing business in the state.

A larger part of the dairy products is manufactured into butter thru the creameries. In the earlier stage of the industry a large number of "promoted" creameries were established in the state before there were cows enough to support them. Most of these failed and retarded the growth of the industry to some extent. As the number of cows has increased and the systems of management have improved, factories have been established and are succeeding at the present time.

The manufacture of cheddar and brick cheese has been given a decided impetus in the past three years. It was long believed that a well-flavored cheese could not be successfully made in sections where alfalfa hay was fed. This prejudice has been removed. A number of very successful plants have been placed in operation during the past three years. One cooperative plant during 1916 paid over $130,000 to the farmers. At the National Dairy Show held in Springfield, Mass., October, 1916, cheese from this state won second in strong competition. Three factories exhibiting had scores over 95 per cent. This proves the charge that the necessary flavor is lacking in western cheese is not well founded.

This phase of the industry is bound to become an important factor.

The number of sections in the United States that can successfully manufacture cheese is limited and there is a constantly growing demand for cheese as food. There is at the present time but one condensed-milk factory in the state. A condensory can be operated only where a large supply of perfectly fresh milk can be obtained. Condensers as a rule create a good market for milk.

Dairying is most highly developed in the irrigated sections of Idaho. Cows are most numerous in Ada and Canyon counties where the product is largely used for the production of butter and cheese. Dairy herds are well established in the irrigated lands of the North and South Twin Falls tract and the Carey Act project of the Idaho Irrigation Company. In the eastern section, north of Pocatello in the upper Snake River valley, a large percentage of the product is shipped to Butte, which offers a very good market. South of Pocatello in the upper Cache Valley, the Salt Lake City butter factories and the condensed-milk factories are receiving most of the supply produced.

The cut-over lands in the northern section of the state are well adapted for dairy purposes; clovers and cereals can be readily grown, and because of the proximity to Spokane and the lumber and mining districts a ready market is secured.

The communities that are not especially adapted to livestock and dairy farming are the dry-land farming sections in south-central and eastern Idaho, and the Palouse wheat-growing section in the north. These are regions where large farms are the rule and where permanent pastures are established with difficulty.

BREEDS OF DAIRY CATTLE

For purposes of comparison dairy cattle may be divided into two groups. The major group includes the Holstein-Friesian, Jersey, Guernsey, and Ayrshire; the minor group includes the Brown Swiss and Dutch Belted. Some authorities classify the milking Shorthorns as a dairy breed; others designate them as a dual-purpose cattle.

Holstein-Friesian.—The Holstein-Friesian cattle are a popular breed in many sections of the west, especially in those communities where the product is used principally for market milk, cheese, and condensing purposes. The breed originated in Friesland, one of the provinces in north Holland, and has been bred principally for milk production in this and adjoining provinces for approximately 2,000 years without the introduction of outside blood; consequently the dairy characteristics are quite uniformly established. They are the largest of the dairy breeds, averaging 1,200 pounds in weight, although it is not uncommon to find females weighing up to 1,700 pounds.

In Holland they are also used for beef purposes and a large proportion of the meat supply is secured from this breed. In the United

States they stand high for a dairy breed as meat producers. The calves are vigorous, grow rapidly, and are well adapted for veal production, the average weight at birth being 95 pounds. In color they are black and white in varying proportions, but never blending, the colors being distinct.

They have excellent breeding qualities, are good feeders, are quiet and contented in disposition, and are not easily frightened at any unusual or sudden disturbance.

As milk producers the Holstein-Friesian cows stand high. They produce more milk at less cost per 100 pounds than any other dairy breed. Under good farm conditions, herds should average from 8,000 to 10,000 pounds per cow per annum.

The weakest feature of the breed is the low fat content of the milk. The percentage of fat is the lowest of any of the breeds, altho the total fat production is high because of the large quantity of milk produced. The world's yearly record up to the present time for butterfat production of 1,205 pounds fat is held by the Holstein cow, Duchess Skylark Ormsby.

Jerseys.—The Jersey and Guernsey cattle are classified as the Channel Island breeds, as they originated on the islands of Jersey and Guernsey which are a part of the Channel Island group that lies in the English Channel off the coast of France. The Jerseys are a most cosmopolitan breed as they are distributed from Canada to Mexico. It is stated that there are more Jersey cattle in the South than all other breeds of cattle combined.

On the island of Jersey a most intensive system of agriculture is followed. The climate is mild and uniform and the cattle are pastured by tethering. The cows remain out of doors the greater portion of the year and are fed very little grain, but in addition to pasture and hay they are liberally supplied with roots.

Much attention has been given by the breeders on the island to developing type as well as production, and as a result there has been developed an animal of great beauty and symmetry.

The Jerseys are the smallest of the dairy breeds, the cows on the island of Jersey ranging from 700 to 950 pounds, and the bulls from 1,200 to 1,800 pounds. In the United States, however, the breeders have devoted more attention to size, and it is not unusual to find mature cows weighing over 1,000 pounds. The American type of Jersey is not quite so symmetrical and uniform but is more rugged in appearance. In color the breed varies thru the different shades of yellow, fawn, tan and even a creamy white and thru all shades of brown to deep black. With all these colors there may be patches of white.

The cattle are rather nervous in disposition and are excitable under abnormal conditions, but when properly handled are exceedingly quiet and docile, and respond very readily to kind treatment.

While in quantity of milk produced the Jerseys are exceeded by other breeds, in the use of feed for economical production they stand high.

The best known characteristic of the Jersey is a milk flow of high fat content. The breed is well adapted for those communities where the product is used for the manufacture of butter. The Jersey is also a most persistent milker and for this reason is a great favorite as a family cow.

As a producer of beef the Jersey stands low. The average weight of calves at birth is 55 pounds. The world's record for the breed is held by Sophie 19th of Hood Farm, with a production of 17,557.7 pounds milk, 991.1 pounds fat.

Guernseys.—Undoubtedly the Guernsey and Jersey originally came from the same stock, but the conditions under which they have been developed on the island of Guernsey have resulted in an animal that is somewhat more rugged and heavier by approximately 100 pounds than the island Jersey. The breeders of Guernseys have not considered type as much as have the breeders of the Jerseys, consequently the Guernseys lack the symmetry and uniformity that characterize the Jersey.

The Guernsey cow weighs on an average 1,000 pounds and varies in color from a light yellow and orange with considerable white, to the dark shades approaching a brown. The muzzles are usually flesh colored, although a black nose is sometimes found. A distinct characteristic of the breed is a very liberal yellow secretion, especially seen where the hair is light and also found in the ears and around the eyes and tail.

The Guernseys have the dairy temperament highly developed, but the cows are quiet and easily handled, and in the management of the bulls less trouble is reported than with other breeds, as they seem more docile.

In quality and quantity of milk produced, the Guernseys are similar to the Jerseys with the exception that the milk is noted for its extremely yellow color, and butter made from Guernsey milk has a high color at all times of the year. The Guernseys are well adapted to those sections where butter factories predominate, as they are economical producers of butterfat. For beef production the breed stands low as it is not well adapted either for beef or veal production. The strong and weak points of the breed are similar to those of the Jerseys.

The champion Guernsey cow at the present time is Murne Cowan, with a record of 24,008 pounds of milk and 1,098.18 pounds fat.

There has been a steady, conservative growth in the popularity of the Guernsey throughout the United States, especially in Wisconsin and the eastern dairy states, and at the present time there are a number of excellent herds distributed thru the western states.

Ayrshires.—The native home of the Ayrshire cattle is in the county of Ayr in southwest Scotland. It is a region of fair fertility, of natural pasturage, but distributed in such a way that the animals must cover great distances a day in order to satisfy their appetites. As a breed, the Ayrshire is the youngest of the well-established dairy breeds, and it seems to have been largely developed in the nineteenth century. Some authorities claim that it was established by the crossing of Holland, Durham, and the Channel Island breeds on the native stock.

In size of animal and quality and quantity of milk produced, the Ayrshires stand about midway between the Holstein-Friesian and the Channel Island breeds. The females average approximately 1,000 pounds in weight.

The Ayrshires do not approach the extreme angularity in form that characterizes the other dairy breeds. They are smoother over the shoulders, back and rear quarters, and when not milking, fatten quite readily and make a fair quantity of beef. They are very uniform and symmetrical in type. The striking characteristic of Ayrshire cattle is the large, symmetrical udder. The Scotch breeders have devoted much attention to developing a perfect udder and have succeeded to a remarkable extent. The udders are attached well up behind and extend far forward with a flat and even lower surface. The teats are uniform in size and evenly placed. One criticism is that the teats are too small.

The common color is red or brown and white in different proportions. In America the red or reddish brown predominates over the white. The Scottish type has a much higher proportion of white, but these colors, like those of the Holstein, are distinct and never blend. The horns are long and curve outwards, upwards, and, in some instances, backwards.

In disposition they again stand between the Jersey and Holstein. They are more active and alert than the Holstein but are not as sensitive to unusual surroundings as the Jersey. They are regular and sure breeders.

At the present time the Ayrshires as a breed rank fourth in number in the United States. Most of the cattle are descended from the cattle imported into Canada in the early days, altho recently there have been a number of importations made direct from Scotland. Most of the Ayrshires in this country are distributed in the north-central and eastern states, although one of the highest-producing herds is located on the Pacific Coast. They are the leading dairy breed in Canada and New Zealand.

There is no breed of dairy cattle that excels the Ayrshire in obtaining food and thriving on scanty pasture, or in giving a profit upon the coarsest roughage. While they have not been extensively advertised they are growing very rapidly in popularity. The present Ayrshire record is held by Lily of Willowmoor with 22,596 pounds of milk and 955.56 pounds of fat.

Brown Swiss.—Of the minor dairy breeds, the Brown Swiss is one of the more prominent. While they are found in almost every state in the Union, the total number is small as compared with the leading dairy breeds. They are native of Switzerland where they have been bred for milk, meat, and draft purposes, as far back as history records.

In appearance they are plain and well proportioned (altho inclined to fleshiness), with straight broad back, heavy legs and neck, and a general appearance of coarseness.

The mature females average 1,200 pounds in weight; they are quiet

and docile, and are extremely hardy. They are regular breeders, and the calves when dropped are larger than those of the other dairy breeds. Under good farm practice they should produce 6,500 pounds of milk. The fat average is a trifle under four per cent. College Bravura 2nd holds the Brown Swiss record of 19,461 pounds milk and 798.16 pounds fat.

Dutch-Belted.—The Dutch-Belted cattle have the same origin as the Holstein-Friesian and have similar characteristics. The females vary in weight from 900 to 1,300 pounds. Their distinguishing characteristic is the presence of a while belt extending around the center of the body, extending from just behind the shoulders to just in front of the hips. The rest of the body is coal black. There are but few herds in America, these being located in the extreme eastern states.

Milking Shorthorns.—The milking Shorthorn is sometimes classified as a dairy breed and again as a dual-purpose animal. There have been several families of the Shorthorn breed that are famous as milk producers. In the best milking strains the cows are rather rangy and angular in confomation, with large udders and well-placed teats. The highest milk producers conform very closely to the dairy type. A number of cows have made records exceeding 600 pounds in butterfat. It has been found difficult in farm practice to find many Shorthorn cows of high milking qualities that will transmit these with much regularity.

COMMUNITY BREEDING

Before making a selection of any breed of dairy cattle, it is most important to study the matter from a community standpoint. It is unwise to select a breed because it does not happen to be represented in the community. From an economic standpoint it is much better to select a breed that already predominates in a particular locality. This is recognized by all progressive breeders and has many advantages, among which the following may be enumerated:

1. A greater advantage in the sale of surplus stock. Buyers are attracted to communities where they are able to buy in carload lots.

2. A better use of pure-bred bulls of recognized merit.

3. The organization of local breed associations whereby interest is created in good stock and better methods, and in cooperative buying of food stuffs and supplies.

4. Lower cost of official testing of pure-bred cows.

Selection

There are two methods in common practice in the selection of dairy cattle; the first is selection by conformation or the general appearance of the animal, the second is the selection by the record of milk and butter produced.

Selection by conformation.—It is common knowledge that there is a certain type or conformation that is definitely associated with milk production. Score cards have been formulated from which a detailed study may be made showing the different points to be considered and their relative importance. The score card given below may be used as a guide.

*Table 1. General score card for the dairy cow.**

	Perfect Score
1. General form	**9**
Wedge shaped, when viewed from side, top and front	6
Size for the breed: Jersey, 800 lbs.; Guernsey, 1050 lbs.; Ayrshire, 1000 lbs.; Holstein, 1,200 lbh	3
2. Quality	**7**
Hide: thin, mellow, pliable, and loose	2
Hair: fine, soft	2
Secretions: abundant, yellowish	1
Flesh: muscular, free brom bunchiness	1
Veins: large and prominent	1
Bone: fine and clean	1
3. Head	**6**
Forehead: broad between eyes, and dished according to breed	1.0
Face: medium in length, clean cut in outline, ished below eyes	.5
Nostrils: large	1.0
Muzzle: broad, but not coarse	1.0
Jaws: wide at base, strong	.5
Ears: medium sized, thin, haid fine, blood vessels shownig, secretion abundant	.5
Eyes: full prominent, clear and bright	1.0
Horns: small at base, incurving, attached close together at poll	.5
4. Neck	**2**
Moderately thin, of good length, nearly free from loose skin, neatly joined, throat clean.	
5. Forequarters	**11**
Shoulders: withers sharp; shoulder blades lean	2
Chest: broad and deep, well sprung foreribs; large heart girth; moderately full crops, brisket light	8
Forelegs: straight, fine bone, strong	1
6. Body, capacity	**18**
Back: straight, strong, vertebrae prominent	5
Ribs: long, flat, well sprung, wide apart	3
Abdomen (barrel): long, deep, broad, well held up; loin broad, strong and level; flanks low	10
7. Hindquarters	**12**
Hips: wide apart, prominent	3
Rump: long, wide, level	3
Pin bones: widely spaced, on level with hips	3
Thighs: incurving; escutcheon broad, extending well up on pin bones	1
Tail: tapering, fine boned, long and neatly set on; switch, long	1
Hind legs: squarely placed, not sickle hocked, bone fine	1
8. Mammary system	**35**
Udder: large; quarters even and not cut up between; extending well up behind and well forward in front; not fleshy; soft an pliable	20
Teats: squarely placed; even in size; of convenient size for milking; free from lumps not leaky or hard to milk	8
Mammary veins and wells: veins long, branching, tortuous, entering body well forward; wells large	7
Total	100

*Taken from U. S. Dept. of Agr. Bul. 434.

General form.—In selecting a dairy cow by conformation it should be kept in mind that capacity and constitution are two of the principal points to be considered. The dairy cow may be considered as a machine for the cheap conversion of feed into milk and butterfat. Capacity is indicated by the well-known dairy wedge-shape, which is visible from three points of view, *i.e.*, side, front, and top. This wedge shape necessarily gives the cow a large stomach and well-sprung ribs, which enables her to handle a large amount of coarse roughage.

Large, well-developed cows of the breed being considered should be selected. Small, stunted animals have never proved to be economical producers.

Quality.—Constitution or quality refers to the general health of the animal. Without good health maximum production can not be expected, and when animals of doubtful constitution are allowed to mingle with the herd they may introduce disease which may prove costly. Some indications of good health and quality are a fine, loose hide; abundant secretions; bright, clear eyes; and a good appetite. Large nostrils and large heart-girth indicate good lung capacity. Straight back and limbs and fine bone show good breeding and quality.

Capacity.—Breeders of dairy cattle all strive for capacity, as the value of the animal depends on the amount of milk and butterfat she can produce. Capacity to produce depends largely on her ability to handle feed. A strong jaw, with good teeth, capacious stomach for storing the feed, and a flexible, well-shaped udder from which prominent, tortuous milk veins emerge, to enter the body well forward, are indications of a maximum production.

Too much emphasis can not be laid on the udder. The udder is the organ thru which the milk is manufactured from the blood and there must be a large udder and a free circulation of blood in order to produce a high yield. A good udder extends well forward and is well up behind. The teats should be far apart, equally placed, and of good size. Special attention should be given the fore udder as this portion of the gland is especially subject to incomplete development. Attention should also be directed to the fact that size of udder alone is not so important as the number of active secreting cells. Oftentimes fatty, non-active tissue may be present, and the udder, instead of being loose and pliable after milking, remains practically the same size. This condition is undesirable.

When a cow is dry it is often difficult to accurately judge the development of the udder. There should be an abundance of loose folds of skin. The length of the attachment should be especially noted.

One of the indications of active circulation is the development of milk veins. This is one of the most reliable indications of dairy capacity, since a large quantity of blood must pass through the udder to insure heavy milk production. Large veins denote such circulation. These, in the case of heavy producers, divide and re-divide, forming a net work of veins along the abdomen.

Dairy temperament.—This quality in dairy cows is rather difficult to describe, yet all dairy cattle possess it to a greater or less degree. It

tions in the United States, three of them being in Idaho. The ideal cow-testing association contains twenty-six members, usually owners of ten or more cows, who sign an agreement to have their herds tested for one year. The total cost averages $1.50 per cow annually, in addition to the board of the tester.

SELECTION AND MANAGEMENT OF THE HERD BULL

The ultimate solution of the problem of stocking farms with economical producing cows rests almost entirely upon the use of the most improved sires. The influence of the bull on the herd is of the most vital importance. All the future females in the herd will carry fifty per cent of his breeding, and this is the basis for the old saying that "the bull is half the herd." Almost any pure-bred bull will improve a scrub herd but with a highly productive herd only the bull of the highest inheritance will increase or even maintain the efficiency of the herd. Unquestionably, the herd sire should be pure-bred in the breed he represents and should have production records in his ancestry.

There are two methods used in the selection of the herd sire—1st, the selection of a young bull based on conformation and pedigree, and 2nd, a tested sire selected from the record of his daughters.

Selection based on conformation and pedigree.—Many men prefer to purchase a young bull. The advantages of this practice may be stated as follows:

1. A young bull is docile, and may be fed and developed according to the ideas of the purchaser.

2. The possibility of introducing disease by the introduction of the bull is reduced to a minimum.

3. A young bull of recognized breeding can usually be purchased at less cost than one ready for service, and the transportation cost is small.

The chief disadvantage is that the young bull is untried and his ability to transmit desired characteristics can not be determined until his heifers have dropped their first calves.

In the selection of the young animal the pedigree which includes the records of his ancestors is of vital importance. The first consideration should be the production records of his maternal ancestry, his dam being the most important, but that is also dependent upon the records and individuality of the grandams back thru the pedigree for at least five or six generations. Second in importance to the record of the dams is the record of the sire's daughters. If his sire has produced many daughters of merit, it is reasonable to expect that his sons will transmit these characteristics. Young bulls are often selected on the basis of some famous ancestor found in the fourth or fifth generation. The fact should be remembered that an animal inherits fifty per cent of its blood from its parents, twenty-five from its grandparents and twelve and one-half per cent from the great grandparents, so undue importance should not be attached to some remote ancestor. The pedigree that is valuable is the one that shows that the females whose names compose it have all been great producers of milk and butterfat. In studying the records of production more consideration should be given those that cover an entire

is not found in the more sluggish beef animals, but is indicated in the finely bred dairy cow in her alertness, her vivacity, and in her disposition to be always actively engaged in the business of producing milk. She is always found eating, drinking, or chewing her cud. While it can not be called nervousness, it is a form of constant energy and activity. Briefly, it is the inherent tendency which the high-producing cow has to eat and digest her food and manufacture the raw product into milk.

Selection by records of production.—While selection by conformation is the system in most general use, the more accurate method is selection based on performance. This method is coming into more general use each year. The only way to select the profitable from the unprofitable in a herd of dairy cows is by keeping records of the amount of milk produced, and testing for butterfat at regular stated intervals.

The most satisfactory plan of keeping milk records is that of keeping complete daily records of each individual animal. A pair of spring-balance scales and suitable milk sheets are necessary to keep the weights of production.

Some of the advantages of keeping complete daily records of milk production are:

1. It enables the farmer to know the profitable and encourages the disposal of the unprofitable.

2. It allows more discrimination in feeding, apportioning the grain to the milk produced.

3. It enables the farmer to build up a profitable herd quickly as heifers can be selected from the best cows.

4. It enables the herdsman to detect sickness quicker than otherwise would be the case.

5. It brings to the notice the slightest variation in flow so that the cause for the shrinkage may be remedied.

6. It makes it possible to judge the work of the different milkers.

When complete milk records are kept, composite samples of milk, covering a period of two days, should be tested for butterfat by the Babcock testing method and the result counted as the average for the month. The tests for butterfat should be made at regular monthly intervals.

Cow-Testing Associations

The idea of cow-test associations originated in Denmark, where the necessity of keeping accurate records of the production of the cows was early recognized on account of high-priced lands and expensive feeds. In 1895 the first cow-test association was organized. A cow-test association is an organization of a number of dairymen to obtain the records of each cow. A man is hired to test and to weigh the milk at least once a month. He prepares the monthly and yearly recordsof production in such form that the dairymen can make the most use of them. Such an association does cooperatively what the individual might do for himself if he would take the time. The first cooperative cow-testing association in the United States was established in Fremont County, Michigan, in 1905. There are at the present time approximately 350 of these associa-

year than the short-period records that may have been made under abnormal conditions.

It is always preferable to examine personally the sire before purchase. He should be strong in vitality, constitution and capacity, and in general conformation, and show the breed characteristics. Attention should be given to the dam. She should be of a size which is from medium to large for the breed, showing no weakness in conformation, exhibiting strong capacity for milk production as evidenced by a large, flexible, well-shaped udder with uniform, evenly placed teats. She should show no evidence of organic weakness. It is always advisable to select a cow with production records conducted under official supervision, rather than by private test.

The tested sire.—The second method of selection is to purchase a tested sire, one that has producing daughters. The advantages may be thus enumerated:

1. It is possible to get a proven sire.
2. The mature conformation is known.

The disadvantages are as follows:

1. He may be difficult to manage.
2. He may introduce disease.

When a herd of dairy cows has been bred to a high state of efficiency, the problem of the selection of a suitable herd sire becomes increasingly difficult. Many breeders hesitate to use an untried bull, even tho his conformation and pedigree may be most satisfactory. Often he will not transmit these desired characters to his offspring, and the efficiency of the entire herd may thus be lowered, *i.e.*, the daughters may be lower in productive capacity than their dams. In such cases the breeders usually select mature bulls whose daughters have already been tested, and whose productive ability has been proven.

There is a danger connected with the purchase of an aged bull, and that is the possible introduction of disease into the herd, especially contagious abortion. The buyer should guard against this and be assured that the disease does not exist in the herd from which the bull is to be purchased.

Often because of improper handling an old bull is vicious or a nonbreeder.

Management of the bull.—The young bull should be fed from birth to maturity so as to make a normal, steady growth. The growth should not be checked at any stage as an undersized animal may result. Grain should be provided in small quantities just as soon as he will take it. The bull calf should be separated from the heifers at about six months of age, or as soon as he begins to annoy them. At this time a heavier ration of grain should be allowed—a mixture of barley, oats, or bran and oil meal, supplemented with alfalfa or clover hay for roughage, is quite satisfactory. Some farmers feed skim milk until the young bull is eight months old. The same principles apply to the rearing of the bull calf as to the heifer.

Under the best conditions the bull should be sufficiently mature at

ten months for very light service. From 12 to 15 months of age, not over two cows per week should be bred. As he increases in maturity the number may be gradually increased.

The ration for the mature bull is very similar to that for the cow producing milk. He should be given a liberal allowance of leguminous hay supplemented with six or eight pounds of a grain mixture and in a properly balanced ration from six to twelve pounds of corn silage.

He should be halter-broken when a calf and at the age of ten or twelve months a stout ring should be placed in his nose for convenienc in handling. He should be dehorned at about the same time.

In most sections of Idaho, an open shed with an adjoining paddock where he may exercise is the most satisfactory methor of stabling. He should never be allowed to run loose in the pasture with the herd. In the first place it is dangerous to the attendant or the passerby, and in the second place no record can be kept of the breeding dates, young aninals are bred too early, he exhausts himself and becomes an uncertain breeder.

Too often the bull is confined in a dark, dirty stall, with no chance for exercise, and as a consequence he becomes vicious and, in many instances, impotent or an uncertain breeder at an early age. To maintain health and virility, the bull must have ample exercise. Many successful breeders use the tread power where the bull may run the separator or the feed grinder. In some instances, a light cable is stretched between two high posts, the bull being attached to a sliding chain so that he can walk back and forth the length of the cable.

Where more than one bull is used they may with advantage be allowed to run together in a suitable paddock. There is little trouble when the animals are dehorned and it has the decided advantage of giving them more exercise than when confined alone. Plenty of exercise is an important factor in preventing a bull from becoming vicious.

A bull should never be petted, even when a calf, and should always be handled with a firm hand. He should always be handled with a strong staff. Even with a quiet bull, safety lies in handling him without fear. Nearly all accidents occur where apparently docile bulls have been too much trusted. Never should he be given a chance to display his strength by breaking fences and gates. The main points in keeping a bull in good condition are to avoid excessive use, and to give plenty of exercise and a moderate ration.

Bull Associations

A study of existing conditions in the United States reveals the fact that there has been a slow development and an enormous loss to the dairy industry because of the indiscriminate use of scrub bulls, and the slaughter of bulls of merit before they were old enough to demonstrate their prepotency on their offspring. There is at present a concerted, organized movement to remedy this condition thru cooperative bull associations. These associations are formed by farmers for the joint ownership, use, and exchange of high-class pure-bred bulls. Like the cow-testing associations, the bull association movement originated in Denmark. The first association was organized in 1876, and by 1906 there were 1,095, with

a total membership of 26,200 owning 1,369 bulls. The idea is comparatively new in the United States but the number of associations is growing very rapidly. It is especially well adapted to small herds where a valuable bull for each herd would be impossible. It enables the owners of small herds to cooperate in the ownership of bulls of merit.

The plan of operation is to interest from fifteen to thirty farmers who will jointly own four or five bulls, dividing the territory into four or five breeding blocks with a bull to each. As many as fifty or seventy-five cows may belong to the farmers in each block and the bull is kept on a farm conveniently situated. The blocks are numbered, and to prevent inbreeding each bull is moved to the next block once a year. By this method, by paying only a small part of the purchase price of one bull, the association has the use of good bulls for a number of years. The common practice is to distribute among the members of the associations the purchase price and expense for supporting the bulls according to the number of cows owned by each member.

The objection has been raised that contagious abortion or tuberculosis might be spread. But results so far thruout those sections where associations have been formed show the reverse to be true. The educational work of each association results in measures being taken to prevent the introduction and spread of all communicable diseases. The bull association requires that all cattle in the association be tested for tuberculosis, and precautions are taken to prevent the introduction of abortion.

FEEDING DAIRY CATTLE

There is no question that concerns the farmer more directly nor one that is more vitally important than that of the successful feeding of dairy cattle for milk production. There has been a decided increase in the price of all feed stuffs in the northwest during the past year, in some instances as high as 100 per cent, and the average increase on all items of feed varies from 25 to 50 per cent. The largest direct expense, then, in milk production is for feed. This cost comprises from 60 to 75 per cent of the entire expense of keeping an average dairy cow for one year. In some localities during the past year alfalfa hay has sold for $35 per ton where four years ago hay of the same kind and quality was purchased at $5 per ton. Probably the greatest problem, then, confronting the dairymen of the northwest at the present time is to lesson the cost of production of dairy products. It involves the provision of an abundance of palatable feed at a minimum cost, and the supplying of it in such a way as to secure the maximum production for the food consumed.

In considering the problem of feeding it must be borne in mind that the dairy cow feeds for two purposes—1st, for maintenance, and 2d, for work, which includes milk production, laying on of fat in some instances, or, in the case of the young animal, growth.

The first use that is made of the food is for maintenance. She uses it to maintain her body, to perform the functions of the body, such as pumping the blood, digesting the food, and moving from place to place. In other words, the maintenance ration is one that furnishes just enough food nutrients to maintain an animal so that she will neither gain nor

lose in weight, but not enough to provide nutrients for any milk production. It maintains an animal at rest. With the average cow, producing a pound of butterfat a day, the maintenance ration is approximately 60 per cent of all she can consume. With the higher producer it amounts to from 40 to 50 per cent of all she can consume.

From a productive standpoint, this feed is lost to the dairyman. This maintenance ration is a fixed charge and varies little either when the cow is dry or when she is producing a maximum quantity of milk. It should also be understood that it is only after she has been supplied with this ration of maintenance from the total amount of food consumed that she can produce milk without loss of body weight.

After this ration of maintenance has been furnished, the rest of the food that she consumes in the case of the high producer is used for milk production. The mistake is commonly made when this ration of maintenance is supplied of neglecting to add the additional amount of feed she is capable of producing. The maintenance ration itself is unproductive. The production ration must be supplied. This is illustrated in the following table, taken from Farmer's Bulletin No. 743 of the U. S. Dept. of Agriculture:

Table 2. Approximate proportion of cows' feed required for maintenance and available for milk production.

Cost of ration	Cost of maintenance	Available for milk production	Proportion of ration available for
Cents	Cents	Cents	production
10	10	—	———
15	10	5	One-third
20	10	10	One-half
25	10	15	Three-fifths

The effect of under-feeding may not be noticed at once, as the cow will produce milk for a time at the expense of her body. She will draw on her body flesh for maintenance and the production of milk. Therefore, if she loses weight during the major portion of her lactation period, it is an indication that she is not receiving sufficient food for maintenance and milk production.

This is not true of all cows. There is a large percentage of dairy cattle thruout the state that do not make use of all the feed above maintenance for milk production, but will in addition store fat upon the body. They have not the nervous energy or dairy temperament sufficiently highly developed to transform this feed into milk. Cattle of this class are often overfed. Live weight, then, is quite a reliable indication of the amount of food an animal should receive. Judgment must be used, however, in interpreting this rule. For instance, the high producer loses weight from two to four weeks after calving. The shock due to calving and the energy necessary to produce a large amount of milk, leaves the animal in such a condition that she can not consume sufficient feed to manufacture the amount of milk she is producing, consequently she draws on the body flesh. It can be easily understood then why it is necessary to

have the cow in excellent condition of flesh at the time of calving that she may draw on the reserve flesh. Breeders who attempt to make high official records of milk and butterfat production have long recognized this principle, and often the cows are from two to three hundred pounds above their average weight. Likewise it is disastrous, from the standpoint of economy, to have a high producer in a state of emaciation at the time of calving. She has not this reserve to draw from and the level of production will be low from the beginning of the lactation period.

It should also be observed that towards the end of the lactation period when the foetus is being developed the cow will increase in weight and flesh.

After the initial loss in weight under a proper system of feeding there should be but little variation in live weight during the major portion of the lactation period.

Feeding as individuals.—It is quite evident that in order to secure the maximum production at a minimum cost, the individual requirements must be studied. It has been the common practice under many farm conditions to feed all the animals in the herd an equal amount of grain, hay, and silage, without reference to the quantity of milk each cow produces. This is an extremely wasteful method as the high-producer is underfed and the low-producer overfed. This is one of the factors that has increased the average cost of producing dairy products.

Home-grown feeds.—Idaho is fortunate in being able to grow in abundance some of the most important milk-producing feeds. The leguminous hays, alfalfa, and clover, supply ample protein in the ration of the average producer. Barley, wheat and oats are the principal grains while corn grows to sufficient maturity for corn silage. It is easily possible to balance a suitable ration. For this reason the following three rules are peculiarly adapted to this state. These are of service as a guide for practical feeding and have been used by many successful feeders.

1. Feed the cow all the roughage daily that she will eat up clean.
2. Feed one pound of grain daily for every pound of butterfat produced weekly.
3. Feed all the cow will consume without gaining in weight. If she increases in weight, reduce the grain ration.

Balanced ration.—A balanced ration is one that supplies the various food nutrients in the amounts needed by the animals to meet the requirements for which they are being fed. There are three substances which must be considered in making up the ration of the dairy cow. They are contained in almost all feeding stuffs but in varying amounts. They are protein, carbohydrates and fat, and ash or mineral matter.

Proteins are compounds containing nitrogen. In the animal body proteins are used to rebuild old or form new muscle, blood, tendons, hair, and connective tissue, for the making of curd or casein and albumen in the milk, and as a source of energy. Proteins form approximately one-

third of the solid material found in the milk, hence, they must be supplied in comparatively large quantities. It should be remembered that no other food material can take the place of protein because no other contains nitrogen and this element is absolutely necessary to maintain the animal and produce milk. Our most common nitrogenous food stuff is alfalfa hay.

The carbohydrates (sugar and starches) differ from protein in that they lack the nitrogen element. They occur in the form of starch, sugar, and fibre. Their function is to supply heat, energy, and fat in the body, and sugar in the milk. They are found most abundantly in cereals. They are used in larger quantities by the cow than protein and fat.

Fats or oils are contained in all feeds, but vary widely in amount and are never found in as large quantities as the carbohydrates. Fats have the same function in the cow's body as carbohydrates, and contain the same elements in a more concentrated form; in formulating a ration the two classes of compounds are considered together. In feeding, one pound of fat is equal in value to 2¼ pounds of carbohydrate.

The ash is the mineral part of the plant substance. It makes up the greater part of the bones and is a necessary part of all lean meat and is found in the blood and other fluids of the body. Ash is an important food element in the nutrition of the young, growing animal and the cow giving milk. It is not considered, however, in formulating the ration as most of the feed stuffs contain the mineral elements in sufficient amounts to meet the body requirements. Feeds especially rich in mineral elements are alfalfa hay and wheat bran.

A considerable amount of work has been done at various experiment stations to determine the method of supplying the proper nutrients in the right proportions to secure maximum results in production. Analyses have been made showing each of the several chemical constitutents of the various feed stuffs. A fairly accurate knowledge of the subject has resulted.

The earliest feeding standard is known as the Wolf-Lehmann standard; it has been widely used by feeders of all classes of live stock. The standard devised by Professor Haecker of the Minnesota station has been generally used by dairymen and is an improvement over the Wolf-Lehmann standard as provision was made for maintenance and then an allowance added for milk production.

Dr. Armsby of Pennsylvania in his recent work on nutrition has devised a slightly different standard. It was assumed in previous standards that a pound of digestible protein was of the same nutritive value, no matter in what class of food stuff it was found. According to Armsby, this is erroneous. For instance, a pound of protein in a highly concentrated feed as linseed oil meal is more valuable than a pound of protein in alfalfa hay. The difference is due to the increased amount of energy necessary in digesting the coarser food.

The following table has been prepared showing the digestible protein and energy value of common feeding stuffs.

Table 3. Table of dry matter, digestible protein, and net energy values in 100 pounds of various feeding stuffs. (U. S. Dept. of Agr., Farmers' Bulletin 346.)

Feeding stuffs	Total dry matter pounds	Digestible protein pounds	Net energy value therms
Green fodder and silage:			
Alfalfa	28.2	2.50	12.45
Clover, crimson	19.1	2.19	11.30
Clover, red	29.2	2.21	16.17
Corn fodder, green	20.7	.41	12.44
Corn silage	25.6	1.21	16.56
Hungarian grass	28.9	1.33	14.76
Rape	14.3	2.16	11.43
Rye fodder	23.4	1.44	11.63
Timothy	38.4	1.04	19.08
Hay and dry coarse fodder:			
Alfalfa hay	91.6	6.93	34.41
Clover hay, red	84.7	5.41	34.74
Soy bean hay	88.7	7.68	38.65
Cowpea hay	89.3	8.57	42.76
Corn forage, field cured	57.8	2.13	30.53
Corn stover	59.5	1.80	26.53
Hungarian hay	92.3	3.00	44.03
Oat hay	84.0	2.59	36.97
Timothy hay	86.8	2.05	33.56
Straws:			
Oat straw	90.8	1.09	21.21
Rye straw	92.9	.63	20.87
Wheat straw	90.4	.37	16.56
Roots and tubers:			
Carrots	11.4	.37	7.82
Mangels	9.1	.14	4.62
Potatoes	21.1	.45	18.05
Rutabagas	11.4	.88	8.00
Turnips	9.4	.22	5.74
Grains:			
Barley	89.1	8.37	80.75
Corn	89.1	6.79	88.84
Corn-and-cob meal	84.9	4.53	72.05
Oats	89.0	8.36	66.27
Pea meal	89.5	16.77	71.75
Rye	88.4	8.12	81.72
Wheat	89.5	8.90	82.63
By-products:			
Brewers' grains, dried	92.0	19.04	60.01
Brewers' grains, wet	24.3	3.81	14.82
Buckwheat middlings	88.2	22.34	75.92
Cottonseed meal	91 8	35.15	84.20
Distillers' grains, dried			
—Principally corn	93.0	21.93	79.23
—Principally rye	93.2	10.38	60.93
Gluten feed	91.9	19.95	79.32
Gluten meal—Buffalo	91.8	21.56	88.80
Gluten meal—Chicago	90.5	33 09	78.49
Linseed meal, old process	90.8	27.54	78.92
Linseed meal, new process	90.1	29.26	74.67
Malt sprouts	89.8	12.36	46.33
Rye bran	88.2	11.35	56.85
Sugar-beet pulp, fresh	10.1	.63	7.77
Sugar-beet pulp, dried	93.6	6.80	60.10
Wheat bran	88.1	10.21	48.23
Wheat middlings	84.0	12.79	77.65

As a result of investigations Armsby has prepared a feeding standard based on the amount of digestible protein and energy value which considers the carbohydrates and fats together. The term 'therm' is used to represent energy value of 1,000 calories. The following table shows the live weight and the digestible protein and energy value for maintenance. To this is added digestible protein and energy value for milk production.

Table 4. Table showing maintenance standard for cattle. (U. S. Dept. of Agr., Farmers' Bulletin 346.)

Live weight pounds	Digestible protein pounds	Energy value therms
750	.40	4.95
900	.46	5.70
1000	.50	6.00
1250	.60	7.00
1500	.65	7.90

He suggests .3 therms in energy value and .05 pounds of digestible protein for each pound of milk, based on milk containing 4 per cent fat and 13 per cent total solids.

To calculate a ration.—Suppose a cow weighs approximately 900 pounds and is producing 35 pounds of 4 per cent milk. There would be required:

		Digestible protein pounds		Energy value therms
For maintenance		.46		5.70
For milk production	(35 x .05)	1.75	(35 x .3)	10.50
		2.21		16.20

The problem thus presented is to formulate a ration to meet these requirements. In calculating the ration we will begin with roughage, as the cow is so adapted by nature that she requires a certain amount of bulk. Let us take 10 lbs. of alfalfa hay and 40 lbs. of corn silage. Referring to Table No. 3,

		Digestible protein pounds		Energy value therms
10 lbs. alfalfa hay	(10 x .0693)	.693	(10 x .3441)	3.441
40 lbs. corn silage	(40 x .0121)	.484	(40 x .1656)	6.624
		1.177		10.065

This leaves over 1 pound of protein and 6 therms of energy that will have to be supplied by grain. It will require 9 or 10 pounds of grain to supply this deficiency if we follow the practice of feeding 1 pound of grain daily for every pound of fat produced weekly. Thirty-five pounds

of milk, testing 4 per cent, give 9.8 pounds of fat in a week. It is assumed in this case that we have barley, bran and oil meal on hand. Let us try the following mixture: 6 lbs. barley, 2 lbs. bran, and 1 lb. oil meal.

		Digestible protein pounds		Energy value therms
6 lbs. barley	(6 x .0837)	.5022	(6 x .8075)	4.845
2 lbs. bran	(2 x .1021)	.2042	(2 x .4823)	.9646
1 lbs. oil meal	(1 x .2926)	.2926	(1 x .7467)	.7467
		.9990		6.5563
40 lbs. corn silage		.484		6.624
10 lbs. alfalfa hay		.693		3.441
		2.176		16.6213

While this is a trifle low in protein, the ration approaches the requirements sufficiently for practical purposes.

An attempt has been made to establish a basal ration to be used for experimental purposes for the University herd. It was desired that such a ration should be composed of home-grown feed stuffs as far as possible, or of feeds that could be easily secured in the northwest. After a number of trials, the following ration was adopted:

Alfalfa hay, 1 part.

Corn silage, 4 parts.

Grain, 1 part (consisting of barley 4 parts, bran 2 parts, and linseed oil meal 1 part).

This followed closely the general plan of experimentation as advocated by the Official Dairy Instructors' Association.

The following table is based on the preceding outline.

Table 5. Table showing digestible proteins and energy value of rations compounded as indicated above.

RATION				
Hay Lbs.	Silage Lbs.	Grain Lbs.	gives Digestible protein (pounds)	Energy value (therms)
6	24	6	1.4182	10.273
6½	26	6½	1.5368	11.130
7	26	7	1.6554	11.986
7½	30	7½	1.7730	12.843
8	32	8	1.8916	13.699
8½	34	8½	2.0102	14.556
9	36	9	2.1224	15.412
9½	38	9½	2.2464	16.268
10	40	10	2.3650	17.125
10½	42	10½	2.4826	17.981
11	44	11	2.6012	18.838
11½	46	11½	2.7188	19.694
12	48	12	2.8374	20.551

Table 6. Table showing requirements for maintenance and milk production.

Weight of cow (pounds)	Daily milk production (4 per cent milk) (pounds)	Digestible protein (pounds)	Energy value (therms)
900	15	1.21	10.20
1000	15	1.25	10.50
1250	15	1.35	11.50
1500	15	1.40	12.40
900	20	1.46	11.70
1000	20	1.50	12.00
1250	20	1.60	13.00
1500	20	1.65	13.90
900	25	1.71	13.20
1000	25	1.75	13.50
1250	25	1.85	14.50
1500	25	1.90	15.40
900	30	1.96	14.70
1000	30	2.00	15.00
1250	30	2.10	16.00
1500	30	2.16	16.90
900	35	2.21	16.20
1000	35	2.25	16.50
1250	35	2.35	17.50
1500	35	2.40	18.40
900	40	2.46	17.70
1000	40	2.50	18.00
1250	40	2.60	19.00
1500	40	2.65	19.90

It has been found that the general proportion of this ration could be quite easily adapted to the high-producing cow or the low-producing cow, and could also be adapted to animals of different weights.

900-pound cow, giving 20 lbs. milk, testing 4 per cent:

	Digestible protein pounds	Energy value therms
For maintenance	.46	5.70
To produce 20 lbs. milk	1.00	6.00
	1.46	11.70
Hay 6 lbs., silage 24 lbs., grain 6 lbs. give	1.418	10.273

900-pound cow, giving 40 lbs. milk, testing 4 per cent:

For maintenance	.46	5.70
To produce 40 lbs. milk	2.00	12.00
	2.46	17.70
10½ lbs. hay, 42 lbs. silage, 10½ lbs. grain give	2.48	17.98

	Digestible protein pounds	Energy value therms
1250-pound cow, giving 40 lbs. milk, testing 4 per cent:		
For maintenance	.60	7.00
To produce 40 lbs. milk	2.00	12.00
	2.60	19.00
11 lbs. hay, 44 lbs. silage, 11 lbs. grain give	2.60	18.838
1500-pound cow, giving 20 lbs. milk, testing 4 per cent:		
For maintenance	.65	7.90
To produce 20 lbs. milk	1.00	6.00
	1.65	13.90
7½ lbs hay, 30 lbs. silage, 7½ lbs. grain give	1.77	12.84
1500-pound cow, giving 40 lbs. milk, testing 4 per cent:		
For maintenance	.65	7.90
To produce 40 lbs. milk	2.00	12.00
	2.65	19.90
11½ lbs. hay, 46 lbs. silage, 11½ lbs. grain give	2.71	19.69

These rations also quite closely correspond to the rough rule that is followed by many dairymen of feeding one pound of grain daily for every pound of butterfat produced weekly.

The university herd has been maintained on this system of feeding for the past two years with very gratifying results. Care was taken to keep the weight normal thru the greater portion of the lactation period. For the average producing herd this system seems to be well suited. With cows that are being pushed for records, a more concentrated ration,—one higher in protein—is necessary. Their individual characteristics must be taken into account.

The sample rations showing the proportion of grain fed to low-producing cows may be misleading to the dairymen. In these cases little grain feeding is advocated. Very good results are being obtained with this class of animals by feeding a good quality of alfalfa hay and corn silage alone. But with the higher producers some grain feeding is essential.

Palatability is of great importance in successful feeding. Best results can not be obtained when the feed is not relished.

Order of feeding.—It is quite essential that cows be fed at regular intervals, although the particular time is not so important. Concentrates are given first, usually at the time of milking. Hay and other forage crops are not ordinarily fed until after milking as they fill the air with dust which, from a sanitary standpoint, is not desirable. Certain root

crops and very acid silage should be fed after milking. When fed before milking, a decided feed-taint is noticed in the milk.

Succulence.—Green feeds have that property called succulence. Such feeds have a favorable effect upon the digestion outside of the actual food nutrients they may contain. If best results are to be secured, some form of succulence must be provided, especially in the winter ration. Succulence is commonly provided in the form of silage and root crops.

SILOS AND SILAGE

The silo is adapted to practically every agricultural section in Idaho. It provides the cheapest means of storing succulent feed for winter dairying in herds composed of ten or more animals. There are four general types found in the state, each of which will be briefly considered.

Concrete silo.—In irrigated sections, where exceptionally dry climatic conditions exist the concrete silo seems peculiarly adapted. It has the advantage over other types of silos in being permanent and stable. A concrete silo that is well constructed will last indefinitely. It is fireproof, can not blow down, and does not shrink in dry weather. Where sand and gravel are near at hand the cost of construction is but slightly greater than that of other types, as very little skilled labor is necessary. The average cost for Idaho is approximately $3.00 per ton-capacity. The concrete stave silo is quite popular in some sections.

Wooden silo.—There are many stave silos erected in the northern sections of the state where the rain fall is heavier. They are comparatively easy to build and have been pushed by many commercial firms. Stave silos, however, are temporary structures, lasting from five to fifteen years, depending upon the kind of lumber used, care in erecting, and climatic conditions. During a dry season or during the season of prevailing winds they are liable to fall down or otherwise get out of repair. The difficulty may be overcome to a certain extent by having the silo properly anchored and the hoops kept tight.

Modified Wisconsin silo.—A type of a home-made silo that is quite popular is the Modified Wisconsin silo. It is more substantial than the stave silo, as it is not so liable to be blown down or get out of repair thru drying. For this 2 x 4's are used as studdings, set twelve inches apart and half-inch boards are bent around on the inside. Two layers of the half-inch lumber are used with paper between. The outside can be boarded up in a similar manner. One serious disadvantage is that a silo less than 14 feet in diameter is very hard to build owing to the difficulty in bending the sheathing.

Wooden hoop silo.—A very cheap type of homemade silo for northern Idaho is the wooden hoop silo. The hoops are made of four or five layers of one-half inch lumber that will bend to the required circle. A good grade of flooring is used for the staves. To make the hoops, mark off a circle the same diameter as the inside of the hoop. This circle can be made on a platform or on the barn floor. Blocks are nailed on the inside of the circle from eighteen to twenty inches apart, and even with the circle mark. This makes a form around which the hoops can be made. In making the hoops care should be taken to break the joints of the different layers. Nails should be used that can be driven thru and clinched.

In raising the hoops into place, scaffolds may be used or three poles

may be set up just outside of the silo. The hoops are held in place by resting on pegs which are driven thru holes that have been bored in the poles.

The flooring is nailed on the inside of the hoop, care being taken to keep the boards perfectly plumb. All the boards are nailed on, leaving only enough space for doors. A door is made to fit each of the spaces between the hoops. If a more finished appearance is desired, the silo can be boarded up on the outside of the hoops, which will give it a dead-air space. This type of silo is cheap and substantial and has much to recommend it.

Essentials in construction.—It is essential in silo construction that the walls be air-tight. Wherever air gains admission thru air holes, spoilage of the silage will result. It is essential, then, that the inside walls of the silo be painted. The concrete silo should have a coat of coal tar. The walls should be smooth and plumb so that the silage mass will settle uniformly; otherwise, air spaces will be formed along the outer edge and putrefaction result. The silo should also be deep enough so that the weight from above will thoroly pack the silage and force out the air.

Size.—The diameter of the silo depends upon the number of cattle and amount to be fed per head per day. The height depends upon the number of days' feed required. A considerable loss is occasioned by the molding of silage which results when it is not removed from the entire surface daily. The diameter is too great in such cases for the number of cattle fed. To keep the silage in best condition about two inches should be removed daily from the entire surface. If six months' feeding is desired a silo 30 feet high will be necessary.

Table 7. Height of silo needed for a given capacity with a given diameter.*

Height of silo Feet	Capacity in tons of silo having inside diameter of 10 feet	12 feet	14 feet	15 feet	16 feet	17 feet	18 feet
20	26						
22	30	43					
24	34	49					
26	38	55	74				
28		61	83	95			
30			93	105	119		
32			101	115	130	148	
34				125	143	161	181
36					151	174	196

Table 8. Ratio between diameter of silo and number of cows to be fed.*

Diameter of silo. (feet)	No. of cows to be fed
10	12
12	17
14	23
16	30
18	38

Tables 7 and 8 were taken from Cir. No. 136, Bu. An. Ind. U. S. Dept. of Agr.

Table 9. Table giving the inside diameter of silos 24 feet and 30 feet deep which will permit the surface to be lowered in feeding at the mean rate of 1.2 to 2 inches per day, assuming 40 lbs. of silage to be fed each cow daily.

FEED FOR 240 DAYS						
No. of cows	**Silo 24 feet deep** (Rate 1.2 in. daily)			**Silo 30 feet deep** (Rate 1.5 in. daily)		
	tons	Inside diameter		tons	Inside diameter	
10	48	11 ft.	11 in.	48	10 ft.	2 in.
15	72	14	7	72	12	5
20	96	16	10	96	14	4
25	120	18	10	120	16	0
30	144	20	8	144	17	6
35	168	22	4	168	18	11
40	192	23	10	192	20	3
45	216	25	7	216	21	5
50	240	26	8	240	22	7
60	288	29	2	288	24	9
70	336	31	6	336	26	9
80	384	33	8	384	28	7
90	432	35	9	432	30	4
100	480	37	8	480	31	11
	(Rate 1.6 in. daily)			(Rate 2.0 in. daily)		
10	36	10 ft.	4 in.	36	8 ft.	9 in.
15	54	12	8	54	10	9
20	72	14	7	72	12	5
25	90	16	4	90	13	10
30	108	17	10	108	15	2
35	126	19	4	126	16	4
40	144	20	8	144	17	5
45	162	21	11	162	18	11
50	180	23	1	180	19	7
60	216	25	3	216	21	5
70	252	27	4	252	23	2
80	288	29	2	288	24	9
90	324	30	11	324	26	3
100	360	32	8	360	27	8

Silage Crops

Corn.—Corn is generally recognized as the best crop for silage purposes because of its heavy yield and because it is easily handled. The solid stems and broad leaves when cut in short lengths pack closely and form a solid mass which not only keeps well but furnishes a food that is much relished by dairy stock. Corn frequently produces more food material to the acre than any other crop that can be grown for silage purposes. In many sections of Idaho the crop can be counted upon to reach maturity; measured yields of as high as twenty-two tons per acre have been recorded.

To make the best silage, corn should be cut when the lower leaves are turning brown and when the kernels are past the milk stage and are glazed and dented. The principal reason why corn is advocated for silage in Idaho wherever it can be successfully grown is the fact that it supplements leguminous hays as alfalfa and clover and tends to balance the ration.

Other silage crops.—There are some sections of Idaho, however, where corn for one reason or another cannot be grown successfully. In these sections other crops and crop mixtures can be successfully substituted for corn. Of the crops and crop mixtures successfully siloed at the central experiment station and by prominent dairymen here and there thruout the state, peas and oats, peas and wheat, vetch and wheat, and wheat alone deserve special mention. At the central experiment station these crops have been grown for several years in fields ranging in size from one acre to twelve acres. They were sown in the spring and harvested for the silo when the grain had begun to harden. Cut at this time the straw was still green and there was little waste from shattering. On the University farm at Moscow it requires from ninety to one hundred days from the time of seeding for the various crops mentioned to reach the proper stage of growth for harvesting for silage purposes. It is essential for the successful siloing of these crops to insure fine cutting of the material, close packing and the addition of a liberal amount of water. With attention given to these details, silage made from the crops mentioned keeps perfectly. It has the characteristic silage odor and when fed properly gives rise to but little waste from mold or other causes. Silage made from peas and oats and from vetch and wheat has been fed for several years to the University herd of dairy cattle with highly satisfactory results. Wheat alone makes a silage of a mildly acid flavor but is not eaten as readily as is silage made from the other crops. The ordinary amounts of wheat silage have shown a tendency to throw certain animals off feed. Silage made from wheat alone is valuable but it must be fed with care. In normal years under conditions similar to those which prevail in the Palouse country, yields of these crops varying from seven to ten tons per acre may be expected.

It is possible to silage alfalfa successfully if a carbohydrate as glucose is added to it while it is being tramped. The glucose is required apparently to insure a normal silage fermentation. In an experimental way at the central experiment station red clover has been siloed successfully alone and in mixtures with oat straw. The clover-straw mixture (up to half and half by dry weight) is eaten greedily and with highly satisfactory results. Ordinarily, however, the legumes are much more valuable for feed when cured and used as hay. The only occasion when it is practical to silo them is during a rainy hay-making period when they cannot be properly cured and used as hay.

When corn will not yield over seven tons per acre, the dairyman may well turn his attention to other crops for silage purposes.

Summer silage.—It has been demonstrated that there is a decided decrease in the milk supply during the months of July, August, and September, due to several reasons, the most important being the failure of

pastures and the hot weather. As is often the case the dairyman is not prepared at this time to give the herd the attention that it is accustomed to receive during the months of winter feeding. In order to tide over this period, the use of summer silos is recommended. If the land is pastured, it will take on an average, even under conditions where irrigation is practiced, one acre per cow during the season, while one acre of corn put in the silo will supply several cows for the same period. Even where pastures are luxuriant, the cattle, during the hot weather, will not eat sufficient grass to supply the needs of the body and allow for liberal milk production, but they will eat silage greedily when it is supplied.

As a rule, a cow under summer conditions will consume about twenty pounds a day. When it is not necessary to use the silo during the summer it may be sealed up and reserved for winter feeding. The summer silo is filled in the fall and sealed, and opened when needed. This is the most economical method at present for tiding the herd over the period of short pasturage and extremely warm weather.

Roots.—For the small herd ranging from two to eight animals, succulence can be supplied in the ration by the use of roots. They have a mildly laxative and toning effect upon the system of the cow which is desirable. Wing and Savage * found that one pound of dry matter in mangels is equal to one pound of dry matter in grain and the mangels can successfully replace half the grain ordinarily fed in a ration of grain, mixed hay, and silage. The Cornell studies led to the conclusion that with concentrates costing $30 per ton, mangels are an economical feed for dairy cows when they can be produced and stored for $4 per ton.

The roots most commonly used are mangels, sugar beets, and carrots. These may be stored in pits and used as needed during the winter.

Other Feed Stuffs

Alfalfa hay.—Alfalfa stands first in the list of roughages as a feed for dairy cattle. Because of its palatability and high protein and ash content, it is of much importance in balancing the ration that is low in protein. A mistake is often made, where alfalfa is grown for the dairy cattle, in allowing it to become too ripe before cutting. This reduces the palatability, as it becomes somewhat woody and is not so readily relished by the cattle. Sometimes alfalfa is some sections of the state is used as the sole ration. When such a system is followed, digestive disorders result, with a higher death loss in the herd.

Clover hay.—Hay from clover just in bloom is one of the best roughages for dairy cows. It is somewhat lower in protein than alfalfa but has a slightly higher energy value. It occupies a place similar to alfalfa in balancing the ration.

Timothy hay.—Timothy hay is rather unpalatable to dairy cattle and has little value as a source of food for milk production. It is low in protein and when fed must be supplemented with expensive protein concentrates in rather large quantities.

Barley.—Barley is a very palatable feed and one that is used to supply the carbohydrates in the ration. Judging from its composition, it

* Cornell Exer. Sta. Bul. 268.

would seem that the value of barley is slightly lower than that of corn, yet the Scandinavians consider these grains of practically equal value. It is very extensively used as a dairy feed with much success in the northwestern states. It is usually rolled or ground for feeding.

Wheat.—Wheat has practically the same feeding value as corn and barley, and can be substituted in place of either in the ration of the dairy cow. However, it is usually too high-priced to be very extensively used.

Corn.—Corn is very extensively used thruout the Middle West, but is not of much importance as a dairy feed in the west because of the high price. It is very palatable and much relished by the cattle.

Oats.—Oats are most excellent feed, very palatable, and of a slightly laxative effect. They supply somewhat more protein than does corn or barley, but because of their high price they can not be economically used in a large way. It is usually possible to sell the oats and purchase other feeds which furnish nutrients at a cheaper price.

Linseed meal.—This extremely valuable feed is the residue after the linseed oil is extracted from the flax seed. From a physiological standpoint, it is one of the best feeds. It increases the palatability of a ration and is very high in protein. It seems to exert a very favorable effect upon all classes of animals to which it is fed. It has a slight laxative effect, and a pound or two fed daily to cows soon to freshen is advisable.

Dried beet pulp.—This food has always been popular with the dairymen. At the Massachusetts Station * it was found that 4.3 pounds of dried beet pulp are equal to the same weight of corn meal when fed with a basal ration of two pounds wheat bran, seven pounds cottonseed meal and seventeen pounds mixed hay. It is high in carbohydrates and has an excellent physiological effect on the cow by keeping the digestive organs in good condition. During the season of high grain prices the dairymen have substituted beet pulp for barley and corn with pleasing results. Where silage is not available, beet pulp is often moistened and used as a substitute. One pound dried beet pulp when moistened will make six pounds wet beet pulp.

Wheat bran.—Next to barley, bran is the most important concentrate used for cow feed in the northwest. It is of great importance for growing animals and cows in milk because of its high ash and protein content. Because of its light, loose character it is valuable to lighten up a heavy, concentrated mass, so that the entire ration is more easily digested, and likewise more palatable. Bran is rich in phosphorus and has a beneficial laxative effect on the digestive tract.

CALF RAISING

To raise the standard of milk production and maintain the efficiency of the dairy herd, it is not only necessary to use the most improved sires, but particular attention must also be given to the successful rearing of the heifer calves from the best cows. The subject of calf-raising is often not given the attention that its importance deserves. A calf that has been improperly reared, one whose growth has been stunted by careless treat-

* Mass. Exper. Sta. Annual Rep., 1913.

ment, will seldom make a profitable producing cow. The practice that is too commonly followed of buying cows early in their lactation period and selling them when dry for beef, is not to be recommended. So long as such a system is employed, no constructive development of the herd can be expected.

While there are certain definite principles underlying a successful system of calf-rearing, much of the success depends upon the skill of the feeder in studying the individual requirements of the young animal itself.

Care of the cow at calving.—If the cow has been dry from a month to six weeks before parturition and is in good physical condition, little trouble is experienced at calving time. If the cow calves in spring while on pasture little attention is necessary. She should be observed once or twice a day as the time of parturition approaches.

At other seasons of the year she should be kept in an enclosed, preferably a roomy box stall, which is well bedded with clean straw. Clean quarters are very essential, as filthy quarters may result in the navel cord of the young calf becoming infected and white scours may result.

Care should be given to keep the digestive system in good condition. A laxative ration should be fed. Legume hays, corn silage, and a bran mash are all slightly laxative and should be given. If the cow appears constipated and her bowels are not moving freely a drench of epsom salts may be given.

She should be left alone at time of calving unless some assistance is evidently necessary. Cows are more or less subject to retention of the after-birth. Under normal conditions it is expelled within a few hours after the calf has been dropped. Where the cows are in low condition of vitality it may be necessary to remove the after-birth if it has not been expelled within twenty-four to forty-eight hours. It is well to secure the assistance of a competent veterinarian if the dairyman is inexperienced in this operation.

Separation from the cow.—As it is the common practice to rear calves by hand, they are separated from the cow soon after calving. Some take the calf away from the mother at once. Others allow it to remain with the cow for several days. The longer it is allowed to be nursed by the mother, the more difficult it will be to teach it to drink. It should always be borne in mind that the first milk (colostrum) should always be given to the calf, and not the milk from some other cow. Colostrum has purgative properties which stimulate the calf's stomach and digestive organs and is especially suited to the requirements of the young calf. It seems preferable to allow the calf to remain with the cow one or two days as it has a beneficial effect on the cow's udder, especially if it is slightly congested.

The stomach of the young calf is so constructed that it requires frequent feeding in small amounts. It is advisable to feed the young calf at least three times a day—morning, noon, and night. The milk should be fresh and sweet and of a temperature of approximately 100 degrees. The digestion is very quickly upset by feeding warm milk at one feed and cold milk at another.

Overfeeding is a common mistake and is responsible for many in-

ferior calves. A good practice is always to keep the calf a little hungry. Each calf should be fed separately, as some will drink much more rapidly than others and this will result in overfeeding. The amount to feed varies with the breed and size of calves. For the first two weeks from 8 to 10 pounds of milk daily should be fed. This amount may be gradually increased until from 18 to 20 pounds are given at the time the calf is six weeks of age. Usually it is not necessary to increase above this amount.

Changing to skim milk.—The fat of the milk is so valuable that very few dairy calves are now raised on whole milk. There was formerly a prejudice against skim milk as it was believed that undersized ,unthrifty calves resulted. These results were not due to the removal of the fat from the milk on which the calves were fed, but to carelessness in management. Because the fat was removed, it was believed that more milk should be fed and consequently digestive disorders resulted from overfeeding. The skim-milk calf differs little in size and value from the same animal when raised by the cow. The fat removed from the milk can be supplied to the calf much more cheaply in the form of some grain. The elements that furnish the growth of muscle and bone are still present in the skim milk in the form of casein, albumen (proteins) and ash.

For the first two weeks the calf should be fed its mother's milk. At the beginning of the third week the skim or separated milk may be gradually substituted for the whole milk. Two weeks may be taken in making this change when the skim milk may be substituted entirely for the whole. The change is made slowly so as to accustom the calf to the additional amount. If the calf is especially strong and vigorous the change may be made a week earlier. It should be noted that calves from those breeds which produce very rich milk will make better gain if the milk is diluted with skim milk, so that the fat content approximates 4 per cent.

Supplements to skim milk.—The young calf should be alowed to eat grain and roughage as soon as he will take it. A vigorous calf will begin to nibble at its bedding in two or three weeks. At that time roughage in the form of some leguminous hay should be supplied, as this is most palatable. This should be supplied sparingly at first, since alfalfa especially, which is exceedingly palatable at first, will cause scours if too much is given to the young calves. If they are turned out on pasture they will be well supplied with all the roughage that it is necessary for them to receive. Care should be taken to keep the hay fresh and clean, and it is best to furnish it in a small rack, feeding only the amount the calves will eat up clean.

The calves will eat grain about as soon as they will hay. If they do not begin eating at once, they should take it by the time they are from three weeks to a month old. It is advisable to feed grain dry and not in the milk. To teach the calf to eat grain, a little should be placed in its mouth after drinking the milk. In a few days it will expect the grain, which should be placed in a small box so that it cannot be soiled by the droppings of the calf. If the grain becomes spoiled, scours may result; it is therefore important to feed an amount that the calf will consume daily. The box should be kept clean at all times. A calf six weeks old

will consume about half a pound of grain a day and by the end of three months this may be increased to two or three pounds a day which is a sufficient amount up to six months unless it is desired to push the growth more rapidly.

The grain ration may consist of corn or barley, with bran or oats and oil meal. Corn and barley are much relished by young calves. Linseed-oil meal has an especially favorable effect upon young, growing calves, as it aids in making the mixture more palatable. The ration used in the University dairy herd with eminently satisfactory results consisted of a mixture of rolled barley, 4 parts by weight, bran 2 parts, and oil meal 1 part.

Cleanliness.—Absolute cleanliness is a most important consideration in the successful raising of young calves. One of the most common causes of sickness in hand-raised calves is dirty milk pails and unclean quarters. The utensils from which the calves are fed should be kept as clean as the milk pails. Discarded feed should be removed from the feed boxes which should be thoroly brushed and cleaned.

The pens should be well bedded with fresh clean straw and frequently changed. The calf pen should be located in the sunniest portion of the barn, as the young animals need all the sunlight they can get. After the calf is a few weeks old it can stand considerable cold if it is kept dry and has dry quarters. A small paddock or enclosure should be provided for exercise. In the summer it should have access to a pasture provided with plenty of shade.

Ties for calves.—The arrangement most commonly used is stanchions, and they should always be used where a number of calves are being run together. The stanchions are made like ordinary rigid stanchions for cows, except that they are smaller. They may be constructed of cheap or scrap lumber made 36 to 40 inches high, 28 inches from center to center, and with a 4-inch space for the calf's head. If the calves are in the pasture, stanchions may be fastened to the fence. A feed trough is put in front with divisions so as to allow for separate feeding. The grain may be fed in the trough immediately after the milk has been fed and the calves kept tied for some time. This prevents formation of the disagreeable habit of sucking each other.

Water and salt.—Many men fail to realize the importance of providing the young animals with plenty of water. This is often neglected with calves which are fed milk. The calves should have access to an abundance of fresh, clean water at all times. As soon as the calf begins to eat grain and hay it should be given salt, the same as in the case of older animals.

Substitutes for milk.—Where milk is sold for market-milk purposes, to cheese factories, and condensers, the problem of raising the calves is somewhat more complicated. In such cases the calves are pushed rather rapidly for six weeks to two months and then changed gradually to a grain ration. In some instances the milk from certain cows for some reason is not desirable for market purposes. In such cases it is possible for the cow to nurse at least two calves. Hard-milking cows are sometimes utilized for this purpose.

There has been a number of patented milk substitutes placed upon the market, which have had varying degrees of success. But even when these are used the young calf should be fed at least two weeks on its mother's milk.

Spring and fall calves.—There are advantages in having calves dropped in the fall. During the winter season more attention can be given to their care and feeding. Living on the mother's or skim milk supplemented with a little grain, they are old enough when spring comes to make the best use of the pastures and to stand the hot weather. During the first six months of the calf's life it is immaterial whether the roughage consists of hay or pasture but for the second six months pasture gives the better results.

Scours.—The most common trouble in raising calves by hand is indigestion or scours, caused by unsanitary methods of feeding, decided changes in temperature of the milk fed, and over-feeding. The animals should be watched very closely for any indication of scours, since a severe case will retard the calf's growth very materially. The first indication is usually a foul-smelling dung. It is usually best to separate the affected calf and disinfect the pen. The ration should be cut down to at least half the usual amount. Such remedies as castor oil and formalin may be used to advantage. A drench of three ounces of castor oil in a pint of milk is sometimes used. Four drops of formalin to a quart of milk has the desired effect in most cases. This should be given for two or three days.

White scours or calf cholera is very serious and when once affected the calf seldom recovers. This is due to infection of the navel soon after birth. It is an infectious disease caused by filthy conditions in which the cow is allowed to give birth to the calf, and is usually avoided when the calf is dropped in a clean stall or in the pasture. If the calf is born in the barn it is best to tie up the cord and wet the navel thoroly with a disinfectant, such as a weak solution of creoline. The symptoms are a very severe diarrhea with the passage of white, foul-smelling dung, the eyes become sunken, and the animal cannot be induced to suck or drink. It usually dies within three or four days.

Feed and care after weaning.—The young animals are usually weaned at six month, altho in some cases where a certain finish is desired milk is given until they are eight months of age. The rearing from this time on is comparatively simple. If on good pasture they require little additional feeding. In winter the roughage should consist of a good quality of leguminous hay, corn silage, and enough grain to keep them in a thrifty condition. The grain ration is composed of the same concentrates in a similar proportion as for the young calves. A liberal use of roughage is desirable, as it is usually the cheapest feed at hand. Under ordinary conditions a gain of a pound a day from the time of weaning to the time of first calving is a good average for the dairy heifer.

Age to breed.—The age at which heifers should drop their first calf depends on the breed and the development of the heifer. Under average conditions, it is planned to have the heifers calve between 24 and 30 months of age. The smaller breeds as the Jersey and Guernsey are sufficiently mature at 24 months, while the larger breeds, as the Holsteins,

which mature more slowly, are usually bred to calve at from 28 to 30 months. The time to breed depends largely upon size and development of the individual heifer. If she is large, well-grown and well-developed, she may be bred earlier. Breeding too young undoubtedly results in small cows. Where early calving is practiced the breeders usually allow 16 to 20 months to elapse between the first and second calves to give the heifer a chance to continue her growth. It is a common theory that lengthening the first lactation period tends to make the heifer a more persistent milker.

Fall and spring freshening.—Under average farm conditions where a regular supply of milk is unnecessary thruout the year, it is a commendable practice to allow the cows to freshen in the fall of the year. There is usually an overproduction of dairy products during the spring and early summer months when the prices decline. A study of the average prices of dairy products reveals the fact that from November to April butterfat prices reach their highest level. When the cows are allowed to freshen in the fall, the farmer has more leisure time and is better prepared to care for his stock than during the harvest season, and cows that freshen under farm conditions in the fall will give a higher production than those freshening earlier. When they begin to decline in the early spring, they are turned out on pasture and the production is increased at a minimum cost. They can then be turned dry during the hot summer months when the harvest season is on and when the farmer is not properly prepared to care for them.

When allowed to freshen in the spring, they milk heavily for two or three months and decline during the midsummer. To bring them back to a higher level of production will require the use of expensive feeds and even with the best type of dairy animals this is often a difficult process. Cows freshening in the fall should annually yield from ten to fifteen per cent more milk than if allowed to freshen in the spring.

Care of cow when dry.—To insure a good flow of milk the cow should be in good condition at freshening. She should be dry at least six weeks. The production of a liberal amount of milk is an exceedingly heavy tax on a cow. If she is not given a rest she will begin the new lactation period at a much lower level of production, and it is almost impossible to increase the flow during the entire period. The amount of feed that she will require depends upon her condition at the time lactation ceases. If she is in fairly good flesh a maintenance ration will be sufficient, and this may be supplied by the use of a good quality of leguminous hay and corn silage or roots. Just previous to calving the feed should be of a laxative nature, altho if she is on pasture this will not be necessary. It is best to allow her to have plenty of exercise in a pasture or corral. She should not be unnecessarily excited or allowed to be chased by dogs or driven thru narrow gates. A sudden fall or excitement may cause an abortion. The average period of gestation is placed at from 280 to 285 days.

Water.—Cows require a large amount of water for their body needs and for milk production. On an average, a cow will consume approximately 100 pounds of water per day, altho with the exceptionally high

producer this is very materially increased. They should be supplied with water at least twice a day, or, better still, they should have access to good clean water at all times.

In regions of severe winter, it is recommended that the cows be supplied with water indoors when the weather is inclement. Where such is the case, the watering devices should be kept clean and free from contamination. One of the most satisfactory methods in use is continuous cement mangers where the water may be allowed to flow in at one end and be drained off when the cows have finished drinking.

Salt requirements.—The amount of salt to be supplied varies according to the salt content of the feed stuffs in the ration. Salt may be supplied by mixing the proper amount regularly with the feed (usually from one to three ounces daily). A common practice, and one which has much to recommend it, is to keep salt in boxes before the animals so that they may have access to it all the time.

SHELTER

It is essential that a dairy cow, whose function is that of production, must have comfort in the fullest sense if she is to return a profit to the owner. To successfully manage any class of livestock, a study must be made of the conditions nature has provided for their comfort. Under natural conditions the average cow makes her greatest production during May and June. There is plenty of feed at hand, and it is palatable and easily digested, and the cow is comfortable. In order to maintain this production thruout the year and secure the maximum returns, these early summer conditions must be imitated as nearly as possible. The cow must be made comfortable. It is necessary to have barns to protect the animals from severe climatic conditions. The barn does not need to be expensive. but it should have a uniform temperature of from 55 to 60 degrees, and an abundance of light and pure air.

Ventilation.—An abundance of pure air is second in importance only to proper methods of feeding. It is not only necessary from the standpoint of the health of the animal, but it is necessary for the economical production of milk. Tightly constructed barns make it necessary to install some system of ventilation. The King system of ventilation is the one most commonly used. Briefly, it consists of a large flue, at least two feet square, opening near the floor and extending above the roof of the stable for the escape of the air. A series of smaller openings are arranged on either side of the barn for the air to enter. These openings are 4 by 12 or 4 by 16 inches in size. The air is taken in at the ceiling. The intakes extend downward in the wall with the opening three or more feet lower than the opening in the barn. The interior of the barn should contain at least 500 cubic feet air space per cow. This necessitates making the average height of the ceiling nine feet.

A barn may also be ventilated by dropping the windows in from the top.

Light.—A dark barn affords an ideal place for the growth of disease germs and other bacteria of a detrimental nature. Sunlight is the most powerful of all germicides. In order to keep the barn sanitary it should

be well supplied with windows. These should provide approximately four square feet of lighting area per cow. They should be placed from 4 to 4½ feet from the floor and extend near the ceiling in order to allow the sunlight to reach as much of the floor as possible. By placing the windows flush with the inside wall the dust that would settle on the ledges and in the crevices is eliminated. They may be fitted to ra.se, slide, or swing, at the option of the owner.

Floor.—The floor of a barn may be built from almost any building material, but the most common types in use are clay, wood, and concrete.

Clay.—While the clay floor provides comfort for the cow, it is not to be recommended as it is extremely difficult to keep clean. This is especially true where no gutter is provided. If for any reason the clay floor is used, a gutter of cement should be built that extends forward far enough to catch the urine. The space under the cow is then made of clay mixed with lime, thoroly wet and firmly packed. This can be more easily cleaned than the ordinary dirt floor, but requires frequent repairing.

Wood.—The tight wooden floor is comfortable to the cows and can be kept in good condition altho it is not strictly a sanitary construction. In constructing a wooden floor the boards should be laid tightly together to prevent any of the urine from seeping through the cracks, thus causing an accumulation of filth and bad odors in the barn. A most rapid decay occurs when the floor is laid above the soil with no air circulation beneath. Under the best conditions a wooden floor may last from six to ten years.

Concrete.—The concrete floor where properly constructed is very durable and requires little expense for maintenance. It is the only material which meets with the three requirements of sanitation, durability, and economy. It is also impervious to moisture. The first cost is but little more than wood. One objection raised is in regard to the comfort of the animals. It is a good conductor of heat and in consequence is cold, which may cause udder troubles. Where plenty of bedding is used the objection may be overcome. In sections where straw for bedding is scarce and expensive, a wooden platform can be built over the cement floors to protect the cows. This platform may be made of planks imbedded in coal tar, or in a movable form which may be removed for cleaning.

The surface of the concrete should not be left smooth. After it has set, but before it has hardened, it should be finished with a broad trowel or float, which will give a sandpaper finish to all parts where the animals walk. This will prevent the animals from slipping and falling.

Arrangement of cattle.—It is most economical of space and time in caring for the cows to have them in two rows. A building 34 to 36 feet wide (outside measurements) gives sufficient space for such an arrangement. Whether the arrangement of the cows is such that the cows face outward or with their heads together is largely a matter for the owner to decide. Each method has certain advantages. When the cows face the center both rows may be fed by making one trip with the feed truck, distributing the feed on both sides. The manure is more easily removed when the cows face outward. The walls do not become splashed with manure and filth and the cows present a better appearance. Where this

arrangement is used there is often difficulty experienced in constructing the stable without center posts.

The gutter should be from six to eight inches deep and from fourteen to sixteen inches wide. It should be deep enough so that the cows will not stand with the hind legs in it.

Mangers.—While there are numerous types in use, the concrete, continuous manger seems to be most satisfactory. It is built in the form of a long trough in front of the cows. The advantage of this type is the ease with which it may be cleaned and that it may also be used for supplying water during severe weather.

The manger should be at least two feet wide and six inches deep, and should be separated from the floor of the stall by a 6 x 6-inch concrete curb.

Platform.—The platform should have a depression of one inch, 14 inches wide, next to the tie. The success in keeping the cow clean depends largely upon having the platform of proper length. This varies from 4 ft. 6 in. to 5 ft. 2 in., depending upon the size and breed of cattle kept. A common plan followed is to have the platform gradually widen from one end to the other to a maximum of from four to six inches so that all sizes of cows may be properly accommodated.

The stall equipment should be put in or provisions be made for its installation at the time the floor is laid. The standard width of the stall is 3 ft. 6 in.

Location.—The barn should be located where there is good drainage, so that the yards may be kept in good condition. It should be situated in such a manner that the labor in handling the cattle and caring for the product is reduced to a minimum.

MILKING MACHINES

One of the obstacles in the development of the dairy industry in the United States is that of labor and the difficulty of securing competent and efficient hand milkers. A satisfactory milking machine has been one of the greatest needs of the dairy farmer and the use of milking machines attracts wide-spread interest. It would seem as if they had now passed the experimental stage and may be considered an economic success. The different types have been continually improved and by long, continued trials at various experiment stations have thoroly demonstrated that they will milk cows and, in the hands of a careful operator, will do as efficient work as the average milker. At the Kentucky station, it was demonstrated that two men, aided by a boy to carry the milk to the milk house, required three hours to milk fifty cows by hand. Using the mechanical milker with two units per man, the two men and one boy as above were able to milk these cows in 1 hour and 15 minutes. Using three units per man, the two men alone milked the cows in 1 hour and 45 minutes.

In January, 1916, a milking machine was installed in the dairy barns at the University of Idaho. Data were compiled showing the economy of production and effect of the milker on the health of the herd. It was observed that there was no decrease in production during this period with the individual cows as compared with similar preceding periods of the

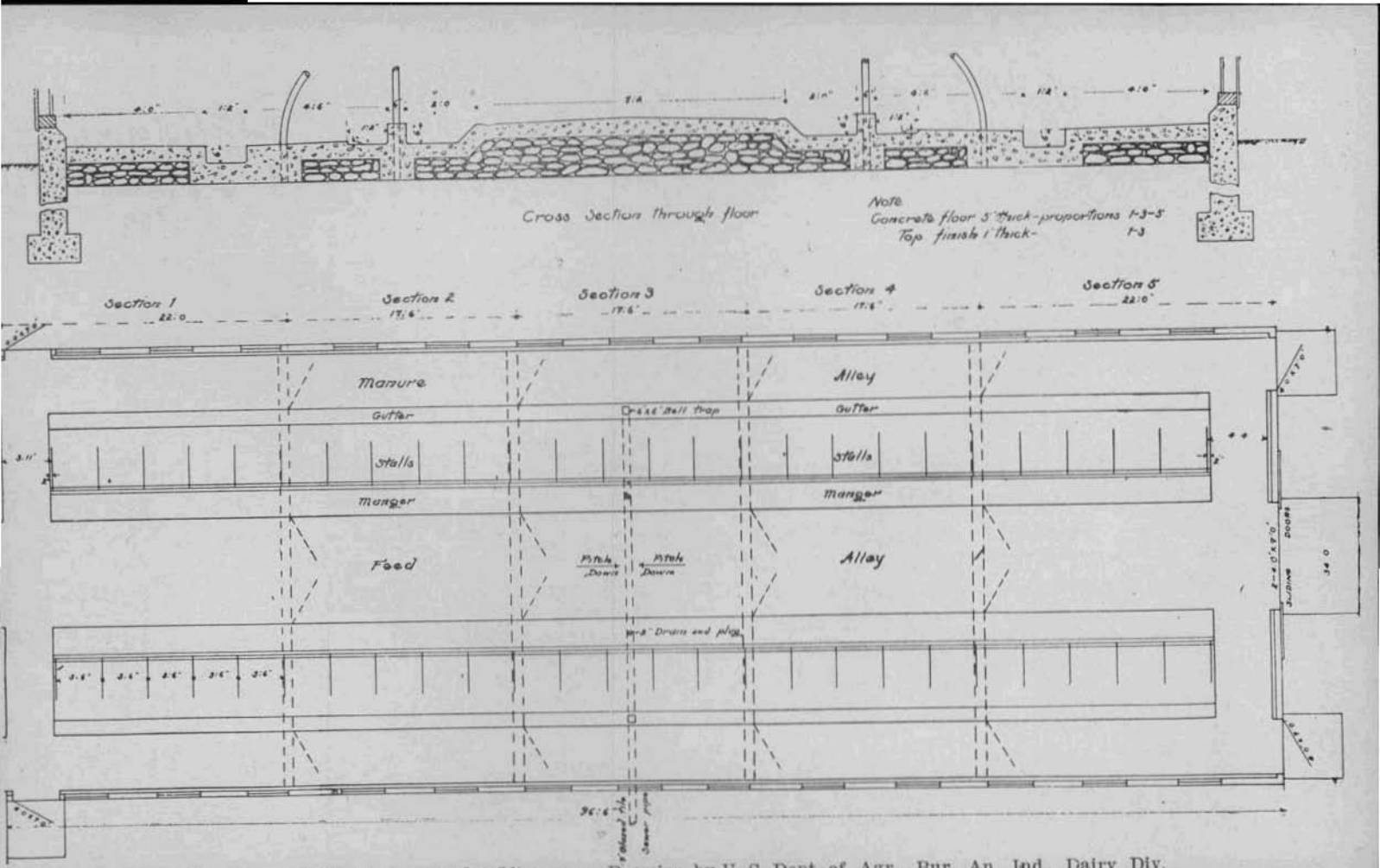
same cows.* Close inspection was given each individual animal by the Department of Veterinary Medicine to determine the effect of mechanical milking on the udders. No ill effects could be ascertained.

It was also observed that with the same amount of labor necessary to handle the University herd when milking by hand, the herd could be milked three times a day with an average increase of 20 per cent in milk flow. While this practice is probably not practical for the farmer who is milking cows as an adjunct to other farming operations, for the dairyman who devotes his entire energies to the industry and who is supplying milk for a city market or cheese factory, it is an important point in securing maximum production.

Another condition noted with the mechanical milker is its relation to the hard-milking cow. Often cows that are capable of high milk production are not given the attention they deserve because of difficulty in milking. One pure-bred Holstein cow in the University herd, Philidea Young DeKol, was a notoriously hard milker. In 1914 she produced 8,550 pounds of milk, 336 pounds fat; in 1915, 8,001.5 pounds milk, 274 pounds fat; in 1916, with the mechanical milker, in a similar period she produced 11,795 pounds milk, 360 pounds fat. The milking machine with this class of cattle apparently increases the length of the lactation period, as the average hand milker has a tendency to "dry up" the cow that he finds difficult to milk.

The milking machine, like any other piece of machinery, must be kept in perfect repair in order to be most efficient. If the machine is properly cleaned and used, the sanitary conditions of the milk are much improved over any ordinary conditions, but with careless handling the milk may be very high in bacterial content. Owing to the first cost of the machines and of installing, and the labor involved in operation, it appears that the milking machine is economical only in herds where not less than fifteen cows are milked thruout the year.

*Date Jan. 1, 1916, to Oct. 1, 1916.



Floor plan of a modern dairy barn for fifty cows. Drawing by U. S. Dept. of Agr., Bur. An. Ind., Dairy Div.

The following publications may be obtained without cost, by addressing the Agricultural Experiment Station, Moscow, Idaho.

Bulletins

65. Alaska Wheat Investigations.
72. A Report on the Milling Properties of Idaho Wheat.
73. A Study of Idaho Butter with Suggestions for Improvement.
75. Composition of Irrigated and Non-Irrigated Fruits.
76. Tomato Culture in Idaho.
81. Soils of the Cut and Burned-Over Areas of North Idaho.
85. The Use of Lime-Sulfur as a Summer Spray for Apple Scab.
86. Some Poisonous Plants of Idaho
87. Insect Pests of the Orchards and Gardens of Idaho, and Their Control.
88. The Milling Values of Dry-Farmed and Irrigated Wheat.
89. Sheep and Lamb Feeding Experiments.
90. Creamery Records.
91. Methods of Clearing Logged-off Lands.
92. The Annual Report of the Experiment Station for the Year Ending June 30, 1916.
93. Experiments with Small Grains Under Irrigation.
94. Experiments with Legume Crops Under Irrigation.
95. The Management of Irrigated Grass Pastures.
96. The Management of Farm Flocks in Idaho.
97. Commercial Onion Culture in Idaho.
98. Winter Versus Summer Pruning of Apple Trees.
99. Experiments in the Irrigation of Apple Orchards.
100. The Production of Clover Seed Under Irrigation in Southern Idaho.
101. The Production of Alfalfa Seed in Southern Idaho.

Farmers' Bulletin 769. Growing Grain on Southern Idaho Dry Farms.

*Ground Squirrel Control.
*Cost of Pumping for Irrigation.
*Oats in Washington.
*The Home Drying of Fruits and Vegetables.

*Purchased of Washington State Experiment Station for distribution in Idaho.

Circulars

2. Field Peas.
3. Feeding for Egg Production.
4. Forest and Shade Trees and Basket Willows Recommended for Planting in Idaho.

The list below may be obtained, also without cost, by addressing the Department of Agricultural Extension, Boise, Idaho.

Bulletins

3. Measurement of Irrigation Waters.
5. Hog Cholera in Idaho.
6. Rural School Lunches.
7. The Alfalfa Weevil.
8. Directory of Idaho Pure-bred Breeders.
9. The County Agriculturist Movement.
10. Batters and Doughs (Boys' and Girls' Club Work).
11. Third Year Sewing (Boys' and Girls' Club Work).
13. First Year Sewing (Boys' and Girls' Club Work).
14. First Year Cooking (Boys' and Girls' Club Work).
15. General Announcement (Boys' and Girls' Club Work).
16. Meat.
17. Second Year Sewing (Boys' and Girls' Club Work).
18. Biennial Report of Extension Division, 1915-16.

Biennial Report of the State Pure Seed Commissioner.

Circulars

10. Home Economics Schools.
11. Farmers' Schools.
14. How to Keep Fowls Healthy (Boys' and Girls' Club Work).
15. Fitting Fowls for Exhibition (Club Work).
16. Gardens (Club Work).
17. Butter (Club Work).

Farm Hints

20. Help Fight Hog Cholera.
21. Potato Diseases.
22. Grasshopper Control.