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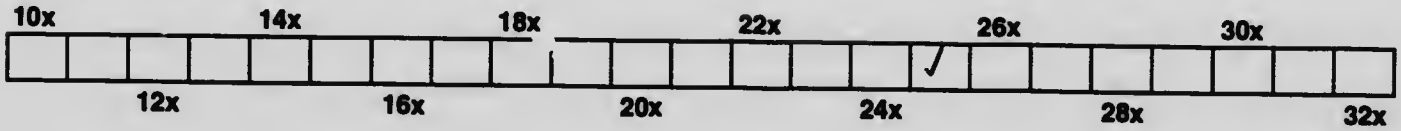

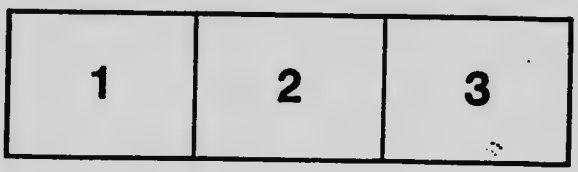

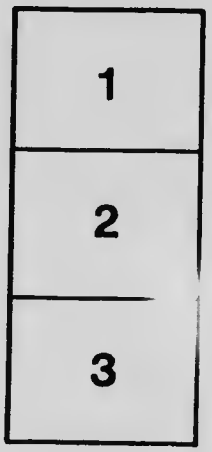

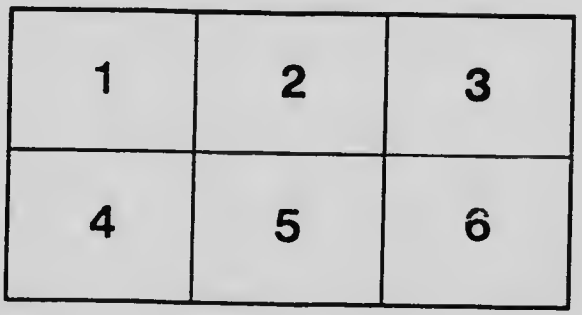

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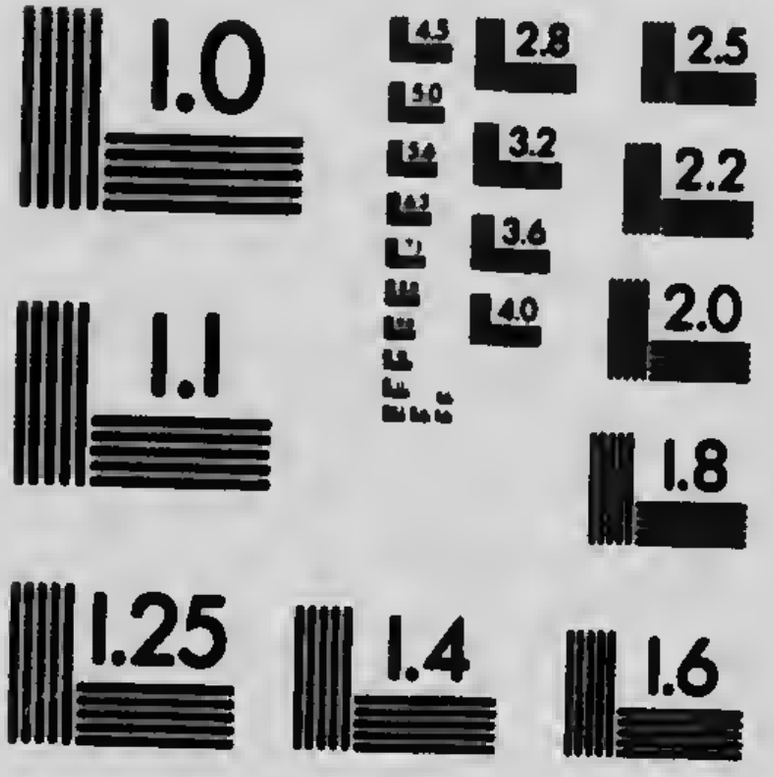

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PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF AGRICULTURE

(LIVE STOCK BRANCH)

CARE AND FEEDING OF DAIRY CATTLE

BULLETIN No. 67

THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA.

PRINTED BY
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VICTORIA, B.C.:
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1916.

DEPARTMENT OF AGRICULTURE,

VICTORIA, B.C., June, 1916.

To His Honour FRANK STILLMAN BARNARD,

Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

I have the honour to submit herewith for your approval Bulletin No. 67, entitled "Care and Feeding of Dairy Cattle," which has been prepared by Mr. S. H. Hopkins under the direction of Mr. Wm. E. Scott, Deputy Minister of Agriculture.

I have the honour to be,

Sir,

Your obedient servant,

W. MANSON,

Minister of Agriculture.

DEPARTMENT OF AGRICULTURE,

VICTORIA, B.C., June, 1916.

Hon. W. Manson,

Minister of Agriculture.

SIR,—I have the honour to submit herewith for your approval Bulletin No. 67, prepared by Mr. S. H. Hopkins, on the "Care and Feeding of Dairy Cattle."

I have the honour to be,

Sir,

Your obedient servant,

WM. E. SCOTT,

Deputy Minister of Agriculture.

PROVINCE OF BRITISH COLUMBIA.

DEPARTMENT OF AGRICULTURE (LIVE STOCK BRANCH).

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Minister of Agriculture.

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Veterinary Inspector.

WM. J. BONAVIA,
Secretary to the Department.

* Granted leave of absence for overseas service.

"We are seven." Dairy cows in the making.

CARE AND FEEDING OF DAIRY CATTLE.

INTRODUCTION.

A GREAT INCREASE in urban population over rural has made British Columbia a large importer of dairy products. In the last few years our farmers have gone in for dairying more extensively, and the supply of dairy products is beginning to overtake the demand. It will, however, be many years before the home market is fully supplied. The opportunities for the dairy-farmer are many. Dairying is and should be the backbone of our agriculture. The most prosperous agricultural communities of the world, where intelligent farming reaches its highest level, depend chiefly on dairying. Denmark, Holland, and the Island of Jersey are examples.

There are many reasons why dairy-farming is practised on the highest-priced lands and pays good returns. The dairy cow is the most economical producer of food of all farm animals. A good cow giving about 7,500 lb. of average milk in a year will produce four times as much solid food as a well-fed steer during the same time. The hog comes next in order to the cow as a profit-maker, and hogs are generally raised on a dairy-farm to consume the skim-milk or buttermilk, thus enhancing the profits.

Intelligent dairy-farming tends to conserve and increase the fertility of the farm, unlike exclusive grain or fruit growing, which reduces fertility. The selling of dairy products takes away very little from the land, most of the fertility contained in the crops being returned to the soil in the barnyard manure. The manure from a well-fed cow is worth $25 a year. Much of this fertility is taken from the air during the growth of the crops, the clovers grown being especially beneficial in adding nitrogen to the soil. Any foodstuff purchased by the dairy-farmer also adds fertility to the farm.

The foregoing explains why the average yield of wheat per acre in Denmark is 42 bushels, England 32, and on this continent less than 20.

An important item is the low cost of freight on concentrated products like butter and cheese having much value in small bulk. Labour is distributed evenly throughout the year, winter as well as summer.

Another advantage connected with dairy-farming is the steady market available and the certainty of returns. Market prices for dairy products vary but little from year to year. Dairy products are food necessities, while some farm products are more or less luxuries. Moreover, the market is close at hand. "There is no market like the home market," and that is very far from being supplied by home production. Although returns at any one time are not large, they are coming in the whole year through. Thus intelligent dairy-farming is not at all speculative, but is essentially "safe" farming.

DAIRYING DISTRICTS.

The Coast districts of British Columbia are most favourable to dairying. In these sections the industry is most developed, especially in the Lower Fraser Valley and on Vancouver Island. A mild, moist climate with a long growing season, together with proximity to large markets, make these the premier dairy districts of the Province. A large amount of fresh milk is required by Vancouver, Victoria, and other centres of population. In addition, twenty creameries are in operation in the Coast sections. Seven of these are farmers' co-operative creameries, and the rest are owned by city milk companies. Three condensed-milk factories are operated, two on the Mainland and one on Vancouver Island. A list of the co-operative creameries at present operated follows:—

"We are seven." Dairy cows in the making.

Coast Districts.—Chilliwack, Edenbank (Sardis), New Westminster, Saltspring Island, Comox Valley, Nanaimo, and Cowichan.

Interior Districts.—Salmon Arm, Armstrong, Kelowna, and Cranbrook. Grand Forks, Nelson, and Kamloops have each a privately owned creamery.

This list will be lengthened in the near future.

It is gratifying to find that the Interior districts have also taken up dairying. They already have four co-operative creameries established. There is no reason why dairying should not be developed in the Interior. The climate is dry in many districts and pasture not abundant. But all the Interior valleys grow splendid crops of clover, alfalfa, roots, and other staple dairying crops, with or without irrigation, according to the district. Wherever these crops can be grown dairying can be successfully carried on. All these sections at present have to import large quantities of dairy products from outside the Province. Large importations of butter come from the Prairies, where conditions are not so favourable for dairying. This state of affairs should be remedied.

Home butter-making is practised to some extent, but the quality of butter so made is not up to standard generally. Creamery-made butter is better and more uniform in quality. The aim should be to build creameries at convenient centres in each district when the number of dairy cows warrants it.

DAIRY BREEDS.

HOLSTEIN-FRIESIAN.

This is the most popular dairy breed in British Columbia at present. The Holstein is the oldest improved breed in existence. It has been kept and improved in Holland since the time of Caesar. The "black and whites" are the largest of our dairy breeds. Holsteins possess the highest average milk yield of any breed, and although the per cent. of cream or fat is the lowest, the total yearly yield of milk solids is highest, on the average. They are an especially vigorous breed, with large, strong frames. The cows possess a very quiet disposition and are usually regular breeders. The calves are large and make fine veal. The beefing qualities of the breed are good for a dairy breed.

AYRSHIRES.

This hardy, white-and-brown Scotch breed has won recognition by its merits. In New Zealand it is the most important dairy breed. This breed is noted for a good, uniform production rather than for remarkable records. Few inferior Ayrshires are found. Being an alert, active breed, they are good rustlers on rough and scanty pastures. The milk is of a good, average composition, but, like the Holstein, lacks the colour of the Channel Island breeds. It is richer in butter-fat than Holstein milk, averaging about 4 per cent. In beef production Ayrshires rank high for a dairy breed.

JERSEY.

As economical producers of butter-fat the Channel Island breeds—Jersey and Guernsey—have first claim. Although the total average yield of milk is less than in most other dairy breeds, Jersey milk has the highest average per cent. of butter-fat of any breed (slightly over 5 per cent.). A pronounced yellow colour adds to the saleability of Jersey milk, and the fat globules are so large that the cream rises quickly to the surface and churns easily. Jerseys are early maturing and are very persistent milkers, but are more apt to be delicate as calves than other breeds. In size they are the smallest of the common dairy breeds. The Channel Island breeds are ill-adapted for beef-making, the fat being very yellow and not well distributed. Jersey calves are small for vealing purposes.

GUERNSEY.

This breed is considerably larger and coarser-boned than the Jersey. The colour differs from the fawn-shaded-with-black of the Jersey, and is a yellow or buff with

white markings. In yield of milk this breed ranks a little above the Jersey. The per cent. of fat is slightly less on the average. The yellow colour of the milk and butter and the size of the fat-globules are more pronounced even than in the case of the Jersey.

DUAL-PURPOSE BREEDS—DAIRY SHORTHORN AND RED POLL.

These two breeds have been developed as a result of the demand for a cow giving a medium quantity of milk, but with better beefing qualities than the dairy breeds. In England the majority of the cattle are dairy or dual-purpose Shorthorns, but the Shorthorn as found generally on this side the water is the beef type, and has usually no claim to be styled dual-purpose. For this reason genuine dual-purpose Shorthorns are difficult and expensive to procure in British Columbia. Shorthorns are often called Durhams.

Red Polls as a breed in America are fairly good milkers, and possess better beefing qualities than any of the dairy breeds.

Dual-purpose cattle find their place where facilities and fodder are available for raising the male calves as steers rather than disposing of them when young for veal, as is the practice with those keeping the strictly dairy breeds.

Dual-purpose type stands midway between the dairy and beef types. Hence neither the largest milk yields of the special-purpose dairy breeds nor the ideal beefing qualities of the beef breeds can be expected from dual-purpose cattle.

CHOICE OF BREED.

The Holstein and Ayrshire breeds are well adapted for supplying market-milk. The yield is large and the fat and other milk solids are well balanced for human food. The per cent. of fat is nearer the legal standard of 3¼ per cent., and the milk is not apt to churn during transportation.

Jerseys and Guernseys are specially suited for cream or butter production or as family cows.

COLOUR AND FAT IN MILK.

While the yellow colour of the milk of the Channnel Island breeds is very attractive, it has nothing to do with the richness of the milk. This is shown by the fact that milk of exceptional Holstein cows analysing 5 per cent. of butter-fat still has the natural white colour of Holstein milk. Goats' milk is richer in fat than Jersey milk, but both the milk and butter are perfectly white.

Holstein and Ayrshire milk is better for feeding infants than the milk of the Channel Island breeds, due to the small size of the fat-globules and their consequent easier digestibility.

COMPARISON OF BREED RECORDS.

The following table given by Eckles is an average record of the pure-bred cows of different dairy breeds kept at United States experiment stations. It cannot be taken as a complete breed record, but may serve as a guide.

	Pounds of Milk per Year.	Per Cent. of Fat.	Pounds of Fat per Year.	Per Cent. of Total Solids.
Holsteins	8,699	3.5	300	12.29
Ayrshires	6,533	3.8	252	12.9
Jersey	5,508	5.1	283	14 9
Guernsey	5,509	5.0	274	14.2
Dairy Shorthorn	6,017	3.6	218	12.8
Red Poll	5,906	4.0	238	

Alfalfa makes successful dairying possible in the Dry Belt.

COMMUNITY BREEDING.

There are many advantages in choosing a breed favoured by the district round about rather than one not well represented. The locality becomes famous for that particular breed and buyers of surplus stock are attracted. Systematic and more intelligent breeding is possible. The best bulls become known and are retained in the district by trading.

CROSSING BREEDS.

Very often the result of the first cross between distinct breeds is good, many animals inheriting the good qualities of both breeds, especially vigour. But as a rule many inferior animals appear in the second generation.

Crossing distinct breeds defeats the very object for which the breeds have been developed. Pure breeds are kept pure in order that certain characteristics may become fixed so strongly that they will be transmitted regularly. Crossing breaks the chain of inheritance, and no one can tell the outcome.

It may seem natural in crossing the Holstein and Jersey breeds to expect the cross-bred to yield the quantity of the Holstein with the quality of Jersey milk. But it is just as natural to get the opposite result, because all tendencies, both good and bad, are transmitted from parents to offspring.

STARTING A DAIRY HERD.

Usually the sale of dairy products is the prime object, and in that case high-class grade cows will serve the purpose better than pure-breds, because they are not so expensive. A few registered females may be bought when funds allow if it is the expectation to sell breeding stock.

The herd must be kept up mainly by home-bred stock. Purchased stock is very apt to be unprofitable and expensive. Sellers do not readily part with their best animals. There is also the constant risk of bringing in disease, such as tuberculosis and contagious abortion. For these reasons good dairy-farmers raise most of their own cows.

Hence every dairy herd should own a good registered bull backed by good dairy records. The bull is half the future herd, so no chances should be taken with a grade animal whose breeding is unknown. With a registered animal it is possible to know the ancestry more fully and to get more certain results. He must, however, be a good individual himself. Pedigree breeding, combined with selection, has been the means of improving all our modern breeds of live stock.

KEEPING MILK RECORDS.

Breed, weed, and feed is a good maxim. No matter how carefully the breeder may be, some cows will disappoint him and turn out simply "boarders." It will be impossible for him to detect and weed out these undesirables by his own observation. Only by periodically weighing and testi[ng] the yield of each cow will he be able to arrive at figures showing him exactly [how much] each cow returns above or below cost of keep. Yearly records are of far more [value] than short-time tests. The persistent milker is the profit-maker.

The daily weighing of the milk of each cow and keeping a record of the weights involves surprisingly little extra trouble. This system has many advantages. In fact, intelligent dairying is impossible without it. Without knowing a cow's yield of milk and butter-fat it is impossible to feed her accordingly. A cow giving the same amount of milk as another may be yielding twice the quantity of butter-fat. The milk charts are also an infallible indication of loss of health. A sick cow may often be detected early by the decreasing milk-flow. The effect of a change in milkers will also be shown. Some milkers will obtain 25 per cent. more milk than others from the same cow.

COW-TESTING.

Testing milk for per cent. of butter-fat need not be done more than once or twice a month. Samples should be taken of both morning and evening milk. Testing is most easily and cheaply carried on where a cow-testing association is in operation with Government assistance. The following figures were obtained by the Dairy Division of the Live Stock Branch, Department of Agriculture, in carrying on cow-testing work in the Lower Fraser Valley :—

Comparison of Ten Best and Ten Poorest Cows.

	Milk.	Fat.	Food Cost.	Food Cost of 100 Lb. of Milk.	Total Cost of 100 Lb. of Milk.	Total Cost of Keep per Cow.	Profit per Cow.
	lb.	lb.					
Average of 242 cows.....	7,373	315	$44.25	$0.61	$1.15	$84.25	$ 67.00
Highest 10.....	12,347	466	53.25	.43	0.75	93.25	126.85
Lowest 10.....	3,477	167	34.50	.99	2.15	74.50	11.00

NOTE.—Cost of production figures would be higher in the Interior.

The following scale of charges was adopted :—

Ranch-grown produce at actual cost of production.
Bought produce at car-load prices.
Grain bought at car-load prices.
Grain home-grown at car-load prices, less 40 per cent.
Pasture at $1 to $2 per acre.
Hay at $10 to $12 per ton.
Mangels at $4 per ton.
Corn ensilage at $3 per ton.
Green feed at $2 per month.

Fixed charges (in addition to cost of feed) for labour, interest, and depreciation on barn and cow, taxes, insurance, veterinary, etc., are assessed at $40 per cow per year.

In the above table butter-fat was reckoned at an average price of 35 cents per pound; skim-milk at 25 cents per 100 lb.; calf at birth, $5; and manure was calculated as worth $25 per cow for "highest 10," $20 for average cow, and for the "lowest 10" it is $15.

The Dairy Division of the Live Stock Branch, Department of Agriculture, will be glad to help in the organization of cow-testing associations where not already formed. They will also send, free, upon request, special sheets for recording daily milk yields.

Where necessary, the testing may be done at home. A small Babcock tester, acid, pipette, and graduated bottles will cost about $12. The method used is quite simple and easy to follow. The yield of butter is about one-sixth more than the quantity of butter-fat from which it is made. This is called the "overrun." It consists mainly of the water and salt incorporated in the butter.

SELECTING COWS.

GUARDING AGAINST DISEASE.

Tuberculosis and contagious abortion are the two most serious contagious diseases that may be introduced into a herd by means of purchased animals. They are both germ diseases. One tubercular cow may soon infect most of the herd, and that means heavy financial loss and the risk of tubercular milk dangerous to human beings. The tuberculin test is the only reliable means of detecting affected animals. All animals should be bought subject to passing this test, which

will be applied free by the veterinarians attached to the Department of Agriculture. Contagious abortion is a more difficult disease to guard against, and the losses from it are very heavy. All that can be done is to make careful inquiry as to the freedom from cases of abortion of the herd from which the animal comes. The bull may carry germs of this disease.

Often when stock is bought from dealers and not from the breeder it is difficult to get reliable information.

AGE.

A cow will usually give her greatest yield during the fourth milking-period, or about her sixth year. Some, however, make their best record later. If a cow continues to breed every year, as she should do, she usually shows no very marked decline until twelve years. Most cows have to be disposed of for different reasons before reaching that age. A three-year-old will give about 75 or 80 per cent. as much milk as when mature at six years. The per cent. of butter-fat tends to decline with advancing years.

THE DAIRY TYPE.

The special points to be seen in a good dairy cow in full flow of milk are:—

(1.) The extreme angular form, without surplus flesh, but showing health and vigour:

(2.) The great development of udder and milk-veins:

(3.) The middle or barrel of the cow is very large in proportion to the size of the animal.

The difference between the dairy and beef types will be shown by the accompanying diagram.

A good dairy cow never carries much flesh when in full milk. She may put on flesh when dry, but after calving the strong stimulation to produce milk, which every good cow possesses, makes her part with this flesh and fat in the form of milk. A cow that carried any considerable amount of flesh after milking some months lacks the necessary stimulus. She may yield well for a few months, but she will not be a persistent milker.

A thin cow, however, is not necessarily a good cow, but it is easy to distinguish between a starved, dull-looking animal with rough, staring coat, and the well-fed, sleek-looking but thin dairy cow carrying a look of thrift, contentment, and capacity put to good use.

The wedge shape is particularly noticeable in most good cows. The point of the wedge is at the withers or top of the shoulder, which are sharp and not beefy. The wedge gradually widens out along the top of the back until its greatest width is reached across the hips.

The ribs are well spread and deep to provide the capacity to consume large quantities of bulky food.

The heart-girth or chest capacity is large to provide room for the vital organs—the heart and lungs—which purify and pump the blood from which the milk is made.

The rump from the hip-bones to the tail is long and level with the rest of the back. A drooping rump is unsightly and often indicates a faulty udder below.

The proper conformation of the thighs and udder will be seen from the illustration. The thighs should not be beefy, but should appear quite thin and arched on the inside.

THE UDDER.

A good udder is attached high behind and well forward on the abdomen. This, with good depth and width, gives great capacity. The fore-quarters more often lack development than the hind-quarters. They should be equally developed, making the vessel shapely. The teats should be level and wide apart when the cow is milking.

The texture of the udder is important. Large, well-formed udders may contain too much connective tissue to be effective. These are termed fleshy udders. In such

udders the quantity of milk-secreting glands is really small, and after milking the udder is almost as large and distended as before. A good udder "milks away," and when empty shows a lot of loose skin of a soft, pliable texture.

THE MILK-VEINS.

These pass out of the front of the udder, one on each side, along the abdomen, and can readily be felt just beneath the skin. They enter the body-cavity through openings called "milk-wells" toward the front legs.

These veins carry the blood, from which the milk is secreted, on its way from the udder back to the heart and lungs. A large supply of blood means a large milk production. The milk-vein is one of the most reliable indications of milking capacity. The larger the vein and the more crooked and branching, the better are the indications. In judging a dry cow or one that has been milking a long time, the size of

A typical Ayrshire cow.

the milk-wells should be noted. The veins decrease in size as the lactation period advances, but with mature cows the size of the milk-wells remain constant. In young animals the veins will be smaller than when mature.

THE HERD BULL.

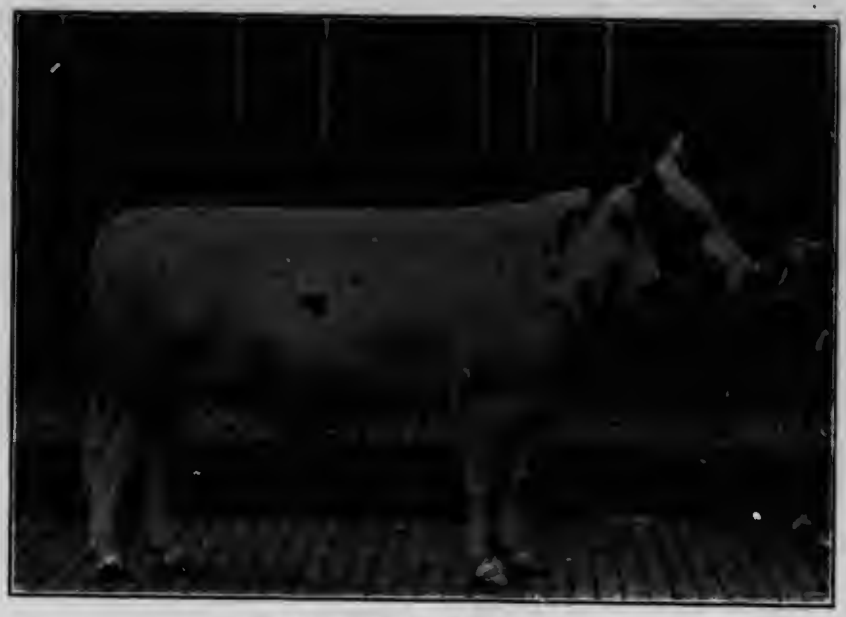
It is a well-known saying that "the bull is half the herd." Some authorities claim that he counts for more than half the future herd. Investigations seem to show that the sire possesses the faculty of transmitting dairy qualities even more than the dam.

It is, then, mistaken economy to buy a bull simply because he is cheap. A pure-bred bull of the breed chosen should be got. He should be a typical specimen of his breed, with good conformation and strong vitality and constitution. In addition, he must have ancestors with good dairy records. His dam especially should be a high producer.

The reason why a pure-bred animal is more likely to transmit good dairy qualities and improve the production of the herd is that the pure breeds have been bred generation after generation along the same lines. The longer this has been carried on, the more firmly fixed are the desirable characteristics, with the greater certainty of their transmission to the offspring.

It must be remembered, however, that all breeds have been improved from the original common or wild stock. The greater the improvement made, the greater is the tendency to revert to the original type. This "drag of the average" makes continued improvement more and more difficult past a certain point. If a cheap grade or scrub sire is used, the chances are that progress will be in the wrong direction. But it may be said that almost any pure-bred bull with good milking ancestry will improve a mixed herd or one of poor dairy quality.

Even pure-bred bulls vary greatly in their ability to pass on the desirable points of the breed to their offspring. Prepotent bulls—sires that transmit good dairy quality to a marked degree—are rare, and exceedingly valuable to any breeder. Too often such bulls are disposed of before the owner has time to discover their



Ayrshire bull, "Hobsland Perfect Piece."

worth in their offspring. A bull should be kept if possible until his capabilities are known. It pays also to try ont a young animal on a few cows before finally adopting him as the herd bull. The only way to try out a dairy bull is to breed from him and then see what his offspring will do at the pail.

AGE OF BULL TO SELECT.

Instead of buying a young untried bull, as is the general practice, it will often pay a farmer to look around for an aged bull for sale by a reputable breeder.

A young animal is generally preferred, however, being more easily handled and shipped. There is also danger of an aged bull being an uncertain breeder, due to lack of exercise, and there is the further risk of introducing contagious abortion into the herd.

CARE AND MANAGEMENT OF THE BULL.

Bull calves of the dairy breeds are usually raised on skim-milk supplemented by a fairly liberal grain ration, the object being to obtain good growth without too much beefiness. A little flesh will not do any harm.

In summer the natural feed is green stuff with a little grain. In winter, clover or alfalfa hay with a good allowance of roots, and for grain a mixture of oats, corn, bran, and linseed-oil meal, will give good results.

Bull calves should be separated from the heifers before six months old, but can run with other bull calves of about their own age.

AGE TO USE.

Most bulls can be used for light service at ten or eleven months. One cow per week is enough at first. Later this number can be increased.

Guernsey bull, "Pilot of the Glen."

RINGING THE BULL.

At about one year of age the bull should have a ring put in his nose. This provides a means of controlling him. The bull's head must be tied securely. The ring is vaselined and a circular hole cut through the cartilage between the nostrils. A bull-punch is the proper instrument to make the hole, but a trocar can be used as well. After the ring is closed and the screw inserted, it should be sandpapered if there are any rough edges. He should not be handled by means of the ring until the wound is perfectly healed, because if so hurt he will become difficult to catch. A good staff and a strong ring are the only safe means of leading a bull.

IMPORTANCE OF EXERCISE.

Hardly one dairy bull in a hundred gets sufficient exercise to keep him in proper breeding condition unless he runs with the herd, and the latter is bad practice. It is dangerous because no bull is safe at large. Many persons every year are killed by "quiet" bulls. Furthermore, when the bull is out with the cows, the owner

cannot keep any record of the date of breeding, as he should do. The heifers are liable to be served far too young and be stunted in growth. Another bad feature of the practice is that the bull exhausts himself until he becomes an uncertain breeder.

The bull should be kept away from the herd, but he should be able to see what is going on around him, and not kept in solitary confinement. The best way is to run two bulls together, and let them work off surplus energy in friendly fights.

A dairy bull has much more nervous energy or "steam" than the lethargic beef animal, and this must be worked off in some way. An open shed and paddock are best best when available. Some have the bull's ring attached by a chain to an extra strong wire stretched tightly from post to post above the animal. He can travel from end to end of this cable at will. One prominent dairyman of the Province uses the herd bull on a tread-power to run his milking-machines.

The open-air treatment is best except during severe weather, although it causes the animal to appear somewhat rough owing to the long coat of hair he grows.

DEHORNING.

Dehorning is best done while very young. If a mature bull has horns, they are better removed. All bulls are dangerous, but they are less dangerous without the horns. Get a veterinarian to dehorn the bull with a special dehorning instrument.

A typical Guernsey cow.

It should be understood that it is never safe to trust any bull. He should be treated firmly but kindly. Bull calves should never be petted or teased.

CALF-RAISING.

Holstein calves at birth are the largest of any breed, often weighing over 100 lb. when born. They average about 90 lb., Ayrshires 65 lb., and Jersey calves about 55 lb. Heifers' calves are smaller at birth than calves from mature cows.

The cows are an important part of the herd. If care is taken in the choice of [illegible] in raising the calves, the dairyman who is compelled to start with a herd [illegible] y quality may in a few years raise the production of his herd greatly.

RAISING CALVES ON WHOLE MILK.

Although this is the most natural method, it is a costly process. After the first month a calf needs an average of about 16 lb. of milk a day. This means nearly 500 lb. per month for four months. When milk is worth $1.50 per hundred, this brings the cost for milk alone to $30 for four months' feeding. Some dairymen allow one cow to nurse two calves. Others feed whole milk for only two or three months, and then substitute grain for the milk. But calf-raising without skim-milk is at the best an expensive method.

RAISING CALVES ON SKIM-MILK.

Skim-milk calves can be reared equally as good for dairy purposes as those nursed by their mothers. Some calves raised on skim-milk are not a good advertisement for the food, but this is because the milk is improperly fed, very often.

SKIM-MILK A VALUABLE FOOD.

The following table shows the average composition of whole milk and separator skim-milk:—

	Whole Milk.	Skim-milk.
	Per Cent.	Per Cent.
Water	87.1	90.5
Fat	3.9	0.1
Protein	3.4	3.57
Sugar	4.75	4.95
Ash	0.75	0.78

It will be seen that skim-milk is a valuable food, being richer than whole milk in everything except butter-fat. The fat does not go to form growth, but only to supply body-heat and body-fat. This can be supplied just as well by the cheaper grain, while the valuable butter-fat is sold for human food as cream or butter. The casein and albumen (protein) and the mineral matter all remain in skim-milk, and these are the materials which build up muscles, bone, nerves, skin, hair, and hoofs. The sugar (a carbohydrate) is converted into heat and fat in the body. Skim-milk calves are economically raised. If properly fed they may be less fat, but they often have more bone and muscle at weaning time than whole-milk calves.

COST OF FEEDING SIX MONTHS.

During the first six months the skim-milk calf will require from 100 to 300 lb. of whole milk, between 2,300 and 3,000 lb. of skim-milk, and up to 150 lb. of grain, besides hay or pasture. The cost of this feed will be less than one-third the cost of whole-milk feeding.

TAKING THE CALF FROM ITS MOTHER.

Some take the calf away from its mother at once, without allowing it to nurse at all. Others let it nurse once; and some allow it to remain with the cow three or four days or until the fever is out of the udder and the milk is fit for use in the dairy. When the calf is taken away at once, there is no fretting on the part of mother or calf, and a calf that has never sucked is the easiest taught to drink from the pail. When the cow's udder is very much inflamed or caked, it may be best to leave the calf with her until the inflammation subsides.

THE FIRST MILK OR COLOSTRUM.

Whether the young calf is taken away from its mother at once or not, it must get its own mother's milk at first. This yellow first milk contains substances, absent

from the milk later, which are essential to the digestive organs of the new-born calf, acting as a physic and stimulant.

AMOUNT OF MILK TO FEED.

The calf's stomach is small and there is danger of overfeeding. For the first two weeks 4 or 5 quarts or about 10 or 12 lb. per day is all a large calf should have. A small calf, as a Jersey, does not need more than 8 or 10 lb. per day at the start. This amount may be fed in two feeds per day, or, better, in three for the first two or three weeks, starting with the smaller quantity and increasing by 2 lb. the second week. For the first two or three weeks whole milk should be fed, but it is not essential after the first few days to feed the calf its own mother's milk. In the case of Jerseys and Guernseys giving very rich milk, it is better to dilute the whole milk with skim-milk right from the start, as the fat is hard to digest. After two or three weeks skim-milk is substituted more and more at each feed. The change to a skim-milk diet should be made gradually and take about a week to accomplish. It is a mistake to suddenly increase the amount of milk fed when changing to skim-milk, with the idea that the calf needs a great deal more of skim-milk than whole milk. The increase should be gradual as the calf grows older, and seldom more than 20 lb. (2 gallons) daily need be fed even a large calf at any time. A good rule is to always keep the calf a little hungry. We have to remember that in the natural or wild state the milk-supply for the young is much less than under our artificial conditions.

TEACHING A CALF TO DRINK MILK.

Two fingers are inserted in the calf's mouth, and he at once commences sucking. The muzzle is then forced into the milk-pail, so that the milk is sucked in between the fingers. He should not have the fingers more than two or three times, or he will always look for them and be troublesome to feed.

POINTS IN FEEDING CALVES.

Each calf must get its share, and no more. Feeding a bunch of calves out of one trough at the same time will not do. The milk must be warm and sweet. We have to imitate nature and feed the milk at blood-heat, which is 100° F. This point is important. When the calf is young its digestion is easily upset, and a thermometer should be used to eliminate guesswork.

During cool weather it will be necessary to heat the skim milk after passing through the separator before it is fed to young calves. Otherwise scours or other digestive troubles are sure to occur.

Feeding-pails must be kept as clean and sweet as the milk-pails, and scalded as regularly, or trouble will follow.

WATER, SALT, AND MINERAL MATTER.

A supply of clean water and salt should be handy all the time. A calf needs a drink of water often in hot weather, as well as its milk. Some calves suffer from want of minerals in the ration and will be benefited by feeding daily ½ oz. of chalk or ground rock phosphate. A little blood-meal in the milk will help ailing calves.

SUPPLEMENTS TO SKIM-MILK.

At three weeks, or about the time change is made from whole to skim milk, grain feeding should commence. Some prefer to mix the supplementary feed with the skim-milk the first two or three weeks, using at each feed two tablespoonfuls of boiled feed-flour, rolled oats, or flax-seed jelly made by pouring boiling water on flax-seed. After five weeks of age the grain is best fed dry after the milk, and most feeders feed the supplement separately from the beginning. If the calf will not begin to eat, a little grain may be rubbed on its muzzle, and it will soon learn to

seek the trough. For the first few days grain should be kept before the calf all the time. After it has commenced eating it should get only what it will eat at each meal. Grain should not be left in the trough to sour. At six weeks old about ½ lb. of grain a day will be eaten; at the end of two months 1 lb. a day; and at three months and later about 2 lb. per day is enough. Some suitable mixtures follow.

GRAIN FOR CALVES GETTING SKIM-MILK.

It is better to feed a mixture of two or three grains than one, but a large variety is not necessary. A number of calf meals are on the marke but they do not possess any particular merit over a good combination of farm-grown grains. It is not advisable to mix grain with the milk. It needs to be chewed and mixed with the saliva. For this reason the best plan is to feed grain right after the milk, when the saliva of the mouth is running freely.

Holstein-Friesian bull, "Johanna de Pauline 2d's Lad."

Some suitable grain mixtures are as follows:—

(1.) Oats, 4 parts; bran, 2 parts; linseed-oil meal, art.

(2.) Oats, 2 parts; corn, 1 part.

(3.) Oats, 5 lb.; bran, 3 lb.; corn-meal, 1 lb.; linseed-meal, 1 lb.

(4.) Oats, ground barley, and bran.

There is little danger of the calf fed skim-milk eating too much grain. Liberal feeding pays in the case of all young growing animals. The calf is possessed of a good set of grinders and can digest whole oats very well.

ROUGHAGE FOR CALVES.

Calves will begin to eat hay as soon as they will eat grain. The hay should be of good quality. In summer they can be turned out to pasture to get what roughage they need, provided the change is made gradually. There is danger of scours when put on pasture suddenly. If shade from the hot sun is not available, they will do better inside eating hay or soiling crops up to six months of age. Corn silage and roots are also good feeds for calves.

RAISING CALVES WITHOUT MILK.

Calf meals sold under proprietary names are used with good success. A mixture may also be componnded at home. One which has given good results in the United States is made up as follows:—

Wheat-flour	30 lb.
Cocoanut-meal	25 „
Nutrium (soluble skim-milk powder)	20 „
Linseed-oil meal	10 „
Dried blood	2 „

The calves are given their mother's milk for a week, when the milk substitute gradually replaces the milk uutil at two weeks no milk is fed. For the first six weeks the calves should have 1½ to 2 lb. of the mixture per day, mixed with 1 to 1½ gallons of hot water. At three months of age an ordinary grain ration may take the place of the above mixture.

The results from this feeding are not as good as when milk is used, but with care good animals can be raised. Patent calf meals and skim-milk powder usually cost between 4 and 5 cents per pound in British Columbia.

"Bessie Botsford," one of the best Holstein-Friesian cows in British Columbia.

FEEDING FOR VEAL.

For producing the best veal the new-born calf should be kept in a darkened stall, and receive twice a day all the fresh whole milk it will drink. About 10 lb. of milk are required for each pound of gain on the calf. The veal should be at its best at the age of two months. For the very best veal nothing but milk is fed, and care is taken that no bedding is eaten.

DEVELOPMENT OF THE DAIRY HEIFER.

After weaning at five or six months of age the animal will subsist mainly on roughage. Good pasture in summer is all that is needed to maintain proper growth. Scanty pasture can be helped out by soiling crops, silage, or grain-feeding.

In winter, clover or alfalfa hay combined with silage or roots should be fed. A little bran and oats may also be given if it is thought necessary. Linseed-oil meal or oilcake can be used in addition with beneficial results. It improves the general health and tone of the animals. They need to be kept in good growing condition, and a little flesh will not hurt their development.

AGE TO BREED—ŒSTRUM.

Breeding too young commonly occurs, and always results in small cows. During the last stages of pregnancy the heifer undergoes a severe strain. In the last three months of the gestation period she does not add anything to her own body even when liberally fed, the food all going to nourish the fœtus. Usually two and a half years is about the right age to have the first calf. This means that the animal should be bred at about twenty-one months. It may, however, be some months earlier in the case of Jerseys, which are an early maturing breed. The periods of heat, or œstrum, when the cow or heifer will take the bull, are about three weeks apart, and usually last for about a day at a time.

Some breeders prefer to have the first calf dropped at an early age, claiming that it fixes the habit of milk production, and at the same time secures financial returns as early as possible. They then allow eighteen or twenty months between the first and second calves. It is thought that a long first lactation period develops the habit of long and persistent milking.

GESTATION PERIOD.

With cattle the normal time between conception and the birth of the calf is nine to nine and a half months.

MANAGEMENT OF DAIRY CATTLE.

DEHORNING CALVES.

Unless they are pure-bred and likely to be used for show purposes, all calves should be dehorned. Horns are useless and often very harmful appendages on dairy cattle, and there is every reason why they should be removed.

Dehorning must be done when the calf is three to five days old. The small buds of the future horns can then be felt. The hair is clipped away. A pointed stick of caustic potash is slightly moistened and rubbed on the spot until the skin bleeds slightly. It must not be allowed to run down the face, or the caustic may burn the skin or reach the eyes. If sufficient caustic potash has been applied, a dent will be felt at the spot in a few days, and no horns will ever grow. In some cases a second application is necessary. Some use Gillett's lye for this operation.

FLIES IN SUMMER.

The annoyance of cows by flies is overestimated. Certain proprietary fly mixtures are used, and some of them are successful in keeping off flies, but this seems to make little difference in the production of the cows. The shortage of feed when the pastures dry up in the heat of summer is the main cause of the lessened milk yield at this time. Flies in the barn can be killed by setting around in shallow pans a mixture of skim-milk two parts and formalin one part.

A good fly-repellent to be put on the cows with a brush can be made from 1½ lb. resin, 2 cakes soap, ½ lb. fish-oil, and water to make 3 gallons. If to be sprayed on, add ½ pint kerosene. Apply twice weekly.

CONFINEMENT DURING ŒSTRUM.

Keep the cow or heifer tied in the barn during her periods of œstrum.

MILKING.

MILKING THE HEIFER.

Before the first calf the heifer should have become accustomed to being tied and handled, especially about the udder. She will then raise no very serious objections when milking commences if the milker goes about the work carefully and gently. She must not be excited, and never be struck.

METHOD OF MILKING.

Every hired man is supposed to be able to milk. However, there is a great difference in milkers, and one of the greatest problems of the dairy-farmer is to get competent help. One may get as much as 25 per cent. more than another from the same cows. One may dry the cow up in a few months, while another would have her still milking well. The milker must never excite or abuse a cow. He should always milk her dry and get all her strippings at the last. Leaving milk in the udder will dry her up. The first milk drawn is the poorest in butter-fat, but the last drawn may run from 6 to 10 per cent. Milking is best done with the whole hand, squeezing the upper part of the teat first between thumb and finger and then extending the pressure downward. The hands should be well washed before milking.

Dust and dirt carry the germs of decay—perhaps of disease—and these multiply fast in a favourable medium like milk. Wetting the hands with milk is a dirty practice, but vaseline may be used and will prevent sore teats. If it is advisable to groom horses, it is much more so to groom cows. A milk-pail with partly covered top is more sanitary than an open pail. The flank and udder should be wiped with a damp cloth before milkings. Dust and bad odours in the air will surely taint the milk. Clean milk is obtainable without expensive equipment by using common-sense, cleanly methods.

PERIOD BETWEEN MILKINGS.

If a cow is milked at twelve-hour intervals, there is little difference between milkings either in yield or richness. Usually the night period is the longer, and the larger amount of milk with lower per cent. of fat is given at the morning's milking. If a cow gives about 60 lb. of milk daily, it will pay to milk her three times daily, but not cows of ordinary capacity.

MILKING-MACHINES.

The milking-machine is a commercial success for herds of over thirty cows. It has been conclusively shown that it will milk cows as well as the average milker. A good milker, however, can probably beat this machine in the amount of milk secured and in the length of time he can keep the cow milking. However, the cow is not injured by machine-milking, and usually prefers it to hand-milking. If the machine is properly cleaned and used, the sanitary condition of the milk is much better than under ordinary conditions; but with careless using the milk may be worse than with careless hand-milking. Great care has to be taken to keep the tubes and other parts of the machine thoroughly clean.

RESTING THE COW BEFORE CALVING.

After the lactation period a cow should be dry six or eight weeks to recuperate. A cow will produce more and richer milk and a stronger calf if given a rest than if milked right up to calving time. A cow that is not given a rest will begin at a much lower level of production than will be the case if she is given a chance to recuperate. In the last few months before calving the cow undergoes a severe strain. If in thin condition she should be dry two months.

DRYING UP THE COW.

Some cows are very persistent milkers and are difficult to dry up. It is usually these cows which most of all need a rest. The safest plan is to miss alternate milkings for a time, then milk the cow once every two or three days. The milk then left in the udder will be reabsorbed without danger of inflammation. It is sometimes necessary to reduce the feed for heavy and persistent milkers for some days in order to get them dried up.

TREATMENT BEFORE CALVING.

In summer the in-calf cow is best out on good pasture, provided she is not driven by dogs or through narrow gateways. Any unusual excitement or blows may cause abortion. She does not need other feed if on good grass. The pasture is also a good place for her to calve, unless one does not wish her to see her calf at all.

In winter the feed should be laxative as parturition approaches. Bran and linseed-oil meal are good feeds combined with clover hay and a liberal supply of silage or roots.

Typical Jersey bull, "Sultanne's Raleigh."

Milking before calving is advisable only with the heaviest milkers, when they are evidently suffering greatly from distension of the udder. If milking is begun it should be continued regularly.

If not on pasture, the cow should have a roomy box stall, well cleaned and bedded. As the time of parturition approaches the udder is distended and hard. When the tendons and muscles relax on either side of the rump, leaving a hollow each side of the tail-head, the cow will usually calve within twenty-four hours.

The cow should be left alone at calving-time unless assistance is evidently necessary. The normal position of the calf is fore feet first, lying on its stomach, with head outstretched between the knees. In this case assistance can be given by pulling horizontally on a rope tied to the fore feet of the calf, pulling only when the cow strains. As a rule the calf will be born in half an hour, but no anxiety need be felt if a much longer time is taken, providing the position of the calf is normal. If abnormally placed, the services of a veterinarian or other experienced person will be required to push back and change the position of the calf to permit of

Cows are very subject to retention of the after-birth. When the cow is in good condition the after-birth is usually expelled a few hours after the calf and often immediately. Cows in a low condition are liable to this trouble. Giving cold water to drink soon after calving may cause it. All water given the first day should be warm, and a warm bran-mash is also beneficial. When the after-birth comes away it should be removed. Otherwise the cow will eat it. Directions for the treatment of retention of the after-birth are given in a later section, as also is the treatment for milk-fever.

CARE OF COW AFTER CALVING.

The vitality of the cow is low following calving, and hence she needs special treatment. She should be away from cold draughts, and in cold weather covered by a light blanket for a few days. The water should be warmed, and a warm bran-mash is also good, with some good hay or green stuff. She should not be put on full feed for about two weeks, gradually increasing the amount of grain. The udder will likely be hard and inflamed and remain so for some days, but this condition will gradually subside and the udder will be all right if the milk can be drawn. Such an udder is better milked three times daily to allay the inflammation.

A Jersey model, "Bosnian's Anna."

WATER FOR THE COW.

An abundant supply of good water is exceedingly important for the cow in milk. A dry cow does not require much water, but when milking the consumption increases enormously. A cow milking 30 lb. daily will drink about 90 lb. of water in winter. If this water is very cold, digestion is stopped until it warms up in the stomach, and the warming process takes so much away from the milk yield. Water should be at least 60° Fahr. when drunk by the animal, for the maximum production. Dry cows in winter do not need watering more than once a day, but cows in milk should be watered twice daily. It will pay to pipe water some distance to have the trough handy for the cattle. They will drink more and give more milk. Pond-water is usually very unsanitary if the pond is small and the cattle can wade in it. Such a water-supply may easily taint the milk, besides causing muddy udders. If the pond is fenced and there is no objectionable drainage into it, such a supply may be all right. For watering cattle in the barn the continuous cement manger is often used,

but there is danger of a diseased cow spreading infection by slobbering in the water. Individual drinking-cups are now much used, attached to each stall. An increased milk yield with less labour in watering is an advantage of this system.

SALT REQUIREMENTS.

When salt is withheld for some time from a milking cow she may become ill and emaciated, and may finally break down completely. From 1 to 3 oz. of salt per day is needed and the cow should have access to it at all times. The best plan is to place a lump of rock salt where the cow can always reach it and help herself to all she requires. Near the sea it is not so necessary to feed salt.

SOILING CROPS AND SUMMER SILAGE.

Soiling means growing green forage, cutting it and bringing it to the stock, instead of having them eat it off where it grows. This system is practised in its entirety in many parts of Europe where intensive farming is in vogue.

In this Province there are several dairymen who do not allow their cows to run on pasture at all, but practise soiling entirely. All the best dairy-farmers go in for partial soiling. That is, they allow their cows pasture, but grow green crops as well, to cut and feed to the stock when pasture begins to fail. Some use silage in the summer instead of green feed, and thus save labour.

ADVANTAGES OF SOILING.

(1.) Saving of land:
(2.) Saving of fencing:
(3.) Better use of manure:
(4.) Animals are kept in better condition.

The first and greatest advantage comes from the larger amount of feed that it is possible to get from a given area. In soiling, the crops are not cut until almost mature, while under the pasturing system the growth is checked. The plants have not a chance to gather nourishment and size; besides this, much pasture is spoiled by manure and trampling. The manure can be saved and used to better advantage under the soiling system. It has been fully proven that dairy cows give more milk when properly soiled than when on good pasture.

A small holder in the Kootenay District grows roughage enough on five acres for four cows for the year. Owing chiefly to the large quantity of manure available, this small farm has been built up from "an absolute wilderness of thistles" to producing "about double per acre any other in this valley." All the land produces two crops in the year, and some three crops. On this farm a small silo has recently been erected. Oats and peas were used to fill it the first year, and produced enormously.

Eckles says that, "taking all data into account, it seems conservative to say that when following the soiling system one acre will produce at least twice as much, and often three times as much, food as an acre of pasture."

OBJECTIONS TO THE SOILING SYSTEM.

The main objection which prevents wide adoption of the system is the extra labour involved. Another is the difficulty in providing the right amount of a suitable series of crops. Green crops are heavy to handle, and each cow will require about 100 lb. per day. The crops must be fed fresh. Some cut and haul every day, others every alternate day. It is better to have a surplus than to run short. The surplus can be either made into hay, put into the silo, or ploughed under for green manure.

SUCCESSION OF SOILING CROPS AND ACREAGE REQUIRED FOR TEN COWS.

Winter rye	½ acre.
Winter wheat and vetch	½ "
Alfalfa (three cuttings)	2 "

Clover and timothy ..... ¾ acre.
Peas and oats .....1 „
Corn (after the wheat) ..... ½ „
Kale (after the rye) ..... ½ „

Millet, Sudan grass, winter oats, soy-beans, and barley are also used as soiling crops. Silage is just as good a food in summer as in winter. The Western Washington Experimental Farm uses corn ensilage for winter feeding, and the silo is refilled in early summer with fall-sown oats and vetch for summer feeding. When the silo is filled with corn again the feeding of green kale is commenced.

PARTIAL SOILING.

Few farmers are prepared to adopt complete soiling. With nearly all, however, partial soiling or silage is necessary to help out the pasture. When pasture fails during the heat of summer the cows must be fed succulent feed in the barn. In the heat of the day they are better tied up inside the darkened barn, going to the pasture at night. Not only will the cows give more milk, but the lactation period will be much longer, if soiling or summer silage feeding is practised.

FEEDING FOR MILK PRODUCTION.

Authorities claim that the average yearly milk production per cow could be increased over one-half by following better methods of feeding.

TURNING ON PASTURE IN THE SPRING.

No feed gives as good satisfaction to both cow and dairyman as grass, especially in spring. However, in changing from dry feed to pasture, it is best to go slowly. Young grass is very watery and has not much food value in proportion to its weight. There is also danger of an objectionable taste appearing in the milk if the change is not made gradually.

GRAIN-FEEDING ON PASTURE.

This pays in the case of heavy-producing cows. Besides giving more milk at the time, they will continue to milk longer. A cow yielding 40 lb. of milk on pasture may get 7 lb. of grain. Grain-feeding helps to keep up the condition and vitality of the best cows, and the benefit of it is seen during the next lactation period.

PROVIDING FOR SHORT PASTURES.

A great loss occurs each summer, not so much on account of the heat and flies as because of shortage of feed for the cows. They fall off in milk yield, and never again give as much as they would have done if they had been better fed. Summer soiling crops are essential to the best success in dairying. Plots of oats and peas, alfalfa, clover, corn, and kale will doubly pay for themselves. Many are now using silage also to help out during a dry spell in summer-time. If unused, old silage can be covered by the new. These feeds are less expensive than grain.

AMOUNT OF FEED.

A maintenance ration is the food required to just support the animal's body without producing any milk. In the case of an ordinary dairy cow the ration of maintenance is from 50 to 60 per cent. of all she can eat. She then has 40 to 50 per cent. of her food available for milk production, if well fed. If the amount of food is cut down the maintenance requirement remains the same, so that the part used for milk production is lessened. This illustrates the importance of liberal feeding.

Usually heavy-producing cows are underfed and light-producing cows are overfed. A common practice is for all cows in a herd to be fed the same amount of grain regardless of the milk yield of each cow. Each cow should be fed according to her production.

AMOUNT OF GRAIN AND ROUGHAGE TO FEED.

With her enormous paunch, a cow can take care of a lot of roughage. An animal with an immense middle has a much greater producing capacity than a shallow cow, but needs grain or some more concentrated food to do her best.

The following rules for winter [illegible] are practical:—

(1.) Feed all the clover or [illegible]ay that the cow will clean up at feeding-time. Feed for the succulent part of the ration at least 35 lb. of roots or silage per day:

(2.) In addition, feed 1 lb. of grain per day for each pound of butter-fat produced per week, or 1 lb. of grain daily for each 4 lb. of average milk.

The latter rule applies only when good roughage is fed, such as clover or alfalfa hay combined with silage or roots. For a cow giving richer milk (over 4 per cent.) more grain should be fed. If timothy hay is used, more grain will be necessary.

HOME-GROWN BALANCED RATIONS.

Timothy hay is not a good dairy feed, as it is poor in protein and requires expensive concentrates to balance it. The cheapest source of protein is legume hay, such as clover and alfalfa. These are much better than timothy, and less of the expensive grain is necessary to feed with them. By replacing timothy with alfalfa the grain part of the ration may be cut in two.

Roots and silage provide succulence in the winter ration, which helps production and tends to keep the animals healthy. Most farmers fail to provide enough succulence for their cows.

A balanced ration is one in which the proportion of protein or nitrogenous material to the other nutrients is about right. Protein goes to form the curd of milk, and it is the nutrient usually lacking.

The following are some good rations for cows giving about 25 lb. daily:—

(1.)	Corn silage or roots	35-45 lb.
	Clover hay	15 „
	Wheat bran	4 „
	Ground oats	3 „
(2.)	Corn silage or roots	40-50 „
	Alfalfa hay	15 „
	Ground barley	4 „
	Bran	2 „
(3.)	Clover hay	20 „
	Mangels	40 „
	Ground oats	3 „
	Ground barley	3 „
(4.)	Corn silage	40 „
	Clover hay	10 „
	Carrots	20 „
	Wheat bran	3 „
	Ground oats	2 „
	Cotton-seed meal or linseed-oil meal	1 „
(5.)	Clover and timothy hay	15 „
	Green kale	60 „
	Bran, oats, and barley-chop	4 „
(6.)	Ration for cow giving 40 lb. of 4-per-cent. milk daily:—	
	Corn silage 35 lb. or mangels	55 lb.
	Alfalfa or clover hay	12-15 „
	Grain mixture	10 „
	(Oats, bran, and barley, 3 lb. of each; linseed-meal or soy-bean meal, 1 lb.)	

PURCHASING FEEDING-STUFFS.

The farmer does not need to be a chemist to purchase feeds intelligently. He needs to know the functions of the main constituents of feeding-stuffs—protein, fat, carbohydrates, fibre, and ash. Knowing this, and having the analysis before him, he is well able to valuate and compare different feeds.

PROTEIN.

This part of a food goes to form the tissues and organs of the body, the blood, hide, hair, horns, and the curd of milk. Lean meat, blood, and the white of eggs are nearly pure protein and water. The main element in protein is nitrogen. Hence we say that the protein is the nitrogenous part of a food. It will be readily seen what an important part protein plays in the growth of the body, the repair of the wear and tear constantly going on in the body, and also in milk production, since milk is a very nitrogenous product.

CARBOHYDRATES.

Starch and sugar, made up of carbon, hydrogen, and oxygen, are pure carbohydrates. Other similar substances are included under this name. Carbohydrates are used in the animal body to produce heat and energy, and, where plentiful, to produce body-fat as well.

FATS OR OILS.

These form body-fat and the fat in milk. Fats or oils also produce heat and energy in the animal body, and for this purpose they have a value two and a quarter times as great as starch or carbohydrates.

FIBRE.

This constituent is the least valuable of the nutrients in a food. In composition and function it is similar to carbohydrates, but is of less value to the animal, because more or less of it is indigestible and cannot be used. Moreover, this indigestible part of the fibre has to be moved through the intestines. So that the more indigestible or woody fibre a food contains, the less valuable it is.

ASH.

This is the mineral matter taken from the soil the crop grew upon. It is composed chiefly of lime, magnesia, potash, and soda, combined with phosphoric and other acids. All the cells of the body contain some mineral matter and the bones are largely phosphate of lime.

IMPORTANCE OF PROTEIN AND FAT.

A farmer usually has enough home-grown fodder to supply all the carbohydrates and fibre needed. He usually buys feeding-stuffs for the protein and fat they contain, and generally the protein is the most important to him.

We will suppose that he is offered bran at $1.35 and linseed-meal at $2.10 per 100 lb. He finds from the analysis given in the table that good bran contains 15.4 per cent. crude protein and 4 per cent. of fat, a total of 19.4 lb. of protein and fat in 100 lb. bran. From the analysis of the linseed-meal (which should be on every sack) he finds that it contains 37.5 per cent. crude protein and 2.7 per cent. fat, or a total of 40.2 lb. of protein and fat in 100 lb. linseed-meal. By dividing the price per 100 lb. by the above totals—$1.35 ÷ 19.4 and $2.10 ÷ 40.2—he arrives at the conclusion that for each pound of protein-fat in bran he must pay 7 cents, while he can buy a pound of protein-fat in linseed-meal at 5 cents, at the above prices. Furthermore, owing to bran containing more indigestible fibre than the linseed-meal,

there is a larger proportion of the nutrients digested in the case of the latter. Buying on a protein-fat basis the higher-priced linseed-meal would be the cheaper in this case.

The "Commercial Feeding Stuffs Act" of Canada requires that most of the milling and manufacturing products sold as feeds (except bran, shorts, and the meal of whole grains) bear on each sack the guaranteed percentage of protein, fat, and fibre in the feed. It should be remembered that it is usually the total percentage of these nutrients that is given and that this is not wholly digestible. Only the digestible part of the ration is used by the animal. For the guidance of buyers of feed-stuffs both the total nutrients and also the digestible part of these are given in Table 2.

Table 1 will be found useful in "balancing" a ration to make it conform to the standards generally accepted for average-weight cows. These standards are not arbitrary, but will be useful as a guide in compounding rations economically.

CLASSIFICATION OF FEED ACCORDING TO THEIR NUTRITIVE RATIOS.

(Based on Bulletin 92, Washington Experiment Station.)

	Very Wide (N.R. 1:12 and up).	Wide (N.R. 1:8 to 1:12).	Medium (N.R. 1:6 to 1:8).	Narrow (N.R. less than 1:5).
Dry roughage or hay	Corn fodder. Timothy hay. Orchard-grass hay Oat-grass hay. Straw.	Wheat hay. Barley hay. Oat hay. Rye hay.	Pea and oat hay. Vetch and oat hay Timothy & clover. Peas and barley. Vetch and wheat.	Alfalfa hay. Clover hay. Vetch hay. Field-pea hay. Alsike hay.
Succulent feeds.	Orchard grass. Green corn. Corn silage. Potatoes. Wet beet-pulp.	Green oat hay. Carrots. Rutabagas. Sugar-beets.	Any of the above in green form or as silage, turnips, beets, mangels, pumpkins; green wheat, barley, or rye.	Any of the above crops in green form or as silage; kale, cabbage, rape.
Concentrates.	Dried beet-pulp. Dried molasses beet-pulp.	Corn. Barley. Rice-meal.	Oats. Wheat. Rye.	Peas. Wheat bran. Wheat shorts. Oil meal or cake. Soy-bean meal. Dried brewers' grains. Dried malt sprouts. Cocoanut-cake. Cotton-seed meal.

NOTE.—The nutritive ratio is the proportion of protein to carbohydrates. A ratio of 1:5 means that the feed contains 1 of protein to 5 of carbohydrates.

PALATABILITY OF THE RATION.

A cow must relish its food to eat the maximum amount. To milk well she must eat well. Much hay is allowed to get woody and unpalatable before cutting, and often the best parts, the leaves, have fallen off before it is fed. Silage and roots are well liked, and a mixture of silage, pulped roots, and grain is greatly relished.

ORDER OF FEEDING.

Regularity is essential in indoor feeding. The cow is a creature of habit and expects the same routine every day. Grain is usually fed first, and hay is always

given after milking to avoid filling the air with dust. If the cow receives her grain at milking-time, she will always expect it, and will not yield her best unless it is forthcoming. In case she has been taught to expect it afterward, she will not look for it until then. The two main feeds of both roughage and grain are given night and morning, with perhaps a light feed of hay at noon. Watering should be done twice a day with milking cows.

A typical dairy head.

FEEDING HIGH-PRODUCING COWS FOR MAXIMUM PRODUCTION.

An animal must have been dry for at least two months and be in good flesh to do her best. Succulence and palatability are essential in the ration. Sugar-beets or mangels are better for this purpose than silage, and may be fed up to 60 lb. or more per day.

The following is a ration fed to a Jersey (weight 900 lb.) yielding 40 lb. of milk and 2 lb. of butter-fat per day:—

Corn silage	35 lb.
Alfalfa hay	15 „
Corn-meal	2 „
Bran	3 „
Oats	3 „
Oil-meal	2 „

The above ration will be found to conform closely to the standard given in Table 1.

The following is a winter ration for Holstein on test giving 80 lb. milk:—

Alfalfa hay	18 lb.
Mangels	75 „
Ground oats	8 „
Ground barley	5 „
Oil-meal	5 „

The following is a daily ration for a Holstein weighing 1,350 lb. and giving 100 lb. of milk daily:—

Mangels	30 lb.
Sugar-beets	30 „
Alfalfa hay	„
Corn-meal	6 „
Bran	6 „
Oats	6 „
Gluten feed	2 „
Linseed-meal	2 „
Cotton-seed meal	2 „

Grain mixed with pulped roots and moistened.

The British Columbia Holstein, "Pietje Canary's Jewel," recently completed a Canadian record of 988 lb. of butter-fat and 24,140 lb. of milk in a year. She was fed and milked four times a day. For the first few days after calving only hay and mangels were fed. Then a mixture of grain was gradually added, consisting of 3 parts oats and 1 part each of barley, oil-meal, and soy-bean meal. When in full milk a day's ration consisted of 100 lb. mangels, 24 lb. grain mixture, and hay. Later in the test more linseed-oil meal was substituted for the soy-bean meal. The large amount of succulence is the feature of this ration. This cow is bred and owned by Mr. J. M. Steves, Steveston, B.C.

COST OF KEEPING AN AVERAGE COW.

A yearly balance-sheet for a cow giving 6,000 lb. of milk testing 3.8 per cent. fat would read somewhat as follows:—

Debit.		*Credit.*	
Feed—		228 lb. butter-fat @ 35 cents	$ 80 00
Pasture and soiling, 6 mos.	$ 8 00	5,250 lb. skim-milk @ 30 cents	16 00
Grain, ½ ton @ $30	15 00	Manure	24 00
Silage, 3 tons @ $3	9 00	Calf	5 00
Hay, 1½ tons	13 00		
Cost of feed (at farm prices)	$45 00		
Barn (interest and depreciation)	3 50		
Cow (interest and depreciation)	8 00		
Tools and implements	50		
Veterinary, etc.	1 00		
Bull	3 00		
Labour charges	24 00		
Total	$85 00	Total	$125 00

The above figures show a profit of $40 for the year, but the actual profit would be more than this. Feed is eaten by the cow which otherwise would be wasted. The above is an average cow, but the wise dairyman will try to get cows above the average.

COST OF KEEPING A RECORD COW.

Contrast the above record with that of the Holstein, "Young Springwood," which at the Ontario Agricultural College Farm recently completed a record of 20,073 lb. milk and 820 lb. butter-fat in a year. During the year she consumed 1,753 lb. bran, 440 lb. oats, 1,032 lb. dried brewers' grains, 404 lb. cotton-seed meal, 73 lb. gluten feed, and 33 lb. wheat, a total of 3,825 lb. of concentrates, or an average

of 10½ lb. per day. Of roughage she consumed 12,650 lb. silage, 5,500 lb. mangels, and 8,966 lb. hay, mostly clover. The cost of feed alone, including the eight weeks she was dry before calving, was no less than $135, but her yield of butter-fat alone was worth over $270. This cow was fed in the stable all year and received no green feed of any kind. Her highest day's yield was 77 lb. and the lowest 40 lb.

MEAGRE AND LIBERAL FEEDING.

For a year accurate records were taken of a herd of poorly fed cows kept by a farmer in New York State. The herd was then removed to the Cornell Experiment Station, where it was liberally fed for two years. Then it was returned to the farmer, who fed them poorly as before. The returns for these seven cows were as follows:—

	First and Fourth Years on Farm.	Second and Third Years at Station.
Weekly yield of milk per cow	109 lb.	155 lb.
Weekly yield of fat per cow	4.7 "	7.1 "
Average fat in milk	4.45 per cent.	4.7 per cent.

By good feeding and care 42 per cent. more milk and 51 per cent. more butter-fat was obtained by the Station herdsman. The per cent. of fat in the milk was increased only ¼ of 1 per cent. by the liberal feeding.

FEED AND RICHNESS OF MILK.

We have now come to know that the milk of each cow has a fixed inherent composition which cannot be controlled by changing the feed. Feeding large quantities of fatty food may cause an increase in the per cent. of butter-fat in the milk, but in a week or two the milk will be of normal composition again, although there may be more of it. A cow in extra good condition at calving will give richer milk than when thin. When drying off, the milk may be richer than earlier in lactation. The shorter the periods between milkings, the richer the milk. Sudden changes of feed or excitement may cause the milk to be richer or poorer than usual. Often, when the per cent. of fat increases, the quantity of milk given decreases, so that the total yield of fat is not increased.

Thin thighs, well arched on the insides to give room for a large udder.

IMPORTANCE OF LIME AND MINERAL MATTER.

It has been found by experiment that a cow yielding 30 lb. of milk excreted each day in the milk and manure nearly 2 oz. of lime. Salt, lime, and phosphorus are the substances most often lacking. Ordinarily the rations

of dairy cows contain enough lime and phosphorus, but salt should be supplied extra. The legumes and grasses are high in lime. The cereals, oilcakes, and brans are rich in phosphorus. In many cases where soft water is drunk there may be a lack of lime or of both lime and phosphorus. These minerals can be supplied by feeding precipitated phosphate, bone-ash, or ground rock phosphate.

NOTES ON FEEDS.

TIMOTHY HAY.

This forage is too much used by dairy-farmers. It is woody and unpalatable as usually cured, and is poor in protein. This makes it necessary to feed with it large quantities of concentrates rich in protein. Corn stover is in the same class.

LEGUME HAY.

Alfalfa and clover are the best hays, alfalfa being the richer of the two. Both are palatable and high in protein and mineral matter, especially lime. In one experiment 14 lb. alfalfa hay replaced 7 lb. timothy and 7 lb. grain without loss in the milk-flow. Alfalfa is an excellent soiling crop, giving at least three crops in a season. A bulletin is issued by the Department on alfalfa-growing. Alsike clover is adapted to a wet situation where it is too moist for red clover to do well. Soy-bean hay is equal to alfalfa in feeding value. Soy-beans are not yet grown much in this Province.

SILAGE.

Either silage or roots will provide the succulence necessary in the cow's ration. Fed in combination with legume hay they make ideal roughage. Corn silage can be put up cheaper than roots can be grown. It is more fibrous than roots, and about 35 lb. a day is enough for one day for a small cow and 40 to 45 lb. for a large animal. In feeding value, 450 lb. corn silage equals about 100 lb. mixed hay. Silage should be fed after milking, so that the odour is not absorbed by the milk from the air. Otherwise silage will not taint milk if properly made. Oats and peas, winter wheat and vetch, clover, alfalfa, etc., are sometimes made into silage. The feeding of silage in summer is bound to become more general.

Many silos for storing silage are being built every year in British Columbia. The silo has solved a hard problem in dairying—the providing of a cheap, succulent feed ready for use at any time throughout the year. The Department sends out free information about silo-building and silage. Do not feed frozen silage.

If silage could be made more like the composition of green grass, richer in protein, by the addition of soy-beans, alfalfa, clover, oats, peas, etc., it would furnish a ration rich enough in protein to nearly do away with the necessity of feeding grains.

It was found that cows receiving 4 lb. grain, with 58 lb. silage composed of 2 parts soy-beans, 1 part cow-peas, and 7½ parts corn silage, yielded more milk and fat than cows of similar capacity getting 13½ lb. grain but no silage. Both lots got the same amount of hay.

ROOTS.

Both old and young animals fed roots in winter will be in better condition than those given dry feed. The large amount of water contained in them is of much more value than the same amount of water taken from the trough. Mangels and sugar-mangels are the most widely used by dairymen, because they yield heaviest. As high as 65 tons to the acre have been grown in the Chilliwack District. Sugar-beets are much richer than mangels in sugar, but usually do not yield nearly as well, and are hard to harvest, growing deep in the soil. Field carrots will do better than

mangels on poor soil, and are more nutritious, but require more labour to grow. Turnips are much affected by green-fly (aphides) in this Province. Turnips may taint the milk of cows fed on them. Do not feed frozen roots or fatal results may follow.

Regarding the feeding value of mangels, it has been found that 1 lb. of the dry matter in mangels equals 1 lb. of mixed grain, and is slightly superior to 1 lb. of the dry matter in corn ensilage. When concentrates cost $30 per ton, mangels are an economical feed if they can be raised and stored for $4 per ton.

KALE.

Many dairy-farmers are now using this crop for fall feeding. It yields excellently, many plants weighing 25 to 30 lb. when full-grown. Kale stands a good deal of hard frost, and can generally be used until December in our main dairy districts. Rape, cabbage, and turnips are valuable feeds, but if fed to dairy cows there is danger of the milk becoming tainted. Cows heavily fed on potatoes are apt to yield poor-quality, salvy butter.

CORN.

Used as grain, soiling crop, or as silage, this crop has proved of immense value to dairymen. The yield of green corn averages about 15 tons to the acre in this Province. The grain is very rich and palatable, but is low in protein and needs balancing with some concentrate richer in nitrogenous matter.

A well-developed system of milk-veins. (Photo by courtesy of Prof. C. H. Eckles.)

WHEAT BRAN AND SHORTS.

Bran is widely used, being rich in the protein and mineral matter necessary for milk production, except lime. Its light weight and palatability makes it valuable for mixing with heavier feeds, making the ration more digestible and preventing constipation.

Shorts or middlings is also a good dairy feed and is somewhat richer than bran. It also lacks in lime. It is close in texture and should be mixed with other feed. Sometimes ground-over bran is sold as middlings.

OATS.

Ground or crushed oats is a splendid feed for dairy cows. Good oats are worth about 10 per cent. more than bran, weight for weight. They make a well-balanced grain ration fed alone. Oat hulls are about equal to timothy hay in feeding value. The oatmeal-factories dispose of a large quantity of this poor material combined with other feeds and sold as mixed feed.

BARLEY.

This grain is somewhat like corn in composition, inclined to fatten. In Denmark oats and barley are sowed together in the proportion of 2 of oats to 1 of barley. The resulting ground mixed grain is reckoned one of their best dairy feeds, equal to bran and shorts.

WHEAT.

When finely ground and mixed with oats or bran, wheat makes a fine dairy feed, if cheap enough.

COTTON SEED MEAL.

This is the ground-up seed of the cotton-plant with most of the oil extracted. It is the richest in protein of all dairy feeds. It should not be fed alone or in large quantity. From 2 to 4 lb. per day is enough. If fed wisely, 1 lb. of cotton-seed meal equals 2 lb. of bran. Cotton-seed meal has not the same beneficial action on the digestive organs as linseed-meal, but is very useful in balancing a ration poor in protein. When fed to cows on spring grass it prevents scouring, being costive in its effects, and tends to harden the butter-fat.

LINSEED-MEAL.

Most of the oil is extracted from the flax-seed, and the seed is then ground. Most of this product exported to Europe is shipped in cake form. Although a little lower in protein than cotton-seed meal, this feed is more healthful. It has a slightly laxative effect and tends to keep the animals in good condition, with sleek, shiny coats. It is especially useful when animals are on dry feed.

Protein is the essential element in milk production and is also the dearest. It is well to investigate whether it cannot be purchased more cheaply in linseed, cotton-seed, or other protein-rich feeds than in the more commonly bought feed-stuffs. Look up the analyses and the prices. Soy-bean meal is about equal to linseed-meal for milk production. It is very rich in fat.

GLUTEN FEED.

This is a by-product from starch and glucose factories. It is the residue of the corn grain after the starch has been extracted. In protein it stands midway between bran and oil-meal and is a very palatable feed, but expensive in British Columbia.

DRIED BEET-PULP.

This feed is becoming widely used in the United States, owing to the spread of the sugar-corn industry. It is almost as rich in starchy matter as corn, but is poorer in protein. It is best fed after being moistened, and will take up about six times its weight of water. Apart from its value as succulence when wet, its actual feeding value is about two-thirds that of bran for milk production.

MOLASSES.

This is well liked by cattle. If dissolved in warm water and sprinkled over the feed it adds greatly to its palatability. Some mixed feeds containing molasses also contain a lot of waste hulls. Care must be exercised in buying this class of feed.

BREWERS' GRAINS.

The wet grains are a good dairy feed if fed fresh every day. Up to 20 lb. per day can be given. They must not be allowed to ferment, and the mangers must be kept clean and sanitary to avoid objectionable odours being imparted to the milk. Dried brewers' grains can be kept indefinitely and are a valuable feed, rich in protein. They give slightly better results than bran for milk production.

ALFALFA-MEAL.

If alfalfa is cut when starting to flower, raked up the same day, and properly cured by leaving in the cock four or five days, it is almost equal to bran in feeding value. Meal from such hay as this appears quite green. When whitish, strawy specks appear, it indicates that the alfalfa has been allowed to get woody and has probably lost the leaves, which are the most valuable part. The feeding value of such alfalfa is much depreciated. It is not wise to pay more than the price of bran for alfalfa-meal, unless for some special purpose.

MIXED FEEDS.

These often contain a poor quality of alfalfa-meal, waste hulls, and the like, and should only be bought after a study of the guaranteed analysis, which, according to law, should appear on the sacks.

RICE-MEAL.

This feed is rich in fat, but very poor in protein and mineral matter. Hogs fed largely on it are liable to have weak, spongy bones. It has, however, given good results fed to cows in combination with other feeds rich in protein and mineral matter. It should not contain rice hulls, which are practically worthless, and it should not smell at all rancid.

OAT FEED.

Oat feed is a by-product from the rolled-oat factories. It contains quite a large percentage of indigestible fibre or hull.

STOCK-FOODS.

Hundreds of thousands of dollars are annually paid out by farmers for different brands of proprietary condimental or stock foods. Authorities claim that by far the greater part of this is money wasted, as farm animals usually have appetites which do not need stimulating, and, if sick or out of condition, they should get specific treatment rather than be given some doubtful "cure-all." In rare cases where an animal is out of condition and without appetite some spice may prove helpful. In "Feeds and Feeding," Professor W. A. Henry gives the following formula:—

Powdered gentian	8 lb.
Ginger	8 „
Fenugreek	8 „
Powdered sulphur	8 „
Potassium nitrate	8 „
Resin	8 „
Cayenne pepper	4 „
Linseed-meal	44 „
Powdered charcoal	20 „
Common salt	20 „
Wheat bran	100 „

This formula can be made up for about a quarter of the cost of the stock-foods usually sold, and, Professor Henry says, will supply more drugs of value. Feed a tablespoonful with each feed.

PASTURE MIXTURES.

Probably not enough attention is paid to the production of suitable hay and pasture, the most important dairy crops. Cows are more cheaply fed on pasture than in any other way. Too often, after slashing and burning, the logged-off land is left to grow a crop of weeds and brush, when by seeding it down to grass and

clover it could be made to bear a crop of good pasture between the stumps. Do not turn the cows on to pasture in the spring until a good crop has grown. The growth may be checked so that the field never recovers that season; besides which, the younger the growth the more watery it is. Fifty per cent. more pasture is obtainable by the system of changing to another field when a pasture gets fairly well eaten off to allow it a period of a few weeks to grow, unchecked by cropping and trampling, etc. Big fields can be split up to good advantage. The following clovers and grasses are given in order of nutritiousness:—

	Nutritive Ratio.
Alfalfa	1 to 3.6
White Dutch clover	1 to 3.9
Alsike clover	1 to 4.8
Red clover	1 to 5.2
Kentucky blue-grass	1 to 7.6
Meadow-foxtail	1 to 8.3
Italian rye-grass	1 to 9.4
English rye	1 to 10.0
Red-top grass	1 to 11.6
Meadow-fescue grass	1 to 12.0
Orchard-grass	1 to 12.0
Tall oat-grass	1 to 14.0
Timothy-grass	1 to 14.0

A good pasture mixture which has proven satisfactory under fairly moist Coast conditions is as follows:—

Red clover	4 lb. per acre.
White Dutch clover	3 „ „
Alsike clover	3 „ „
Kentucky blue-grass	3 „ „
English rye-grass	2 „ „
Italian rye-grass	3 „ „
Meadow-fescue grass	3 „ „
Meadow-foxtail	2 „ „

In drier climates it may be advisable to sow orchard-grass, tall oat-grass, and brome-grass with alfalfa, although, of course, there is the danger of these less nutritious grasses crowding out the alfalfa. It is often found best under dry conditions to plant the alfalfa alone in rows and cultivate the first season until the plants begin to fill up the rows. Orchard-grass grows in tufts. It is a good pasture, but soon gets coarse and woody if not eaten young. It withstands drought well. Brome-grass is hard to kill when once established and is looked upon as a weed for that reason, but it produces well and is palatable to stock.

Kentucky blue-grass is the most nutritious of the cultivated grasses. It is at its best during the early part of the season, but does not withstand drought well. The plants are too short for hay purposes. Red-top grass, along with alsike clover, is very suitable for rich, wet bottom lands, being hardy and long-lived. Meadow-foxtail is a very early grass, heading out at the Coast in April.

The following mixtures have been recommended by the Pullman Experiment Station, State of Washington:—

Western Districts.

Lowlands—

Orchard-grass	4 lb. per acre.
Red-top grass	3 „ „
English rye-grass	4 „ „
Red clover	3 „ „
Alsike	3 „ „

Uplands (fairly heavy soil)—

Orchard-grass	4 lb. per acre.
Italian rye-grass	4 „ „
English rye-grass	4 „ „
Red clover	3 „ „
Alsike	3 „ „

Uplands (light and gravelly soil)—

Orchard-grass	4 lb. per acre.
Tall oat-grass	4 „ „
English rye-grass	4 „ „
Alfalfa	3 „ „
Red clover	2 „ „

Eastern Districts.

(Rainfall above 20 inches.)

Alfalfa	4 lb. per acre.
Red clover	3 „ „
Orchard-grass	4 „ „
Italian rye-grass	4 „ „

(For very light soil substitute tall oat-grass for the latter.)

Where the annual rainfall is from 12 to 20 inches only, 6 lb. each of alfalfa and orchard-grass per acre is recommended. Western rye-grass (or bunch-grass), brome-grass, and orchard-grass, 6 lb. each, is also a good mixture for a Dry Belt pasture. Sudan grass has been tried successfully as pasture and hay in some sections of the Interior.

DISEASES AND OTHER TROUBLES.

In many districts a qualified veterinarian is, unfortunately, not available. Where a veterinary doctor is within reach he should be called early in case of serious sickness. Too often he is called too late to be able to save the animal, when otherwise he would probably have been able to effect a cure.

SUPPLIES NEEDED.

The following list is taken from Dominion Bulletin No. 72. It is recommended that these supplies be kept in a locked cupboard or medicine-chest.

Quantity.	Drugs.	Purpose.	Dose for Adult.	Dose for Calf.
10 lb.	Epsom salts	Purgative, indigestion	1-1½ lb.	4 oz.
1 lb.	Ginger	Tonic, diarrhœa, indigestion	2 oz.	1 oz.
1 lb.	Baking-soda	Indigestion	2 oz.	..
1 gal.	Raw linseed-oil	Laxative, purgative	1 to 2 pints.	½ pint.
½ pint	Olive-oil	Soothing for external use, udder	..	..
½ lb.	Saltpetre	Urinary troubles	1 to 1½ oz.	..
½ lb.	Sulphate of iron	Tonic	½ to 1 dram.	½ dram.
½ lb.	Gentian-root	Tonic	4 drams.	1 dram.
½ lb.	Boric acid	Injections into udder	20 grains to 1 oz. water	..
1 pint	Turpentine	Colic, bloating	½ cup, 2 to 3 oz.	..
½ lb.	Fluid extract, belladonna	Fever, cramp, colic	1 fluid dram.	..
1 gal.	Zenoleum or creolin	External use	5 to 100 water.	..
1 lb.	Carbolic acid (poison)	External use	1 to 30 water	..
1 oz.	Corrosive sublimate (poison)	External use	1 to 1,000 water.	..

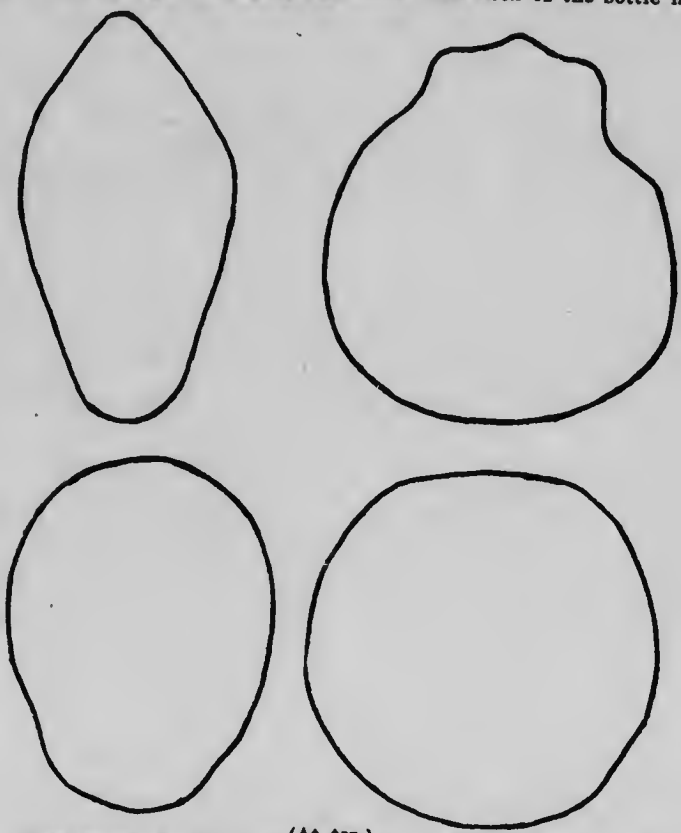
One tablespoonful is equal to about ½ oz.; 1 dessertspoonful is equal to about 2 fluid drams; 1 teaspoonful is equal to about 1 fluid dram; 2 tablespoonfuls

carbolic acid in 3 pints water equals a 2-per-cent. solution; 5 tablespoonfuls carbolic acid in 3 pints water equals a 5-per-cent. solution.

Besides the above drugs, it is recommended that the following appliances should be included: Long-necked bottle for drenching; trocar and canula; graduated glass, 4 oz.; clinical thremometer; ½-inch rubber hose, 5 feet long, with glass funnel to fit end; milk-fever apparatus; hard-rubber syringe; teat-tubes, plugs, and bistoury; small weighing-scale.

DRENCHING CATTLE.

In giving fluid medicines to cattle, a bottle with a long, strong neck, such as a wine-bottle, should be used. The animal's head is held up by the left arm or by an assistant, while the right arm holds the bottle. The neck of the bottle is inserted



(At top.)
Cross-sections through a typical dairy cow at shoulder and at paunch.
(At bottom.)
Cross-sections through typical beef animal at same parts of the body.
(Eckles, "Dairy Cattle and Milk Production.")

in the mouth between the grinders and front teeth, and the medicine allowed to run out as far back on the tongue as possible. If the beast coughs, the head must be lowered at once to prevent the fluid getting to the lungs, where it may cause pneumonia. Cattle are fairly easy subjects to drench.

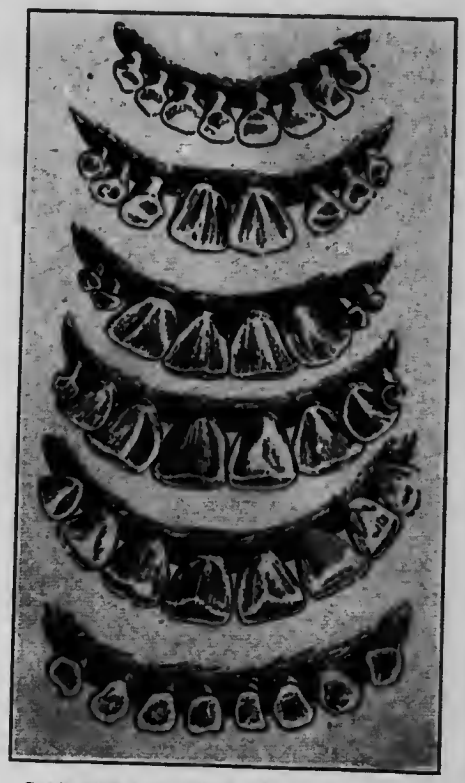
TUBERCULOSIS.

This is a contagious or germ disease, and it may be transmitted from the cow to the human family by means of infected milk. Unfortunately it is impossible to

judge from outside appearances whether an animal is tuberculous or not, except in extreme cases. A cow may be apparently sound and in good flesh, and yet have one or more organs badly affected. The only reliable means of identifying tuberculous animals is by the tuberculin test, which is applied free of charge by veterinarians attached to the Provincial Department of Agriculture. Apart from the question of human health, it pays a dairy-farmer to apply the test and get rid of affected cows, which are a source of contamination and loss.

Tuberculosis may attack almost any part of the body of the animal. Often the lungs are affected. When the bowels are attacked the discharge may be frothy and evil-smelling. When deep-seated glands are affected, perhaps no external sign may be noticed. The udder is sometimes affected, and also the joints.

Suspects should be isolated. The germs are transmitted by the slobber on the mangers, in the drinking-water, or by means of the dung, which when dry is scattered about as dust. Calves may become infected by drinking tuberculous milk. Hogs may contract the disease from cows in the same way. This is a most insidious disease, often working its effects unseen. An animal apparently healthy may be spreading the germs of the disease broadcast, unless the tuberculin test is used periodically to discover such cases. Once the herd is free from this disease it can be easily kept so, each new addition being also tested before being added to the herd. The whole herd should be tuberculin-tested at least once a year.



Cow's teeth arranged according to age. (These are the incisor teeth in the lower jaw. Upper jaw has no incisors.) From top to bottom: 12 months, 18 months, 27 months, 36 months, 45 months, and 10 years of age.

MILK-FEVER.

This used to be one of the most fatal diseases of milk cows, but the discovery of the air treatment in recent years has robbed the disease of most of its terrors. A heifer seldom has this trouble. It mostly attacks the best milkers among the mature cows.

An attack of milk-fever usually comes on within forty-eight hours after calving. The cow first appears restless and excited. In a short time the hind legs become paralyzed and the animal soon falls down. She becomes unconscious and will die in from one to two days unless treated. The position assumed by the unconscious animal is characteristic of the disease. The head is turned sideways, with the nose pointing towards the flank, and the whole body is paralyzed.

No medicine must be given by way of the mouth, as the muscles of the throat are paralyzed and there is great danger of choking the cow. Pumping the udder full of air is the remedy. Where the special apparatus, costing about $3, is not on hand, a home-made arrangement can easily be put together. Some have even used successfully such a crude affair as a bicycle-pump with a quill for a milk-tube, but

there is danger of infecting the udder and causing inflammation if unpurified air is used. The absorbent cotton used in the middle receptacle purifies the air pumped through it by catching germs and dust. The cotton-holder, the milk-tube, and the rubber tube attached to it should be boiled for fifteen minutes before using and before the cotton is inserted. The cow's udder and teats and the operator's hands should be washed with soap and water and disinfected with a 5-per-cent. solution of carbolic acid or creolin. The receptacle for holding the cotton is filled with ordinary cotton, or, better still, absorbent cotton, obtainable at any drug-store. The milk in the udder is left there. The four quarters of the udder are inflated one at a time by inserting the milk-tube into each teat and pumping air in through the apparatus. When a quarter is full of air, the teat is tied with tape to keep the air in. The whole udder should be tightly distended. If it goes down, more air must be pumped in. Usually in one to three hours the cow will regain consciousness and get on her feet. Often only one injection is required to effect a cure. The udder should be kept full of air for a day afterwards to prevent another attack. The apparatus needs to be disinfected for each injection. If germs are introduced they will likely cause inflammation of the udder and some quarters may be lost.

Sanitary milk-pail and scales for weighing each cow's milk.

RETENTION OF THE AFTER-BIRTH.

This trouble occurs in all herds, no matter what care is taken. The failure to expel the membrane causes the cow to become ill, with a high temperature. Poisons from the decomposition of the after-birth are absorbed into the system. The milk decreases in quantity and is unfit for use, and the cow falls away in flesh. The odour from the decaying membranes is very offensive.

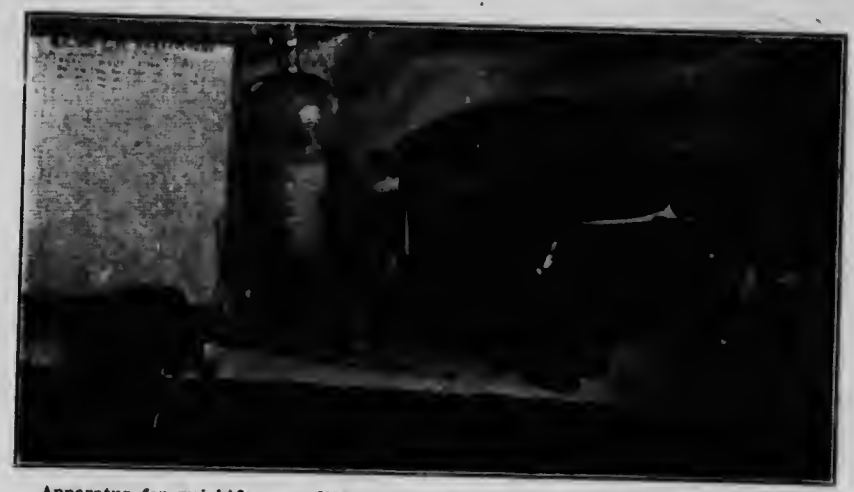
The after-birth should come away within twenty-four hours after the birth of the calf. If not, it must be removed. A weight of 2 or 3 lb. tied to the part of the membrane protruding will often help, but in obstinate cases this will not answer. The operation for removal by hand should be done within a day of calving, if possible. The passages into the womb gradually contract and it becomes increasingly difficult to insert the hand and arm. To avoid the risk of infection from the decaying matter, the arm of the operator should be smeared with carbolized lard or vaseline. The left arm holds the protruding membrane while the right is inserted along the right side of the passage into the womb. The circular attachments with the womb have to be located and brought within reach by gently pulling on the membranes in the left hand. Each circular projection on the membrane is attached by many soft processes to a similar circular, mushroom-like growth on the inner surface of the womb. These are separated one from the other by squeezing in the hand or by inserting the thumb between the two. The process of separation must, however, be carried on gently and gradually one after another until the after-birth can come away freely.

ABORTION.

Abortion is the birth of a calf before the proper time. There are two forms, contagious and non-contagious. When abortion occurs it is often difficult to tell whether it is contagious or not, so that precautions must be taken, anyway. Accidental or non-contagious abortion may be the result of a severe blow or kick, excitement, or improper feeding. Ergot is also a well-known cause. Ergot is a black fungus growing on the heads of grasses or grains. Rye, rye-grass, and blue-grass are especially subject to ergot. A single case of abortion will likely be accidental, but if several occur the cause must be found and removed.

CONTAGIOUS ABORTION.

This is one of the most serious diseases of cattle, causing enormous losses annually. No sure remedy has yet been found. The germs of the disease may exist in the womb, blood, or milk of the cow, and it is a difficult matter to get rid of them. In this disease the calf is usually expelled about the sixth or seventh month. Generally, the cow does not become sick, but the milk yield is much smaller than normal. If the cow is milking at the time she aborts, the fact may never be noticed. The small fœtus and the slight discharge may not be seen by the attendant. Having once aborted, a cow is liable to have the same trouble about the same time in the next pregnancy. Besides the females, the bull may also carry the germs of abortion on the genital organs.



Apparatus for weighing, recording, and testing milk. Milk record sheets, scales, and Babcock testing outfit.

It must be remembered that abortion is only a symptom of the disease itself, which is caused by a specific germ, the abortion bacillus. Investigators say that infection by this germ occurs chiefly during two danger periods—viz., during the time the young calf is being fed infected milk and later in life at breeding-time. It has been definitely shown that the milk of apparently healthy dairy cows may contain the abortion bacillus. This milk fed raw to calves may cause infection soon after birth. The disease then seems to become dormant until the animals reach breeding age, when the degree of the infection is greatly intensified, and abortion usually follows in the first pregnancy of females. It is claimed that infected calves can be identified by the external appearance of the genital organs. In the infected heifer calf or cow the tuft of hairs at the lower end of the vulva will be matted together with black crusts of micro-pus or matter. In the case of infected bull calves or older bulls the hairs at the opening of the sheath will be similarly matted.

According to researches conducted at Cornell University, the blood of a large proportion of calves in which the sexual hairs are matted with pus reacts to the agglutination test for contagious abortion. These calves had been fed raw milk. Those fed boiled milk showed no signs of infection and did not react to the test. It is not, however, practicable to feed any but the strongest calves on boiled or sterile milk, but they may be reared on pasteurized milk, which is nearly as safe. According to present knowledge, it seems very unsafe to feed a new-born calf raw milk from a cow which has aborted or has had retained after-birth or discharges from the vulva. If the milk is fed raw, it should be from a cow which has calved normally, has cleansed promptly (within two hours after calving), and which has not shown any abnormal pus-discharge after calving. Such a cow is more likely to be free from infection.

A strong leather hood for a cross bull. Another device is a 3-foot length of trace-chain left hanging to the bull's nose-ring.

The virulence of the infection is greatly increased by sexual intercourse. In herds where there is a large amount of sterility and consequently copulation is always occurring, the infection becomes intensified in both the cow and bull. Care, then, must be taken in selecting a male from a herd free from abortion. The virulence of the infection may also be increased by introducing an animal from a badly affected herd or by letting the animals get run down in condition. Dr. W. L. Williams, of Cornell, states that from present knowledge nearly all herds may be said to be infected with the abortion bacillus, but that the disease may lie dormant and not show itself, like tuberculosis. Given a favourable opportunity, the disease may become virulent and abortions or sterility will follow.

When an abortion occurs, the fœtus and after-birth must be burned or deeply buried. The cow needs to be isolated and the place disinfected with a 5-per-cent. carbolic-acid solution. The womb must be disinfected and washed with a 2-per-cent. solution of creolin or a permanganate of potash solution made by dissolving 1 teaspoonful of the crystals in 3 gallons of water. A rubber hose can be inserted and the disinfectant poured into a funnel attached to the outer end, which is raised above the cow, while the free end is inserted about 2½ feet. The solution should be about blood-heat—100° Fahr. The hind parts of the cow must be washed with the solution every day. The washing of the womb should be repeated in two or three days, and afterwards twice a week until all discharges cease.

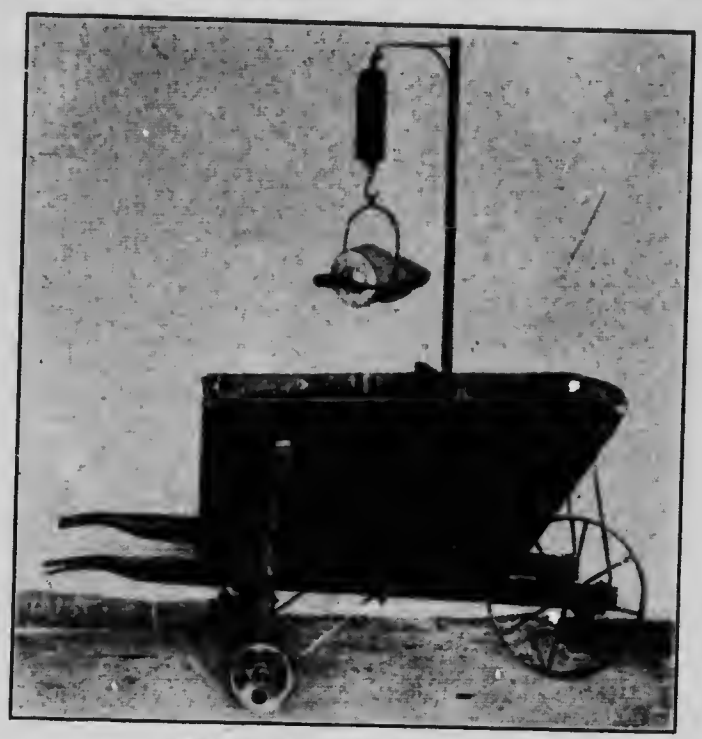
Where possible, it is best to have two bulls, one for the infected cows and the other for the healthy females. As a precautionary measure it is well to irrigate the interior of the bull's sheath with one of the disinfectant solutions mentioned, using a syringe.

Carbolic Treatment.—In addition, some authorities recommend that every animal in the herd should receive hypodermic injections of a 2-per-cent. solution of carbolic acid in doses of 25 to 50 cubic centimetres every two weeks from the fourth month of pregnancy. Large mature cows and those suspected of having the disease receive the largest doses. The efficiency of this treatment depends on the thoroughness with which it is applied. Some authorities claim that if the cows are not bred sooner than six months after aborting, the germs will die or become dormant and the disease will cease to show itself.

Methylene-blue Treatment.—Some authorities claim this to be a cure, but it has not yet been proved such. The method is as follows: Each cow which has aborted

or is suspected of being infected is given once per day doses of the medicinal methylene blue, either in ½-oz. gelatine capsules or the same quantity in the compressed form, or a heaping teaspoonful of the powdered methylene blue. The latter is fed on ensilage or other feed, but this method is rather wasteful. This treatment is continued for five consecutive weeks. Immediately after aborting give an injection into the cow's uterus of a solution of a heaping teaspoonful of methylene blue and 1 oz. of salt to a gallon of boiling water, cooled after dissolving to about 105° Fahr. Thorough disinfection should be carried out as before mentioned.

It may be stated that, even where no treatment is attempted, this disease will often "run itself out" of a herd after several years of losses. Thus the carbolic-injection treatment and the methylene-blue treatment outlined above may sometimes have been given credit for "cures" which were not cures at all, but merely the disease becoming dormant in the herd.



A handy device for weighing the grain feed.

CONGESTION OF THE UDDER.

With most cows, as a rule, after calving the udder is hard, hot, and swollen. This condition is not abnormal and need cause no anxiety. This animal should not be fed heavily at first. Bran-mashes are helpful at this time. The cow should be milked three or four times a day, and the udder well massaged each time and camphorated oil or lard well rubbed in.

INFLAMMATION OF THE UDDER, OR MAMMITIS.

This trouble is also known as garget. Some cases are quite mild, but in others the consequences may be very serious. Sometimes only a slight swelling of one or more quarters occurs, or the milk may be lumpy or thready, with or without swell-

ing. When these symptoms are noticed, treatment is necessary to prevent the case becoming worse. Exposure to cold, wet winds and draughts, bruises, or improper feeding may cause this trouble. The grain ration must be reduced one-half at least when the disease appears. A physic of 1 to 1½ lb. of Epsom salts in 3 pints of water, with 1 oz. of ground ginger-root and a cupful of molasses, must first be given. The cow must be kept in a warm place and away from draughts. An ounce of saltpetre per day for two or three days may also be given. The udder should be gently milked out often, using a milk-tube if the part is very sensitive.

Standard milk-fever apparatus. The cylinder holds absorbent cotton.

If the case is a severe one other symptoms will appear. The animal will shiver, the ears and horns will be cold, and a feverish condition will follow. The udder will be hot and tender, and perhaps no milk can be drawn. Prompt measures will be needed to save the quarters. Blankets or woollens wrung out in hot water may be applied to the udder. They may be kept in place by a sheet passed round the body, which will also support the increased weight of the udder. The blankets should be kept as hot as the animal can bear, by pouring on hot water every few minutes for an hour or two. The udder should be then thoroughly dried and rubbed and kneaded for some time, applying camphorated oil, marshmallow ointment, or melted lard. An application of antiphlogistine is then very beneficial. In place of fomenting with hot water, hot poultices can be used.

INFECTIOUS MAMMITIS.

There is an infectious form of garget caused by germs entering the udder and causing serious inflammation. In addition to the above treatment, authorities recommend an injection into each quarter of the udder of a solution of hydrogen peroxide or a solution of chinosol 4 per cent., glycerine 10 per cent., and water 86 per cent. warmed to about 100° Fahr. Camphorated oil is useful for applying with the hands to inflamed parts, allaying the pain. Equal parts of lard and iodine ointment or a mixture of equal parts lard and mercurial ointment are recommended in bad cases by some veterinarians.

EVERSION OF THE WOMB.

This occurs usually immediately after calving, but may happen at almost any time. The uterus or womb is thrust out and hangs down from the vagina in a large mass. The protruding mass must be carefully washed clean with cold water containing 2 per cent. of zenoleum, creolin, or carbolic acid. Then it should be gently but firmly shoved back into place by means of the closed fist. Straining on the part of the cow can be lessened by tying cords tightly round the body just behind the fore legs and just in front of the hind legs. After replacing, stitch together the lips of the vulva, or put on a truss and build a platform under the hind legs 6 inches high. This trouble is likely to recur next calving-time.

BLOODY MILK.

This is not an indication of disease. It is caused by the rupture of small blood-vessels in the udder. There is no remedy, and the only thing to do is to watch for the appearance of the trouble and reject the affected milk.

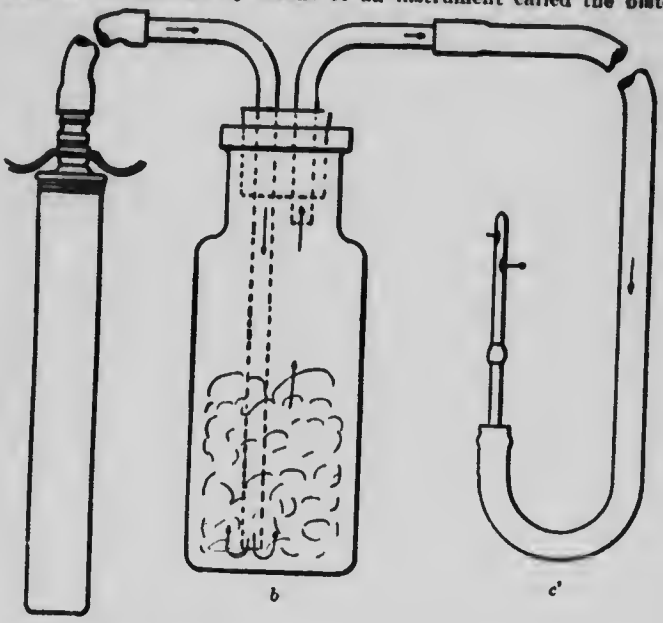
BITTER MILK.

Some cows far along in the lactation period are liable to yield bitter milk, especially on dry feed. Reducing the grain ration and administering a physic of ½ to 1½ lb. Epsom salts is effective in some cases.

The flavour of milk may also be affected adversely by any sudden change of food or by eating turnips, rape, wild onions, or strong-flavoured weeds or brush.

HARD-MILKING COWS.

This trouble is generally caused by too strong sphincter muscles surrounding the opening of the teats. Some cases answer to the use of the teat-plug, made of lead or hard rubber, which is kept in from one milking to another. This is used until the muscles are relaxed. Where this treatment is not sufficient, the sphincter muscles must be cut through by means of an instrument called the bistoury, and



An emergency milk-fever apparatus. (*a.*) Bicycle-pump. (*b.*) Bottle, glass tubes or quills, and absorbent cotton. (*c.*) Rubber tube and milk-tube.

the teat-plug kept in until the wound heals. The bistoury may sometimes be employed also to remove lumps or growths inside the teat, which often stop the milk-flow.

Another way to remove lumps in the teats is for a veterinary surgeon to slit the teat and cut them out while the cow is dry. This is sometimes the only way to save the quarter.

LEAKING AND TORN TEATS.

This may be caused by weak sphincter muscles at the end of the teat, or it may result from an opening higher up the teat. Small openings may be closed after each milking by applying collodion.

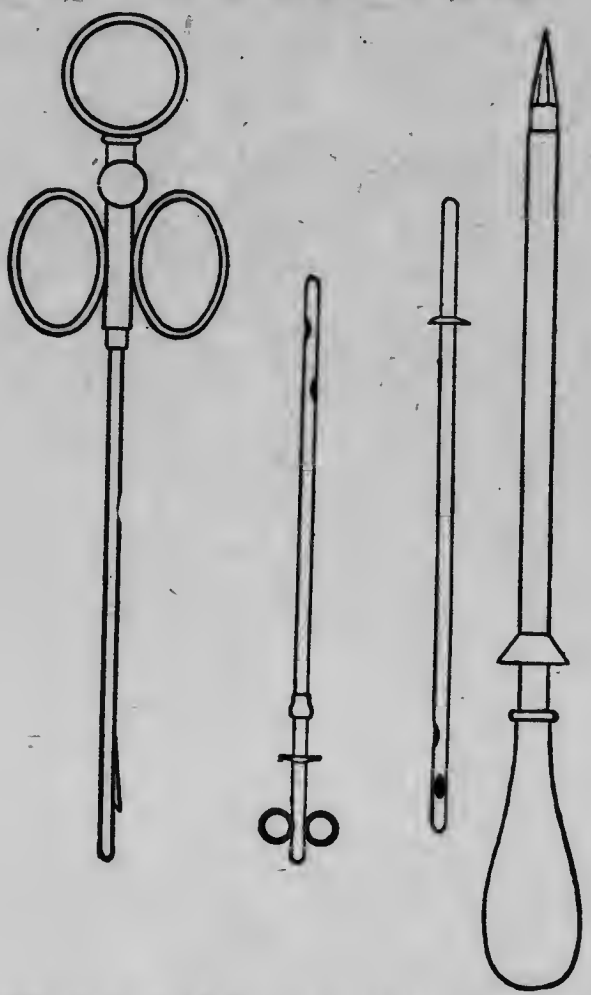
Injuries from barbed wire and other things which lay open a teat are often difficult to cure when the animal is in milk. The lips of the new wound should be drawn together and stitched. Openings left by old wounds will have to be scarified

and then closed by stitches. The milk-tube should be kept in all the time to prevent distension of the teat. It must be disinfected frequently to avoid the risk of garget germs infecting the udder.

SORE TEATS AND WARTS.

These may be caused by cold weather, milking with wet hands, or long finger-nails. Vaseline is a very good rememdy, and may be used all the time. For severe cases, washing well and applying glycerite of tannin is recommended.

If troublesome, warts may be cut off close and touched with a stick of caustic potash. Vaseline or olive-oil will often cause them to disappear.



From left to right: Bistoury, self-retaining milk-tube, common milk-tube, trocar and canula.

BLOATING.

Wet, fresh clover or alfalfa pasture will cause bloating. For the first time cows should go on to the clover only when it is dry. Other feeds sometimes cause animals to bloat. If taken in time, the accumulation of gases in the paunch is easily reduced

by a dose of raw linseed-oil and turpentine. Up to 3 pints of linseed-oil may be given to a cow in pint doses, with 2 or 3 tablespoonfuls of turpentine added. Some authorities recommend 300 c.c. (slightly more than ½ pint) of a 4-per-cent. solution of formalin. Tying a wooden gag in the mouth is also effective, the movements of the tongue causing the gas to escape.

If the animal is near suffocation, the paunch must be stabbed into to let the gas escape. A knife may be used, but a trocar and canula is better, the hollow sheath remaining in the wound to allow the free escape of the gas. The point to be stabbed is midway between the last rib, the hip-bone, and the backbone, on the left side, in the middle of the space which is quite hollow when the cow is in health. The skin is first slit for about an inch. The paunch-wall is just underneath, and a bold stab must be made right into it. A dose of 1 to 1½ lb. Epsom salts or a quart of linseed-oil may then be given.

Some experienced cattlemen cure cases of bloating in a few minutes by inserting a piece of oiled rubber hose in the throat, pushing it down gently until the gas escapes.

CHOKING.

Bloating may be due to choke. A root, apple, or potato may lodge in the entrance to the gullet or lower down. If the bloating is serious, it may be necessary to use the trocar and canula as described for bloat, because no medicine can be given until the obstruction in the gullet is removed. The foreign body may sometimes be reached and removed by hand if high up. When lodged lower down its location may often be seen and felt, and it may be dislodged by gentle rubbing in every direction. If this is not successful, or if the obstruction is lower down and cannot be felt, pass an oiled ½-inch rubber hose down the gullet until it reaches the mass, then press gently downwards. Small quantities of linseed-oil may be poured through the hose to help matters. Rough methods of breaking or pressing down the obstruction must not be used; they will injure or rupture the gullet, and these injuries will likely prove fatal.

IMPACTION OF THE STOMACH.

This disease is slow in showing itself. A little loss of appetite and dullness occur, with some grunting or groaning and perhaps distension of the belly. The dung is very deceptive, as it may pass away in a thin stream. The bowels are coated with walls of hardened material, with a liquid lane running between. The temperature will rise, and the condition of the animal will become very serious. Both linseed-oil and Epsom salts can be given in repeated doses the same as for bloating, until the hardened fæcal matter comes away. Sometimes this disease is caused by the animals eating indigestible objects, such as old clothes or boots. Such a case is difficult to cure. It indicates a lack of some mineral element in the food. Some cases are caused by cows swallowing pieces of hay-wire.

PINK-EYE.

This is a contagious disease of the eyes, occurring usually in late summer. The eyes discharge and are inflamed. Later the eyes become opaque, and the animal cannot see. The patient should be kept in a dark place, fed lightly, and the eyes washed twice daily with a boracic-acid solution (1 dram in 4 oz. of water). This is applied with a syringe.

FOOT-ROT.

This is a contagious inflammation that occurs between the toes and may extend above the hoof. The animal limps and there is swelling of the part. The odour is offensive. This is easily treated if taken early. The cleft of the hoof should be well cleaned by drawing through it a rope or rag saturated with disinfectant, undiluted. If there is much swelling, bran or flax-seed poultices should be applied. This disease is often induced by failure to trim the overgrown hoofs of cattle.

LUMPY JAW (ACTINOMYCOSIS).

The first appearance is a painful swelling on either jaw. Later this may break and discharge a yellowish, sticky pus. The bone is eaten into and the teeth may be affected. Sometimes the tongue is the affected part. The parasite causing this disease must be destroyed as quickly as possible. Paint or inject the affected parts daily with tincture of iodine. Give also internally iodine of potash 2 to 3 drams daily (in two doses) with a pint of warm water. This should be kept up for two weeks, discontinued for a week, and then repeated if necessary.

FAILURE TO BREED—STERILITY.

During a normal heat period in females a ripe egg or ovum from the ovary descends into the Fallopian tube. Without the presence of this mature egg and its union with the male sperm conception cannot occur. Persistent abnormal sexual excitement may not be accompanied by the ripening of the ovum, in which case the female is sterile. In some cases the male spermatozoa may lack the vitality necessary to reach and fertilize the ovum, due to the bull being overworked, underfed, or in want of exercise. Fluid extract of nux vomica may be given to induce animals coming into heat. Commence with ½ dram and gradually increase the dose. Should the animal show an involuntary twitching of the muscles or restlessness and excitability after the medicine has been given for some time, go back to the first dose and repeat. Nux vomica is poisonous and must be carefully used. Fat animals must be made muscular by exercise and thin animals built up by generous feeding. Where the young are suckling, they may have to be weaned before the mother will breed. Errors in feeding must be corrected; more protein may be necessary. A young robust bull should be tried. Mechanical obstructions often prevent conception. Vaginal tumours may have to be removed, or a persistent hymen obliterated, or the mouth of the womb may need to be opened artificially (before service) by a qualified practitioner. Sterility may also be caused by the abortion germ.

Window ventilation is suitable for the mild Coast climates.

Yeast Treatment for Sterility.—As sterility may be due to any one of a number of different causes, there can be no one cure for all. In many cases the yeast mixture has aided conception by bringing about a right condition of the vaginal passage.

The mixture is made as follows: Thoroughly moisten one cake of compressed yeast or dried yeast with fresh boiled water, used lukewarm. Allow to stand in a warm room for at least twelve hours; then stir in a pint of lukewarm water and let stand twelve hours more. At the end of twenty-four or thirty hours the mixture may be used, after straining it through cheese-cloth. First cleanse the vagina by syringing out with warm water; then inject the yeast mixture into the vagina by means of a syringe or clean ½-inch rubber hose, with funnel stuck in the end which is elevated above the cow. It is best to inject the mixture when the animal is first seen to be in heat and have her bred when the period of heat is about over. The

heat period will usually last one day or more, and the periods occur about three weeks apart. The proper time for preparing the above mixture may thus be reckoned by setting down the dates of heat periods.

Soda Treatment for Sterility.—Acid conditions often exist in the vagina and womb of the barren animal. In these cases alkaline solutions are beneficial in acting as neutralizers. About an hour before service inject into the vagina ½ gallon of lukewarm water containing 1 tablespoonful of bicarbonate of soda (baking-powder). The passage may first be cleansed with warm water and the mouth of the womb dilated. Even better results are claimed from the use of ½ oz. of pure phosphate of soda in 2 quarts of water. This latter must he kept in a tightly closed bottle to prevent change. These solutions may also be used two or three times a week. Half an ounce of either substance may also be fed daily in the feed for ten days before service.

LEUCORRHŒA—VAGINAL DISCHARGES.

Leucorrhœa is caused by chronic inflammation of the womb or vagina, or both. It may follow injuries, or retention of the after-birth, or exposure to cold, or any other disturbance of the health at the time of parturition. The main symptom is the glairy white discharge which flows when the cow lies down. If the discharge continues and is putrid, the health fails and the milk-flow shrinks. Half an ounce of granular hyposulphite of soda dissolved in 2 gallons of blood-warm water is a useful injection. If not quickly effective, change to a solution of permanganate of potash. Strong solutions should not be used. Better results are had from the frequent use of large quantities of mild antiseptics, 1 to 1,000 down to 1 to 5,000. Permanganate of potash is a safe antiseptic to use in a great variety of cases. It is non-irritating.

Discharges may also occur as the result of inflammation of the vagina (vaginitis). In granular vaginitis nodules can often be seen on the inner mucous membrane. This form of the disease is infectious and may affect heifer calves as well as cows. Thorough disinfection, both internal and external, is the remedy, especially before breeding. In addition to the injections before mentioned, it is recommended to give by the month daily ½ oz. of hyposulphite of soda for ten days, then miss a week and commence again. This substance is a good internal antiseptic.

POISONING.

Cattle are liable to poisoning, especially by poisonous weeds, such as water-hemlock or poison-hemlock. There are many different kinds of poisoning, so that only general treatment can be given here.

A non-irritating purgative should be given, 1 to 4 pints of castor-oil or raw linseed-oil. For poisoning by a narcotic, 10 to 20 drops of croton-oil should be added. Repeat the dose in two or three hours if necessary. To protect the lining of the intestines, give large quantities of the whites of eggs, milk, butter, lard, or olive-oil. Baking-powder may be used to neutralize acid poisons and diluted vinegar in the case of alkali poisoning.

KICKING COWS.

The habit of kicking may easily be formed in a heifer if she is abused the first time she is milked. A kicking cow or heifer should never be struck. She can easily be prevented from kicking by a heavy strap or rope with a loop. The tie is looped around one leg above the hock, and then tied lightly enough around the other to draw both legs well together.

SELF-SUCKING COWS.

A good remedy for this vice is to insert a bull-ring in the cow's nose, and then hang another ring to the first.

DISEASES OF CALVES.

COMMON SCOURS.

The first sign of this trouble will be foul-smelling dung. Mix up ½ oz. of formalin in 15½ oz. of water, and add 1 teaspoonful of this mixture to each pint of milk fed. The feed should be reduced about a half. In severe cases 3 oz. of castor-oil should be given in a pint of milk. After this for two or three days give a teaspoonful of a mixture of 1 part salol and 2 parts subnitrate of bismuth three times daily. The formalin mixture should also be continued. Formalin should be kept in an amber-coloured bottle to prevent chemical change.

Another good mixture for scours, to be used after the castor-oil, is as follows: Compound tincture of morphia and chloroform, 4 drams; liquid bismuth, 4 drams; oil of cloves, 1 dram; cooled linseed tea, 7 oz. One tablespoonful of this mixture is given every eight hours until better. This mixture can be kept in stock ready for use. Lime-water, 1 oz. to a quart of milk, is also a good remedy.

Scours is a sign of indigestion, and is often caused by improper feeding—cold or sour milk, dirty pails, etc. For sickly calves, from 1 to 4 teaspoonfuls of specially prepared blood-meal, well mixed with the milk, will often be found beneficial.

INFECTIOUS OR WHITE SCOURS.

This fatal disease is caused by a germ which enters the calf's body through the broken navel-cord soon after birth. The calf becomes sick a day or two after birth. A common but not an invariable symptom is the passage of white, foul-smelling dung. Very few calves recover from this disease. A cow should not be allowed to calve in a place where a case of white scours has been, as the disease is very infectious. The calf should be born in a clean stall, disinfected if necessary. If born in the pasture the calf is fairly safe, but if in the barn the navel-cord should be tied up at birth and disinfected with a 3-per-cent. carbolic solution. This will prevent the germs entering the body. The medicinal treatment is the same as for ordinary scours.

LICE.

Young cattle are especially liable to be affected with lice during the winter. When cattle rub themselves much they should be examined for lice. When badly affected the hair comes out in patches. One species sucks the blood and is very injurious. The eggs or nits are attached to the hair. As a remedy two applications of any of the coal-tar dips ten days apart will be effective. Kerosene emulsion is a sure remedy. To make this, dissolve ½ lb. of hard soap in 1 gallon of boiling soft water. When dissolved, add 2 gallons of kerosene and mix by pumping with a spray-pump until emulsified. Add to 19 gallons of water. Wet the animal thoroughly.

HUSK OR VERMINOUS BRONCHITIS.

Calves and pigs sometimes have a cough caused by worms in the air-passages. An old-fashioned but effective remedy is to shut both calves and attendant in a tight shed in which sulphur is burned. When the fumes become so strong that the attendant cannot stand them any longer without suffocating, he removes the pot of sulphur, but leaves the calves in the fumes for fifteen minutes longer. Half-ounce doses of spirits of turpentine can also be given with benefit.

GOITRE—SWOLLEN NECK.

This malady is quite common in some districts in this Province, both in cattle and human beings, but the cause has so far never been ascertained. The two thyroid glands are enlarged so that a swelling appears in front of the windpipe below the angle of the jaw. Calves are often born thus affected. Sometimes they are too weak to rally, and sometimes the swelling subsides and they recover. Older animals may

become affected. Present indications point to the cause being a lack of some mineral, such as lime, in the feed. At any rate, the feeding of lime-water in the milk of calves seems to have proved beneficial in some cases. In other instances salt and sulphur have been used with apparent benefit. Some authorities claim that the cause is the presence of some unknown toxic substance in the feed or water of the locality. This disease is so prevalent in one or two localities as to prove a serious hindrance to stock-raising.

The treatment of goitre consists in, where possible, removing the patient to some other locality. Iodine ointment or tincture of iodine should be applied to the swelling. Injections of iodine solution into the substance of the gland are also recommended by authorities (5 grains of iodine in 1 dram of 25-per-cent. alcohol). Potassium iodide may also be given internally in 1½-dram doses twice daily for a cow, or in 20-grain doses twice daily for a calf.

Samples of the soil and water of an affected district should be sent to the Dominion Chemist, Ottawa, for analysis. The feeding of lime-water to breeding stock will supply any deficiency in lime, and the feeding of ground rock phosphate or of bone-meal will supply both lime and phosphorus.

RINGWORM.

Due to a fungus parasite in the skin, the hair comes out in circular patches in this affection. Scabs form later which appear silvery gray. Remove these by washing with soap and water and apply strong vinegar, sulphur ointment, tincture of iodine, or mercurial ointment.

HOUSING DAIRY CATTLE.

The dairy-barn is the kitchen in which a large part of human food is prepared. It should above all things be sanitary. The public is insisting more and more on clean barns and clean milk from healthy cows. Besides being sanitary, the barn must be comfortable for the cows and convenient for their care.

A sanitary barn need not be expensive. A good, convenient barn is the cheapest in the long run. Cows properly housed are more productive, and can be more cheaply and conveniently cared for. Hired help is cheaper and better satisfied under improved conditions.

TYPES OF BARNS.

The one-story barn is, of course, the most sanitary. Certified milk-barns are almost all of the one-story type. It is the easiest to light and ventilate. With the extra storage-room necessary, it is generally more expensive to erect. This, however, need not be the case in a mild climate with an unlined building. An experienced barn-builder informs us that in the Chilliwack District he is building one-story barns with cement floors, to hold twenty cows, for $350.

The cost of sanitary steel stanchions and cow-stalls would be about an additional $8 per cow. If individual water-troughs or cups were installed, the cost would be about $2.50 per cow more.

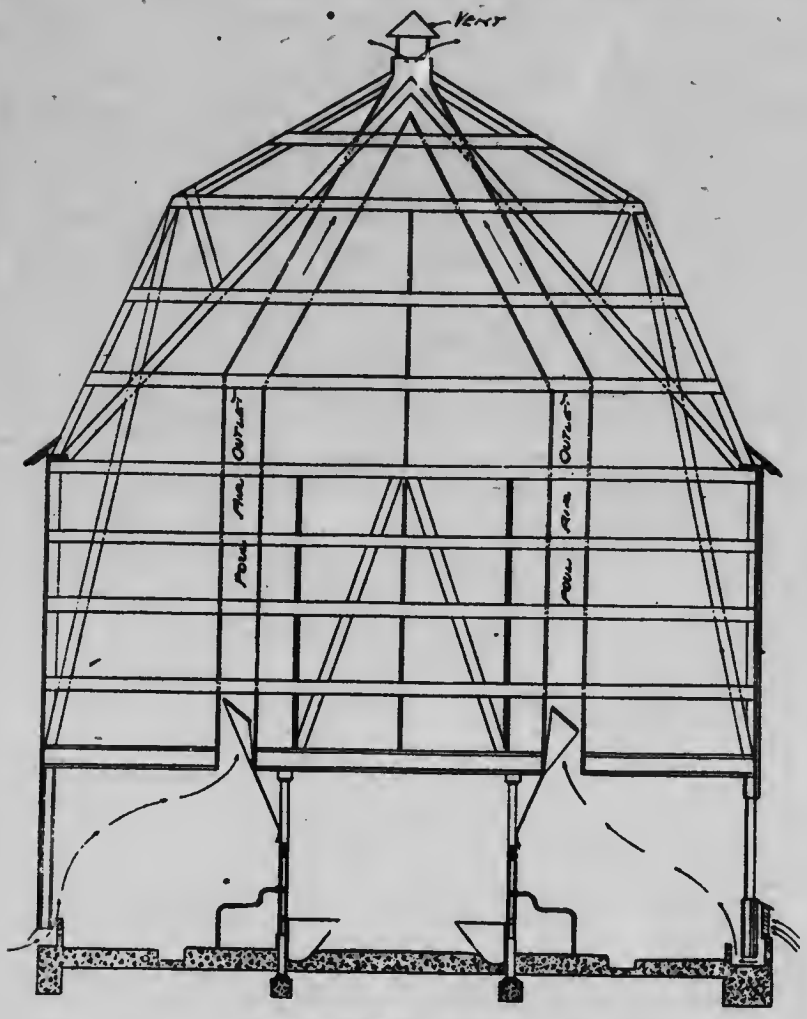
Where it is desired to improve sanitary conditions, a one-story sanitary barn can be built extending from the old one, which will then be used for feed-storage and housing young stock.

The two-story or loft barn is the one most generally used. It is well adapted to the general farm. The room in the upper story for storing bulky feeds is generally provided cheaper than in a one-story barn with separate storage-room. The two-story barn can be sanitary and well lighted and ventilated, if properly built.

Round barns are not at all common, but they have the advantage of compactness and cheap construction. To house the same number of animals a round barn requires about 25 per cent. less wall to enclose it, and 30 to 40 per cent. less material, than a rectangular barn. Usually the silo is built in the middle, and the cows are in a single row facing inwards.

The basement barn is the least sanitary type. It is built by excavating in the side of a hill, so that a great deal of needed sunlight is cut off. The basement barn is warm, but usually lacks light and proper ventilation.

The covered yard is another system of housing used by some with entire satisfaction. The plan consists in having a large shed or covered yard into which the cattle are turned between milkings. The roughage is eaten from racks while loose, and the grain is fed at milking-time while they are tied up. The milking-stable should be sanitary, but need not be large, elaborate, or expensive. An old barn can often be used for the exercise-shed, and a small sanitary milking-stable can be built



Rutherford system of ventilation.

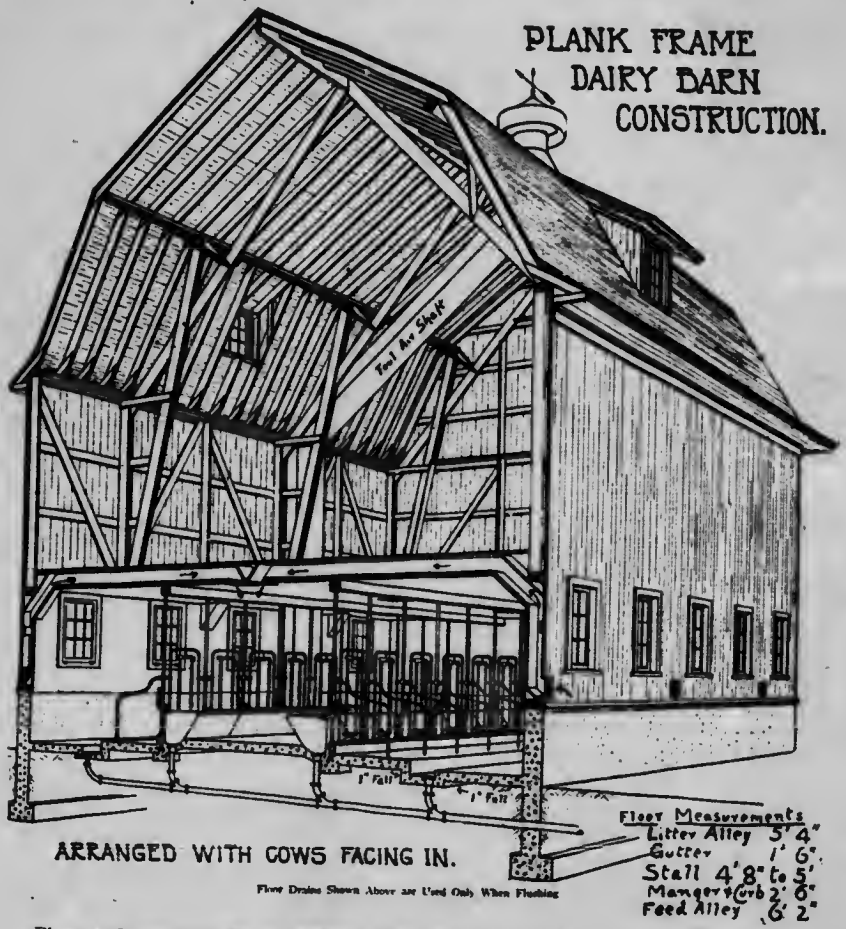
adjoining. A disadvantage of this system is the large amount of bedding required to keep the cows clean in the open shed. The animals, however, obtain the maximum amount of freedom. They must be dehorned for this system to work satisfactorily.

LOCATION.

The barn should be built on a high and dry site. Good drainage is needed to keep the yards as clean as possible. The location and the inside arrangements should be convenient for carrying on all the work that has to be done around the barn. The barn should be built to stand north and south, so that both sides get about equal amounts of sunlight.

LIGHTING.

Sunlight is the best and cheapest disinfectant. Lack of clean windows is a common and serious defect in most barns. Sunlight not only kills germs, but it shows up all the dirty corners, so that they get cleaned up. A dark barn is usually a dirty barn. There should be at least 4 square feet of glass to each animal. Windows cost not much more than other wall material. In cold climates they should be double-sashed to conserve warmth. Windows should reach from 4 feet above the floor nearly to the ceiling, to allow the sunlight to penetrate the barn.



Plans and specifications of different types of barns are sent free on application to the Department of Agriculture.

VENTILATION.

Fresh air is as essential as good food for the health of the cow and for the highest milk yield. A cow requires over 3,500 cubic feet of fresh air per hour, but the question of cubic space in the barn has not much to do with ventilation. The important point is to provide for a constant and ample renewal of the air in the barn. It is not necessary to install an expensive and complicated system of ventilation. In the mild climate of our Coast districts ventilation by means of the windows is quite practicable and inexpensive. For colder climates, where doors and windows are kept shut, the Rutherford system or some similar system can be cheaply installed. The Rutherford system is simple and gives good satisfaction. The flue area per cow should be about 50 square inches. One or two large foul-air flues about 2 feet square are better than many small ones. The large flues give a better draught. They should be smooth on the inside to prevent friction, and give better results if they go straight to the roof without turns.

Sanitary one-story dairy barn built on to old barn by Messrs. Shannon Bros., Cloverdale, B.C. A barn need not be expensive to be sanitary.

MATERIAL FOR FLOORS.

Wood floors are the warmest, but are not durable or sanitary. Under the most favourable conditions a wood floor will last from six to ten years. A well-laid cement floor is almost permanent and absolutely sanitary, and costs little more than wood. Concrete, however, is a good conductor of heat, and therefore is cold for the animals to lie on. This objection may be lessened by laying the concrete for the cow-stall on hollow tile and having it higher than the ground outside to keep it dry underneath. Another very good arrangement is to place 2-inch planks directly on the part on which the animals lie.

To prevent the cows slipping, concrete floors should always be left rather rough.

ARRANGEMENT OF STALLS.

There are reasons in favour of the cows facing both in and out, but the most is to be said in favour of two rows of cows facing in, with the feed-passage in the

middle. The light is then on the "business end" of the cow, where most needed. The most convenient width for such a barn is 36 feet.

Mangers are best made of cement in the form of a continuous manger. This type is easiest to keep clean. Metal partitions, which can be raised or lowered, are sometimes used to keep each cow's food separate. The manger should be at least 2 feet wide, and the bottom should be raised about 2 inches higher than the cow's platform. Otherwise the cow strains to reach the food.

The length of the platform on which the cow stands varies from 4½ feet for Jerseys to 5 feet for Holsteins. Most makes of sanitary stanchions have devices for adjusting according to the size of the cow. The object is to keep the animal's hind feet at the edge of the gutter, so that no manure drops on the platform.

Interior of Mr. Robert Kelly's barn near New Westminster, B.C. A good barn, but too expensive for most farmers. The essentials are: Lots of light, good ventilation, convenience, and a well-laid concrete floor.

MANURE.

The actual value in increased crops of the manure from one cow is at least $24 per year. Barnyard manure gives a return of about $2 per ton when applied to the soil. The total amount—liquid and solid—excreted by a cow in a year is about 12 tons. Mixed with bedding, this is increased to 14 or 15 tons.

It is important to remember that most of the fertilizing value is in the liquid manure. The solids hold most of the phosphoric acid, but the liquid manure contains half the nitrogen and three-quarters of the potash. A great waste occurs in the loss of most of the liquid manure.

HANDLING THE MANURE.

One way of conserving the liquid is to use enough litter to soak it up. Another method is to drain all the liquid manure into a water-tight cistern. If the cistern is built into the side of a hill it facilitates emptying and distributing

Another very serious loss of fertility takes place where manure-piles are left exposed to leaching and fermentation. Over half the fertilising value may be lost in a few months. Fermentation causes the escape of nitrogen as ammonia and rains wash out much fertility into the soil.

Manure should be taken away from the barn immediately, either into a separate shed or pit, or direct to the field. On flat land, spreading immediately on the land has much to recommend it. It saves labour and there is little loss of fertility. If the manure is kept in a pile it should be stored in a shallow concrete pit to hold the liquids from escaping. Some authorities say that, as long as the liquids are prevented from escaping, rain is beneficial rather than otherwise, in making the pile moist, thus holding the ammonia.

The overhead track carrier for manure and feed should be installed wherever possible. It is one of the conveniences of the modern dairy-barn. The track will lead out of the barn to the pit or to the manure-spreader.

Where other bedding is not available, sawdust or shavings makes a very good litter. Shavings will absorb as much liquid as straw, but sawdust does not absorb half as much, weight for weight. Sawdust and shavings manure is not as beneficial to soils as straw manure, and should be kept moist in the pile to prevent fire-fang.

TABLE 1.—FOOD VALUES.

This table gives the digestible nutrients contained in 1 lb. of some common feeds. It is adapted from table in Bulletin No. 206, Ontario Department of Agriculture.

Kind of Food.	Total Dry Matter.	Pounds of Digestible Nutrients.		Nutritive Ratio.
		Protein.	Carbohydrates and Fat.	
Green rape and kale, 1 lb.	0.14	0.020	0.086	1:4.3
Green fodder and corn, 1 lb.	0.20	0.010	0.125	1:12.5
Green peas and oats, 1 lb.	0.16	0.018	0.076	1:4.2
Green red clover, 1 lb.	0.29	0.029	0.164	1:5.6
Green alfalfa, 1 lb.	0.28	0.030	0.138	1:3.5
Corn silage, 1 lb.	0.26	0.014	0.157	1:11.2
Potatoes, 1 lb.	0.21	0.010	0.165	1:16.5
Mangels, 1 lb.	0.09	0.011	0.056	1:5.1
Sugar-beets, 1 lb.	0.13	0.013	0.104	1:8.0
Carrots, 1 lb.	0.11	0.008	0.082	1:10.3
Turnips, 1 lb.	0.10	0.010	0.077	1:7.7
Timothy hay, 1 lb.	0.87	0.028	0.465	1:16.6
Mixed hay, 1 lb.	0.87	0.058	0.460	1:7.9
Alfalfa hay, 1 lb.	0.92	0.110	0.423	1:3.8
Red-clover hay, 1 lb.	0.85	0.077	0.430	1:5.6
Corn fodder, 1 lb.	0.58	0.025	0.373	1:14.9
Corn stover, 1 lb.	0.60	0.017	0.340	1:19.9
Pea straw, 1 lb.	0.86	0.043	0.341	1:7.9
Wheat straw, 1 lb.	0.90	0.006	0.372	1:63.0
Oat straw, 1 lb.	0 91	0.012	0.404	1:33.6
Corn (grain), 1 lb.	0.89	0.079	0.764	1:9.7
Wheat (grain), 1 lb.	0.90	0.088	0.708	1:7.9
Rye (grain), 1 lb.	0.88	0.095	0.721	1:7.6
Barley (grain), 1 lb.	0.89	0.084	0.692	1:8.2
Oats (grain), 1 lb.	0.89	0.092	0.568	1:6.2
Buckwheat (grain), 1 lb.	0.87	0.081	0.536	1:6.6
Pea-meal, 1 lb.	0.90	0.168	0.534	1:3.2
Corn and cob meal, 1 lb.	0 85	0.044	0.665	1:15.1
Wheat bran, 1 lb.	0.88	0.122	0.453	1:3.7
Wheat middlings, 1 lb.	0.83	0.128	0.607	1:4.7
Low-grade flour, 1 lb.	0.88	0.082	0.647	1:7.9
Rice-meal, 1 lb.	0.89	0.074	0.751	1:10.1
Oat feed, 1 lb.	0.93	0.052	0.339	1:6.9
Dried brewers' grains, 1 lb.	0.91	0.200	0.455	1:2.2
Gluten feed, 1 lb.	0.91	0.213	0.593	1:3.0
Gluten-meal, 1 lb.	0.91	0.298	0.566	1:2.0
Linseed-meal (new process), 1 lb.	0.91	0.315	0.411	1:1.3
Cotton-seed meal, 1 lb.	0.92	0.332	0.424	1:1.3
Soy-bean meal, 1 lb.	0.88	0.291	0.558	1:1.9
Cocoanut cake, 1 lb.	0.89	0.154	0.652	1:4.2
Sugar-beet pulp (wet), 1 lb.	0.10	0.006	0.073	1:12.0
Sugar-beet pulp (dry), 1 lb.	0.91	0.041	0.649	1:16.0
Apple-pomace, 1 lb.	0.23	0.011	0.164	1:14.9
Skim-milk (separator), 1 lb.	0.09	0.029	0.059	1:2.0
Buttermilk, 1 lb.	0.10	0.039	0.065	1:1.7
Dried blood, 1 lb.	0.91	0.709	0.056	1:0.08
Feeding standards for daily rations—				
For support of 1,000-lb. cow, dry and not in calf. (For each extra 100 lb. weight add $\frac{1}{10}$)	16-21	0.7	7.00	1:10
1,000-lb. cow giving 20 lb. average milk	25-29	1.6-1.9	9.8-11.2	1:6
1,000-lb. cow giving 30 lb. average milk	27-33	2.2-2.5	11.8-13.9	1:5.5
1,000-lb. cow giving 40 lb. average milk	28 34	2.8-3.2	13.9-16.6	1:5.2
1,000-lb. cow giving 50 lb. average milk	29-36	3.2-3.8	16.0-18.5	1:5.0

Direction for using Table 1.—**To find the pounds of nutrients in a given number of pounds of any feeding-stuff, multiply the weight of nutrients in 1 lb. (as given in the table) by the pounds fodder, meal, etc., which you expect to feed.**

For example: Ration fed to Cow giving 40 lb. Milk daily.

	Dry Matter.	Protein.	Carbo-hydrates.	Nutritive Ratio.
12 lb. alfalfa hay	11.04	1.320	5.076	...
35 lb. corn silage	9.10	0.490	5.495	....
4 lb. ground oats	3.56	0.369	2.270	....
4 lb. bran	3.52	0.488	1.812	....
1 lb. barley	0.89	0.084	0.692	....
1 lb. linseed-meal	0.91	0.315	0.411	...
Total nutrients in ration	29.02	3.065	15.756	1:5.2
[illegible] lb. [illegible] (as given in table)	28-34	2.8-3.2	13.9-16.6	1:5.2

TABLE 2.—FOOD VALUES.

Average Percentage Composition.						Kind of Feeding-stuff.	Pounds Digestible in each 100 lb.		
Water.	Mineral Matter.	Crude Protein.	Carbohydrates. Fibre.	Carbohydrates. Starches, Sugar, etc.	Fat.		Protein.	Carbo-hydrates.	Fat.
10.6	1.5	10.3	2.2	70.4	5.0	Corn (dent)	7.8	66.8	4.3
9.5	1.5	33.8	2.0	46.6	6.6	Gluten-meal	29.7	42.5	6.1
9.2	2.0	25.0	6.8	53.5	3.5	Gluten feed	21.3	52.8	2.9
10.5	1.8	11.9	1.8	71.9	2.1	Wheat	8.8	67.5	1.5
11.2	4.4	15.9	6.2	56.2	5.1	Wheat middlings or shorts	13.6	45.7	4.5
11.9	5.8	15.4	9.0	53.9	4.0	Wheat bran	11.9	42.0	2.5
8.7	2.1	11.3	1.5	74.5	1.9	Rye	9.5	69.4	1.2
10.8	2.5	12.0	4.2	68.7	1.8	Barley	8.4	[illegible]	1.6
8.0	3.9	11.5	11.1	62.9	2.2	Emmer (miscalled spelt)	10.0	[illegible]	2.0
10.4	3.2	11.4	10.8	50.4	4.8	Oats (ground)	10.1	[illegible]	3.7
7.0	5.3	8.0	21.5	55.3	2.9	Oat feed	5.2	30.1	2.6
7.4	6.7	5.4	30.7	50.5	1.3	Oat hulls	1.3	38.5	0.6
13.4	2.0	10.8	11.7	59.7	2.4	Buckwheat	8.1	48.2	2.4
12.4	0.4	7.4	0.2	79.2	0.4	Rice	6.4	79.2	0.4
10.2	8.1	12.0	5.4	51.2	13.1	Rice-meal	7.4	48.3	11.9
10.5	2.6	20.2	14.4	51.1	1.2	Canada field-pea meal	16.8	51.7	0.7
11.7	4.8	33.5	4.5	28.3	17.2	Soy-bean meal	30.1	23.3	14.6
9.2	4.3	22.6	7.1	23.2	33.7	Flax-seed	20.6	17.1	29.6
0.0	5.5	37.5	8.9	36.4	2.7	Linseed-meal (new process)	31.5	35.7	2.4
9.8	5.5	33.9	7.3	35.7	7.8	Linseed-meal (old process)	30.2	32.0	6.9
7.5	6.7	39.9	9.9	27.8	8.1	Cotton-seed meal	33.1	25.1	7.6
10.4	4.3	16.8	24.0	35.0	9.5	Palmnut cake	16.0	52.6	9.0
10.3	5.9	19.7	14.4	38.7	11.0	Cocoanut cake	15.4	41.2	16.7
8.6	2.6	16.3	29.9	21.4	21.2	Sunflower-seed	14.8	29.7	18.2
10.8	6.7	32.8	13.5	27.1	9.1	Sunflower-seed cake	29.5	23.3	8.0
10.7	4.9	47.6	5.1	23.7	8.0	Peanut cake	42.8	20.4	7.2
10.0	7.9	31.2	11.3	30.0	9.6	Rape-seed cake	25.3	23.7	7.6
8.7	3.7	25.0	13.6	42.3	6.7	Dried brewers' grains	20.0	32.2	6.0
75.7	1.0	5.4	3.8	12.5	1.6	Wet brewers' grains	4.9	9.4	1.7
8.4	4.5	8.1	17.5	60.8	0.7	Dried beet-pulp	4.1	64.9	..
89.8	0.6	0.9	2.4	6.3	..	Wet beet-pulp	0.5	7.7	..
7.0	5.5	9.6	16.1	61.3	0.5	Dried molasses beet-pulp	6.1	68.7	..
9.1	11.2	13.1	22.4	42.1	2.1	Alfalfa meal-molasses feed	9.8	40.8	0.9
87.2	0.7	3.0	..	4.9	3.7	Cow's milk	3.4	4.8	3.7
74.6	1.6	17.6	..	2.7	3.6	Cow's milk (colostrum)	17.6	2.7	3.6
90.6	0.7	3.1	..	5.3	0.3	Skim-milk	2.9	5.3	0.3
90.1	0.7	4.0	..	4.0	1.1	Buttermilk	3.8	3.9	1.0
93.8	0.4	0.6	..	5.1	0.1	Whey	0.6	5.0	0.2
10.7	4.1	71.2	..	6.3	13.7	Meat scrap	66.2	..	13.4
6.0	37.4	39.5	..	6.3	10.8	Meat and bone meal	36.7	5.5	10.6
8.5	4.7	84.4	..	..	2.5	Dried blood	70.0	..	2.5
7.0	15.9	53.9	5.8	5.6	11.8	Tankage	50.1	..	11.6
10.8	29.2	48.4	..	..	11.6	Dried fish	45.0	..	11.4
8.0	64.4	23.9	..	3.4	0.3	Raw ground bone	..	..	..
15.0	4.5	6.0	29.6	41.9	3.0	Timothy hay, full bloom	3.4	43.3	1.4
14.2	4.4	5.7	28.1	44.6	3.0	Timothy hay, soon after bloom	2.5	39.2	1.5
7.0	6.8	6.8	26.5	51.2	1.8	Wheat hay	4.4	48.7	6.8
14.0	5.7	8.9	27.4	41.2	2.8	Oat hay	4.7	38.7	1.7

TABLE 2.—FOOD VALUES—*Concluded.*

Average Percentage Composition.						Kind of Feeding-stuff.	Pounds Digestible in each 100 Lb.		
Water.	Mineral Matter.	Crude Protein.	Carbohydrates.		Fat.		Protein.	Carbo-hydrates.	Fat.
			Fibre.	Starches, Sugar, etc.					
20.8	6.6	12.4	21.9	36.8	4.5	Red-clover hay in bloom	7.7	34.0	2.8
21.2	6.1	10.7	24.5	33.6	3.9	Mammoth red-clover hay	6.2	34.7	2.1
9.7	8.3	12.8	25.6	40.7	2.9	Alsike-clover hay	8.4	39.7	1.1
9.7	8.3	15.7	24.1	39.3	2.9	White-clover hay	11.5	42.2	1.5
9.6	8.6	15.2	27.2	36.6	2.8	Crimson-clover hay	10.5	34.9	1.2
9.2	8.5	17.3	25.6	38.7	2.7	Sweet-clover hay	10.0	37.0	1.5
11.9	7.0	14.9	24.2	37.8	4.3	Soy-bean hay	10.6	40.9	1.2
8.1	8.8	14.6	28.9	37.4	2.1	Alfalfa hay	10.5	40.5	0.9
4.9	14.5	23.3	13.2	41.2	3.0	Alfalfa leaves	16.3	35.9	1.3
15.0	7.3	14.8	20.4	39.5	3.0	Sanfoin hay	10.4	36.5	2.0
10.0	7.1	10.3	28.3	41.2	3.6	Oat and pea hay	7.6	41.5	1.5
15.0	7.4	12.8	26.7	35.8	2.3	Oat and vetch hay	8.3	35.8	1.8
12.9	5.5	10.1	27.6	41.3	2.6	Mixed grass and clover hay	5.8	41.8	1.2
9.6	4.2	3.4	38.1	43.4	1.3	Wheat straw	0.8	35.2	0.4
7.1	5.2	3.0	38.0	46.6	1.2	Rye straw	0.7	39.6	0.4
9.2	5.1	4.0	37.0	42.4	2.3	Oat straw	1.3	39.5	0.8
14.2	5.7	3.5	30.0	39.0	1.5	Barley straw	0.9	40.1	0.6
9.9	5.5	5.2	43.0	35.1	1.3	Buckwheat straw	1.2	37.4	0.5
10.1	5.8	4.6	40.4	37.4	1.7	Soy-bean straw	2.3	40.1	1.0
79.8	3.3	1.8	5.0	12.2	0.5	Green fodder corn	1.0	11.9	0.4
42.2	27.7	4.5	14.8	34.7	1.6	Dry fodder corn	2.5	34.6	1.2
82.2	2.5	3.4	11.2	19.3	1.4	Green oats, in milk	2.5	18.2	1.0
...	...	...	...	...	...	Green oats in bloom	1.1	12.4	0.5
70.8	2.1	4.4	8.1	13.5	1.1	Green red clover	2.4	13.6	0.7
71.8	2.7	4.8	7.4	12.3	1.0	Green Alfalfa	3.2	12.1	0.4
75.1	2.6	4.0	6.7	10.6	1.0	Green soy-bean	3.1	11.0	0.5
79.7	1.6	2.4	6.1	9.6	0.6	Green oats and peas	1.5	10.2	0.4
80.0	1.8	3.4	6.4	8.1	0.5	Green wheat and vetch	2.6	10.3	0.3
75.0	1.6	2.9	8.0	11.7	0.8	Green grass and clover mixed	2.3	14.6	0.5
79.1	0.9	2.1	0.4	17.4	0.1	Potatoes	1.1	15.7	0.1
90.9	1.1	1.4	0.9	5.5	0.2	Mangels	1.0	5.5	0.2
86.5	0.9	1.8	0.9	9.8	0.1	Sugar-beets	1.3	9.8	0.1
88.6	1.0	1.1	1.3	7.6	0.4	Carrots	0.8	7.7	0.3
90.1	0.9	1.3	1.2	6.3	0.2	Turnips	1.0	8.1	0.2
79.5	1.0	2.6	0.8	15.9	0.2	Artichokes	1.3	14.7	0.2
85.7	2.5	2.2	2.1	7.0	0.5	Kale and rape	2.0	8.2	0.2
90.0	0.8	2.6	0.9	5.5	0.2	Cabbage	2.3	5.9	0.1
73.6	2.1	2.7	7.8	12.9	0.9	Corn silage	1.4	14.2	0.7
72.0	2.6	4.2	8.4	11.6	1.2	Red-clover silage	1.5	9.2	0.5
76.0	2.4	2.5	7.2	11.1	0.8	Corn and soy-bean silage	1.6	13.2	0.7

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