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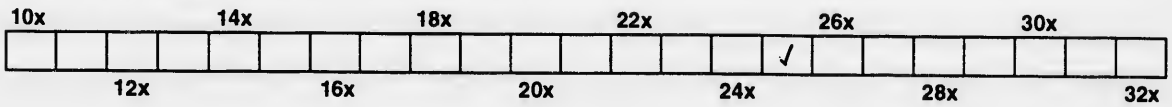

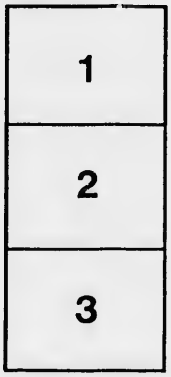

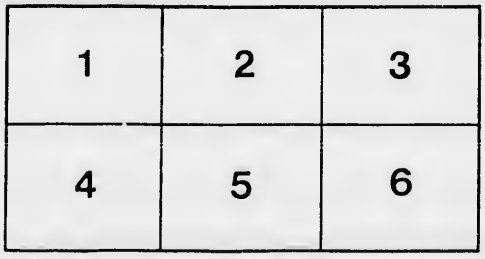

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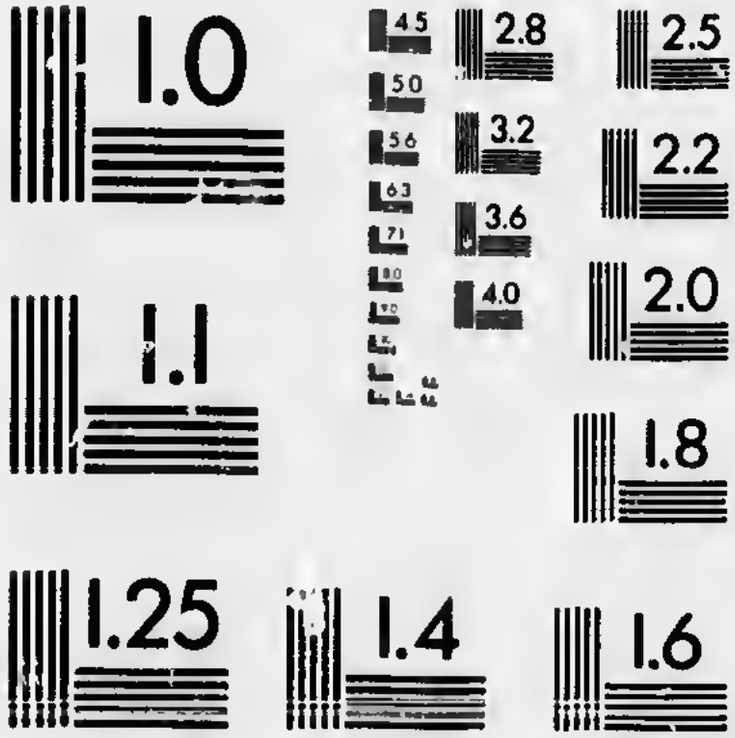

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PUBLISH

Bulletin No. I

DAIRY COWS

Their Feeding and Care

Improvement of the Herds.

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
OF THE PROVINCE OF QUEBEC.

BULLETIN NO. 1

DAIRY COWS

THEIR FEEDING AND CARE. IMPROVEMENT OF THE HERDS.

PRELIMINARY REMARKS

VITAL IMPORTANCE OF THE DAIRY INDUSTRY

Under present circumstances, the dairy industry may be said to be the only plank of safety both for our farmers remote from the markets and for many in proximity to them, and upon it they should unquestionably concentrate most of their attention.

This truth has been forced upon the comprehension of the majority of their class and, as a matter of fact, the development of that industry in Canada, and especially in the province of Quebec, has of late years been extraordinary. But there are still many laggards, who do not grasp all the importance of the change and who find themselves altogether disconcerted by it.

The increase in the production of butter and cheese has resulted in an overstocking of the Canadian markets and it has been necessary to look for an outlet abroad for a considerable portion of the butter and cheese.

Thus far, the English market has been the only one practically open to the Canadian products.

The cost of transporting these products has been reduced and the mode of transportation improved and, as it actually costs no more to send a box of

butter or a cheese on good conditions from Montreal to London, Liverpool or Glasgow than it does from one point to another of England, it will be seen that the Montreal market prices must closely follow those of the English market.

Unfortunately, many other countries are reduced to the same necessity as Canada and also send their butter and their cheese to England, with the result that the supply tends to exceed the demand there and purchasers are becoming more and more exacting and hard to please.

As the consequence of this, we observe : 1 A falling tendency in the prices of butter and cheese, which will probably become more marked ; 2 A stricter classification of products according to their quality, the first qualities obtaining very much better prices than the second qualities : not below the old prices because first qualities are, so to speak, yet the exception.

Producers are therefore compelled per force to produce only choice butter and cheese and to improve their methods of manufacture. These improvements have in view two points : 1 A general reduction of the cost of production to set off against the falling tendency in prices ; 2 Improvement of the quality to retain the market and command the highest possible prices.

Canada's competitors in the English market are Denmark, France. Holland, Germany, Australia, the United States, the Argentine Republic and England itself.

In all these countries, great efforts are being made to secure the preference. It is important therefore that Canada which has, so far, won a high place in English estimation, should not allow itself to be stripped of this market. The question is one of life or death for the agriculture of the province of Quebec in particular.

The present series of bulletins, published under the auspices of the Provincial Department of Agriculture, aims at keeping farmers, factory proprietors and, above all, manufacturers posted on the latest advances in the dairy industry and the latest requirements of the English market, to which we must necessarily conform. Some years ago, the prices of butter and cheese were higher than they are at present. If, at that time, our farmers had worked the dairy industry with as much care and knowledge as they bestow upon it now, they would certainly have cleared large profits from it ; which proves that it is better to lead the van of progress.

If prices have fallen for some time past, the methods of production have greatly improved and permit the obtaining, at the present prices of milk in the factories, of nearly as large profits as a few years ago when the prices of milk were high, but the processes of manufacture less perfect.

Moreover, if prices fall too low, the Canadians will not be the only ones to feel the effect and victory will remain with the countries best fitted for the industry and best equipped for the struggle. Now, it may be said that Canada is a true dairy country. More than any of its competitors, it enjoys the natural advantages essential to success in this branch. With a little good will on the part of the interested, its triumph should ultimately be certain.

Let our farmers and manufacturers then enter boldly on the path of progress and they will have no reason to repent their action ! The chief essentials to success are the necessary skill and intelligent and sustained work.

GENERAL REMARKS

The aim of the dairy industry is to transform on the spot the grosser products of the farm, such as hay, straw, roots, etc., which cannot be easily transported to a distance and sold advantageously, especially when remote from the markets, into products of less weight and bulk, but of greater value ; into products, so to speak, more convertible into money, such as butter and cheese.

These products may then be forwarded to the cities at less cost and with less loss of time ; their sales and the cash returns, by the factory-owners, are effected more profitably and expeditiously, because the latter keep themselves constantly posted on the current market prices and in continual relations with the large city dealers and because, owing to the importance of the transactions to be done, the latter have more dealings with them than with a single farmer visiting the city to sell a few tubs of butter or boxes of cheese. Moreover, purchases and sales by large lots are preferable for all concerned. Further, the dairy industry reduces the impoverishment of the soil to trifling proportions, a fact upon which I shall not insist notwithstanding its importance.

Consequently, the dairy industry in reality is only a means within the reach of the farmers to advantageonsly sell the products of their farms.

A person, who would undertake to make milk by purchasing all his fodder at market prices and to sell it to a creamery or a cheese factory, would, as a general rule, make but slight profits, because the price paid for milk at the factories is not high enough and because the profits realizable on the sale of such fodder would have been already realized by the dealers or farmers who sold it. But a farmer who raises his own fodder cheaply on his own land may, by its transformation by the means placed at his disposal by the dairy industry, sell it at a price always as high and often higher than that which he could obtain by selling it in its natural condition. The more cheaply he can raise his crops from the land, the greater will be his margin of profit. By reducing the cost price of his crops, he increases his chances of augmenting his profits.

The first thing therefore for a farmer to do is to raise from his land as much and as cheaply as he possibly can per acre ; but his crops must be at the same time adapted to the production of milk.

These things appear commonplace ; nevertheless, they are often misunderstood ; certain farmers leave their lands, so to speak, in fallow or do not feed their cows, on the pretext that their feeding costs too dear, and then complain that the dairy industry does not pay, which is a complete mistake. If they stated that bad farming does not pay, they would more fully tell the truth.

If the economical production of the most profitable raw materials for the manufacture of milk — that is to say, farming with a view to the dairy industry, be left aside — that industry still involves a series of other important operations, which we propose to briefly consider and which are :

1. The conversion of these raw materials into milk.

2. The care of milk from the moment of milking to that of its delivery at the factories and its receipt by the manufacturers ;

3. Cheese making ;

4. Butter making.

5. Utilization of the residues of the dairy ;

6. Keeping transportation, inspection and sale of butter and cheese.

MILCH COWS

Number of Cows that should be kept on a Farm.— The most interesting and important factor in the transformation of the crops into milk is certainly the milch cow.

The annual quantity of milk obtainable from a farm *depends above all upon the quantity of fodder raised from the land.*

As a general rule, no fodder or other feed should be bought ; but, as a farmer may have too much of certain kinds of fodder and too little of other feed, a part of the surplus fodder may be sold when a favorable opportunity offers, and bran, oilcake etc., be purchased with the proceeds. In reality, this is only an exchange, which takes it for granted that there is always on the farm an excess in one or two crops as compared with the others.

All purchases, not possessing this special character of exchange of foods, are as a general thing not to be commended, although circumstances may arise in which this may be done to advantage.

Whence it follows that the number of cows to be kept on a farm depends like the milk production, upon the average quantity of the crops that can be raised from the land. The least possible number of these animals to consume these crops should be kept and they must be well fed from one end of the year to the other. In a word, *the transformation of the crops into milk should be effected with the smallest possible number of cows.*

This is a principle, which should never be lost sight of.

Ten cows, well selected and well fed, will give, upon the same quantity of fodder, more milk than twenty ordinary cows.

In fact, the ration of each cow may be divided into two parts ; the first part goes to sustain all the vital functions of the animal and the second is directly appropriatad to milk production. The first part of the ration,

which is absolutely necessary, is termed the *ration of maintenance* and the second the *ration of production.* It will be readily understood therefore that if, for 10 cows, only 10 rations of maintenance and 10 rations of production are needed, it will take 20 rations of maintenance and 20 half rations of production for 20 cows each producing one half less milk. As the rations of maintenance do not go to the direct production of milk, it will be seen that in the first case, 10 rations of maintenance have to be given to 10 rations of production and, in the second, 20 rations of maintenance to 10 rations of production. This facts shows the saving there is in reducing as much as possible the number of cows to consume a given quantity of fodder.

Objection.—Still an objection may be raised. According to the system actually followed by a great many of the farmers of this province, the cows only give milk during the summer, the period of the year during which they are on pasture and when their feed apparently costs almost nothing. During this period, their yield of milk pays well for the food which they receive, and during the winter, the season when the feeding of cattle is so dear that there seems to be little advantage in producing milk, they receive only a simple keeping ration reduced to a minimum. At first sight, this system would seem to be reasonable and calls for little labor, but :

1. With this method, great development must be given to the pastures ; a large farm is requisite and, if the land happens to be dear , a much larger investment of capital becomes necessary.

2. Extensive and poorly kept pastures yield annually a relatively small crop ; they are more subject to freezing in winter and to burning up during the heats of summer, and the cost of keeping animals on such pastures is much higher than it seems at first glance, their yield being relatively very small ; the revenuesof the farm are more uncertain and variable.

3. On a farm cultivated for heavy fodder crops, either in grain or in roots, the returns from the land are five times heavier than from pastures ; the labor demanded by such cropping is therefore remunerated five times more and its cost price can be reduced so low that the production of milk, even in winter, becomes profitable.

4. The cows, which have received during the winter only a small keeping ration, require for some time at the beginning of the summer, in order to

restore them to good condition, a larger keeping ration which is so much lost as far as milk production is concerned.

All these reasons and many others show that the old method of feeding is completely out of date and should be relinquished by good farmers, who desire to derive a handsome revenue from the dairy industry.

It should not be adopted—and even then only by improving it—except where the land has not yet been or cannot be brought, owing to its nature, into a condition of tilth suited to the raising of good crops of grain, fodders or roots &c., &c., in other words, in the case of forced extensive farming, on new lands for instance. Wherever *extensive* (heavy cropping) or *semi-extensive* farming is possible, the method, which consists in feeding the cows to the maximum and in reducing the extent of the pastures as well as increasing that of the hoed and heavy yielding fodder crops, should be followed.

Qualities of a Good Dairy Cow.—What is a good dairy cow? By good dairy cow is meant one that gives in the course of the year the greatest quantity of the richest milk upon the least possible feed.

A cow, which yields a very large quantity of milk for some time after calving but whose milk production is not kept up during the course of the year, cannot be always characterized as a good dairy cow; on the contrary, a cow, which yields a good average quantity of milk daily, but which keeps it up with relative steadiness throughout the year, may often be considered an excellent cow.

A cow, which gives a large quantity of milk, if the milk be poor, cannot always be rated as a good cow, when the milk is taken to a creamery or a cheese factory; but if the milk be sold in a city, it may be considered excellent, provided always that it be not too poor.

A cow giving annually a large quantity of milk would not be the best if it consumed, per 100 lbs of milk, relatively more fodder than another cow with a small annual yield.

In order to surely estimate the value of a herd, the most important thing

to know is the annual quantity of butter, cheese or even merely of milk, in the different cases, produced *per ton of fodder raised on the farm.*

And when it is sought to ascertain the value of a cow or the cost price of her milk, a mistake is often made ; it is deemed sufficient to calculate the milk production during a determinate period of the year and to compare it with the consumption of fodder during the same time. For, a cow only yielding milk during a part of the year, say, 6, 8 or 10 months, eats daily, from one end of the year to the other, and its value cannot be properly determined except by comparing the quantity or the value of the milk given between one calving and another with the quantity or the value of the feed consumed during the entire year.

When the milk is taken to a creamery or cheese factory, the milk of different cows being mixed, the butter or cheese production of a herd cannot be ascertained and no information can be had as to each of the cows in particular.

It such case, apart from weighing the milk, recourse must be had to one of the known processes and especially to the babcock, to determine the richness of each cow's milk. This is the way to proceed :

Tests of Dairy Cows.— The pails used for milking should be weighed empty and the weight should be branded indelibly on them in a conspicuous place.

Each time that a cow is milked, the pail containing her milk should be immediately weighed before being emptied into the can and the weight marked down up on a slate hanging to the wall near the scales. Opposite this weight, that of the empty pail is marked. This operation, which is very simple, need only take a few instants for each cow. An ordinary steelyard should be preferred. These scales are inexpensive and relatively accurate. They can be removed easily to every place where the milking is done. By the regular use of this means, the weight of each cow's annual yield of milk can be obtained exactly. The milking pail graduated in lbs may also be advantageously used. If a little less accuracy is needed it will be found sufficient to weigh the milk of the cows only on one day in the week and, by multiplying the figure obtained by seven, the weight of the milk given during the week will be approximately ascertained.

To determine the richness of each cow's milk, there should be a small bottle kept for each, bearing its number or name. Each day, after taking the weight and when the milk has rested a little, a sample is chosen from the milk of each, care being used to completely fill the little measure employed for the purpose and to take up any of the froth with it. These samples should be analyzed by *the method of compound samples* which will be described in another bulletin and the measure used to get the samples should be similar to that employed for the same purpose in the factories.

As all farmers do not or cannot have babcocks or possess the necessary time to make these tests, they might arrange with the manufacturer at the cheese factory or creamery, to which they bring their milk, to undertake to make the tests for a reasonable remuneration. Every manufacturer should be perfectly acquainted with the use of the babcock and every factory should be provided with one of these apparatus.

As in the case of the weighing, when less accuracy is desired, samples of the milk of the different cows may be taken and tested only every eight or fifteen days, adopting the figure obtained as the average richness of the milk for the week or the fortnight.

With the knowledge of the annual milk yield of each cow and its average richness, as well as of the quantity of food consumed by each cow during the year, it is easy to determine the animals that should be kept and those that should be got rid of as soon as possible.

When the milk is sold merely in the cities, the test with the babcock may be dispensed with and simply weighing the milk will suffice.

Some cows give very little milk for the quantity of feed that they consume, while others give an enormous quantity. I refer, of course, only to well fed cows.

Many cows, as is unfortunately often the case, give very little and bad milk because they are poorly fed or because they are well fed only during a relatively brief period of the year.

Before passing judgment on the value of different cows, they must first be well fed and, supposing them to be so, considerable differences will, in that case, be found between them.

Improvement of the Dairy Herds.—There are two principal means to improve a herd. The first consists in buying right and left the best cows by paying the price asked for them and in selling off the bad ones. This way, generally speaking, calls for a large outlay and farmers thereby run the risk of introducing disease among their herds.

By the second means, the first thing done is to get rid of the worst cows in the stable and then to buy two or three good ones of the breed desired, together with a first class bull of the same breed, which is the most important thing. The cows purchased should be at least at their second or third calving, so that they may be properly judged ; they should still be young enough to be susceptible of improvement and to return a profit for some years

The improvement of the herd thus formed is then begun by the selection and the rearing of the best calves. A systematic test should be made of the milk of all the cows, as already explained, and all that do not give satisfaction should be weeded out and replaced by the best of the young heifers. Whenever opportunity offers, cows should be purchased that will raise the standard of the herd.

If the breed chosen be suitable, it will be quickly seen that the more blood of this kind there is in the herd the better.

In starting with half breeds, (the product of a thorough-bred bull and of cows of mixed breed), three quarter bred animals will be obtained, which will be better for the dairy than half bred animals if the bull be what he should be and if the calves be well selected. With the latter and with good bulls at the third generation, another step forward will be made from the standpoint of economical milk production and this system should be continued until the blood of the herd becomes practically pure. Then only may the most profitable results be anticipated.

Whenever possible, the cows should be registered. In the raising or purchase of cows, the individual qualities of the ancestors and those which are hereditary in the breed to which the animal belongs should not be exclu-

sively looked to. The animal itself must be studied from the point of view especially of its dairy qualities.

A minimum of fat to be secured annually per cow should be adopted for the whole herd and all which yield a quantity less than this minimum should be sold off. Little by little this minimum should be raised as the herd improves.

In this way, such cows only as yield an economical supply of milk will be obtained in the long run. All the others will be weeded out.

It would be well to keep a record of the names of the cows, the dates of their birth, their serving and their successive calvings and of their annual production of milk, butter or cheese, as well as of all information relative to their pedigree. All this information, which is easily collected, is of great value and every farmer should be very careful to obtain it.

To encourage farmers to improve their herds by selection, the Department of Agriculture of the Province of Quebec offers every year to the agricultural societies a grant for special competitions in dairy cows.

It is much to be desired that our farmers should begin this good work as quickly as possible.

Choice of Bulls.— For a farmer who keeps up and improves his herd by the raising of calves, the choice of the bull is the most important consideration. The bull is the groundwork of the herd. He is generally said to be the lord of the herd. Each calf added to it derives from the bull one half of its blood and this is often the most important half. And since it is upon the bull that the improvement of the average quantity of the herd depends, he must be carefully chosen. This is especially true when the cows already have some blood.

Upon the cow especially depends the size, form, constitution and productive capacity of the heifers to which she gives birth. The special dairy qualities of these heifers, as well as the natural capacity to yield a richer milk than their dam, is derived from the thorough-bred bull.

A cow may drop very poor calves, though she may be an excellent milker herself and, in such case, the consequences are not very serious; but, if the bull be lacking in any of the essential qualities or be not good, they assume a much graver character and the entire herd, as well as its increase, may greatly suffer therefrom.

The services of the best available bull should always be sought. In order to make a choice, it is essential to learn as thoroughly as possible the animal's history and antecedents, especially on the the side of his nearest female ancestors. The bulls used should be reputed for their good transmission of their qualities. A frequent mistake made by farmers is to employ bulls that are too young and before their reproductive qualities have been demonstrated, because, at that age, they are cheaper and easier to keep. It is better to buy a bull of a certain age, whose progeniture proves its value, than a young bull even with a good pedigree, but without a past. When a good bull is secured, he should be retained and used as long as he is strong and preserves his qualities. There is but one objection to this: this is that old bulls become dangerous in the long run, but, with a little care and practice, this is only a secondary question.

Choice of Breed.— Good dairy cows may be found in a great many breeds. Some are even found among common cows. Nevertheless certain breeds are famous for the large percentage of good cows which they turn out and the special qualities of these cows. However, here are on this head a few facts culled from experience which it is important to not forget:

A farmer should choose his cows from the strictly dairy breeds. Some persons specially recommend cows which produce both beef and milk; but the most practical authorities, in view of the low price of beef, advise that in this country the choice be made from the dairy breeds.

In the cities, however, where only the milk is sold, many milk-men give the preference to cows with a tendency to fatten, as they frequently renew their stock and sell their animals for slaughtering. But, in this case, such cows are generally fed very heavily and, so to speak, industrially; they are also kept all the time in the stable, which exposes them to contract diseases and necessitates their frequent renewal. In the rural districts, the circumstances are quite different, and it is preferable to pay more attention to the health of the cows and to keep them as long as they are profitable.

Among the class of exclusively dairy cows, the most varied qualities are met with. Some animals are remarkable for their yield of milk, and others for the good quality and richness of their milk and the latter are cows suitable for the economical production of butter. Others again combine quantity with quality and are profitable under certain circumstances. Some cows are very active and support themselves well on the poorest pastures in summer and readily consume the coarsest fodders in winter, while giving an abundant flow of rich milk. Others, to give milk profitably, require to be fed in a special way upon well combined rations. Some cows yield an abundant quantity of milk during a relatively short time ; others give a medium yield thonghout the whole year.

As a general rule, these different qualities belong each to a particular breed ; a farmer thus can always, by selecting from these different breeds, secure for his herd the qualities which the circumstances of his case necessitate. In fact, it is easy to determine the best cows for a given region either for the production of milk, for the production of butter or for the production of cream.

For cheese, there is no special breed. The best cows for butter making are also the best for cheese. This fact has been thoroughly proven and is now generally admitted.

Characteristics of a Good Dairy Cow.—When it is necessary to choose a dairy cow, the animal should be carefully examined in all its parts in order to determine how nearly each of them comes to perfection.

Here, in brief, we give the general marks by which a good dairy cow can be recognized : The veins and especially the milk veins should be big and knotty ; udder well developed and very pliant, contracting well after milking and covered with smooth skin and hair ; the teats well apart and inclined outwards ; the hind legs well apart ; breast well developed and indicating a good constitution ; physiognomy as feminine as possible ; skin smooth and pliable ; head and horns fine ; nature mild, good and peaceable.

A medium dairy cow is known by the same marks, but the veins are not so well developed.

A poor dairy cow will have the legs and especially the thighs coarse and fleshy ; narrow hindquarters ; the skin, and particularly that of the udder, coarse, thick and hard ; the udder covered with coarse hairs and the veins but slightly developed.

A good bull should have as masculine an appearance as possible, a big neck, wicked eyes. forehead broad and covered with hair, a fierce expression, fore part of the body very strong and the hind part narrower, just the opposite of what the cow should be in that particular.

Different Breeds of Dairy Cows.—There are many breeds of dairy cows such as the Dairy Shorthorn, the Devon, the Red Poll, the Ayrshire, the Kerry, the Jersey, the Guernsey, the Dutch Belted, the Brown Swiss, the American Holderness, the Canadian. But these different breeds are not all adapted to the province of Quebec, where a good number of them have already been well tested.

The best known breeds in this province, which give the best results in the way of supplying milk to the butter and cheese factories in the rural districts, are the Shorthorn Dairy, the Jersey, the Guernsey, the Ayrshire and the Canadian. The Brown Swiss, the Dutch Belted and the American Holderness have not yet been thoroughly tried in this country. The Holsteins suit well for supplying milk to the towns.

Shorthorn.—There are two varieties of Shorthorns which should not be confounded together, the Dairy Shorthorn and the Shorthorns which fatten easily. We propose to refer here only to the first.

The Shorthorns are large-sized cows, roan, red, red and white, roan and white in color ; average weight 1350 lbs ; mean annual production of milk—6000 lbs : quality of milk ; 3.7% of fatty matter and of 9 % of non-fatty solids. They give excellent milk for cheese-making and can often be fattened when no longer good for milk.

Ayrshire.—Cow of medium size ; average weight 1000 lbs, color red and white, brown and white, yellow and white, black and white, white generally prodominating ; average quantity of milk : 5,500 lbs ; quality of milk, 3.8% of fatty matter and 8.95% of non-fatty solids. These cows stand the cold well, and their milk produces a butter and a cheese of superior quality. Their

yield of milk is regular and varies little throughout the year; they can be advantageously crossed with the common cows, the Shorthorns and the Jerseys.

Jersey.— Cow small-sized; elegant, color fawn, silver grey, mouse; the shades are very varied. Average weight 830 lbs; average quantity of milk, 4,500 lbs; richness in medium fatty matter, 4.64% and in non fatty solids 9.32% It is one of the best dairy cows. As will be seen, its milk is very rich in fatty

Massena.—Type of Jersey cow.

matter. It makes excellent butter. Some farmers, however pretend that the Jerseys are not hardy enough for the climate of this province and easily become tuberculous.

Guernsey.— Medium sized cow, average weight 1000 lbs; color orange

and white and orange. Quantity of milk 5200 lbs ; quality of milk : fatty matter, 4.55 %, non fatty solids 9.55 %. Good dairy cow.

Fantine 2nd.—Type of Guernsey cow.

Holstein.— This cow is generally of large stature and its average weight exceeds 1262 lbs. Color : black and white or grey and white. These

Pauline Paul.—Holstein cow.

cows usually give plenty of milk, but milk that is comparatively poor. They are suitable for stables whose milk is sold in towns. They grow and attain maturity rapidly.

For information concerning Holsteins apply to the Holstein Friesian Association of America, Yorkville N. Y.

Canadian.—This is one of the best breeds for the Province where it seems to have been formed as it were.

Here is what is said of it by Dr. J. A. Couture D. V. S. secretary of the Herd Book of that breed and one of those who have contributed the most to make it known :

Countess of St-Norbert.— Type of Canadian cow

" Canadian cows are small, weigh about 700 lbs and are of excellent character. They are the hardiest and easiest to feed. No tuberculosis is found in them. They have large teats and consequently are easily milked.

" They are generally black or black with fawn streaks on the back and a fawn or grey ring round the muzzle ; brown with black points or with brown or even yellowish spots. These are the colors admitted for the registration of the cows. The bulls must be black with or without fawn streaks, because it is desired to obtain a uniform black color as soon as possible The horns are black or white with black tips.

" They are the best milkers for the farmers of the Province of Quebec who are endowed only with ordinary means. They do not yield as much milk as the Holsteins or even as much as some Ayrshires on certain days

or in certain weeks, but from calving to calving they give an average yield of milk that is astonishing. The difference in their favor is still more striking when we consider the cost of their maintenance.

"Mr. Odilon R[illegible]haud, of St Denis, Kamouraska, P. Q., who owns 24 cows of this breed obtained the following result from the 12th May 1892 to the 12th May 1893 :

REVENUE :

63,193 lbs of milk taken to the cheese factory	$531 19
1616 lbs of butter made in the house at 20 c. per lbs	323 20
9125 lbs of milk consumed in the house at 12 c. per gallon.	109 50
3 calves fattened on milk	12 00
6 calves fed for some time on milk	18 00
Total revenue	$993 89
Gross revenue per cow	41 41

EXPENDITURE :

4480 bundles of hay at $6 per 100	$268 80
2240 " of straw at $3 "	67 20
4800 lbs of bran at 84 cents	40 32
Pasturage—$5.00 per head	120 00
Total expenditure	$496 32

Net revenue : $497.57.
Gross expenditure per head : $20.68.
Net revenue per head : $20.73.

"This farmer had neither straw-cutter nor ensilage. He gave his cows neither grain nor oil-cake ; they got only dry hay, straw and a little bran.

"Some readers may perhaps find that the yield of milk is not high, but let them consider the food given.

" Mr. Nemèze Garneau, M. P. P., of Ste Foye, near Quebec, has a fine herd of Canadian cows.

" In 1895, five of his cows, among which were an old cow of 15 years and a two year old heifer, gave in eight months, from the 1st February to the 1st October, 18,803 lbs of milk. If we count the old cow and the heifer as one head, we find that the average yield of these five cows was about 20 lbs per day. The milk tested by the Babcock test in August gave 5¼ % of fat. It yielded 987 lbs of butter which, at 20 cents, fetched $197.40 or $39.48 for each cow.

" The entire herd consisted in 1895 of 12 head : a bull, five cows, four heifers and two calves.

" The cost of feeding this herd during the winter was :

2 bushels of mangolds at 12½ cents	$ 0 25
12 lbs of bran at 80 cents	0 09 6/10
11 lbs hay at 7 cents	0 77
6 bundles of straw at 2½ cents	0 15
Total cost of food per day and for 12 head	$ 1 26 6/10

(say 11 cents per head).

" During the summer, the five cows above mentioned had only five acres of pasture and nothing more. The general result was as follows :

Expenditure :

4 winter months at 11 cents per day, say $13.20 per cow and for the five	$ 66 00
4 summer months at $2.00 per month and per head, say $8 per cow and for the five	40 00
Total	$ 106 00

Receipts :

987 lbs of butter at 20 cents		$197 60
Net profit for the five cows	$ 91 60	
Gross expenditure per head for 8 months	21 20	
Net profit per head for 8 months	18 32	

" When the Canadian cow is well fed, she repays liberally what has been spent on her food. At the Hospital of the Sacred Heart, in Quebec, the cow called Première (1712) calved on the 28th August 1892 at the age of 6 years, was milked up to the 15th July 1893, and calved again on the 31st of that month. During those 318 days, she gave 11310 lbs of milk, an average of 35 lbs per day. This cow weighed 675 lbs. Her ration consisted of :

Chopped hay	10 lbs
Chopped straw	5 "
Ensilage	20 "
Bran	2 "
Cotton cake and ground grain	2 "

the whole mixed together and fermented 24 hours beforehand. During all that time the cow was kept constantly stabled.

" The cow called Azilda of Levis (956) belonging to Mr. Némèze Garneau, M. P. P. for the county of Quebec, residing at Ste-Foye, gave 8500 lbs of milk during 10 ½ months ; 5 ½ % of butter per 100 lbs of milk, up to the 16th June 1896 at which date milk is generally poor. She was put out to pasture in summer and received every day during the winter time 15 lbs of dry hay and 4 lbs of grain (a mixture of oats, bran and oil-cake). This cow took two first prizes and a medal at the last provincial exhibition in Quebec.

" A Canadian cow that does not give at least 6000 lbs of milk per annum with sufficient food cannot be considered a good cow.

" As regards quality, the milk of Canadian cows gives from 4 to 5 ½ per cent of fat by the Babcock test. In some exceptional cases as much as from 6 to 6 ½ has been found. The richness of their milk seldom falls below 4 per cent.

" For information respecting this breed, apply to Dr J. A. Couture, D. V. S., 49, Garden Street, Quebec."

At present, the best farmers recommend for the province of Quebec, the Canadian, Guernsey and Ayrshire breeds. Although the others have yielded good results in certain cases, these results are not as general as with the three breeds above mentioned. It must also be observed that if the Jerseys, for instance, are not sufficiently hardy to resist the cold in the northern sections,

they may however give good results in the southern. For colder regions, the Canadian cow is the best. In those regions the farmers should endeavor to form improved herds of them.

Yield of milk and butter by milch cows.—A good milch cow should give at least 5000 lbs of milk during each period of lactation. Nevertheless, as the quality of the milk varies considerably, it is better in judging a cow to rely upon the quantity of fat produced during the period of lactation than upon the quantity to the milk.

The time comprised between calving and the moment when a cow becomes dry, is called the period of lactation. The average duration of a period of lactation is abont 300 days and the cow remains dry during the six or eight following weeks.

Three quarters of a pound of fat during an average of 300 days, say about 225 lbs of fat, may be considered the mean quantity. Nevertheless, many farmers in other countries aim at getting from all the adult cows of their herds, 365 lbs of fat, being one pound for each day in the year, as an average. This should be attempted in this province also. To obtain it, a cow whose milk gives 4% must yield a yearly average of 25 lbs of milk per diem ; a cow that gives milk with 3 per cent must yield an average of 33⅓ per diem ; and one that yields milk containing 5% of fat must yield an average of 20 lbs.

The yield of milk is generally the greatest a short time after calving ; it attains its maximum during the first two months following it. Afterwards it decreases gradually. The rapidity with which it decreases depends upon the natural qualities of the cow and the manner in which she is fed. The average decrease in the case of good, well-fed cows, is generally between half and three quarters of a pound per head per ten days. When cows are badly fed and are given but a small quantity of concentrated food, the decrease is more marked and frequently exceeds one pound of milk per head per ten days. It is more marked towards the end of the period of lactation than at the beginning; it is also more marked in cows possessing but slightly developed milking qualities than in good milkers.

A cow is deemed at her best between her fifth and seventh years ; the constitutional strength of the animal, the method of feeding it and the general

care given, determine the period of time during which it may be kept to advantage.

The quality of the milk yielded by each cow individually remains pretty uniform during the greater portion of the period of lactation and is with difficulty changed in a permanent manner by feeding, if the cow be already well-fed, or through any outward condition. During the latter months of the period of lactation, when the yield of milk decreases more rapidly than before, the quality of the milk generally improves to a certain extent. With regard to fat, the average variation is one per cent more. Variations of more than one per cent in the fat may sometimes occur from one day to another or from one milking to another for certain cows in particular, and under those circumstances variations of one per cent are often observed. The average quality of milk of an entire herd is much more constant and the percentage of fat hardly varies more than two tenths of one per cent from one day to another ; in exceptional cases the variation attains one per cent.

In the case of good, well-fed milch cows, the percentage of total solids in the milk increases proportionately as the period of lactation advances and it is not only the proportion of fat in the milk, but also its proportion in the total solids, that increases.

We have but little information with regard to the manner in which the others constituents of the milk act during the period of lactation. Nevertheless, S. Kühn has found, in the case of cows on which he experimented, that the percentage of proteine and in particular that of caseine, increased toward the end of the period of lactation while that of the albumen and sugar of milk had a tendency to decrease.

The quantity of milk per period of lactation may increase, as a rule, during the first eight years of the cow's life and afterwards decrease. The age at which it is no longer advantageous to keep a cow depends on the breed, the individual character of the animal and above all on the manner in which it is fed and cared for.

The variation in the composition of the milk with the age of the cow has not yet been fully determined. Nevertheless, in many instances, a decrease with increasing age has been observed in the total solids and particularly in the richness in fat.

Examples of results obtained with milch-cows.— The quantity of food which milch cows can advantageously transform into milk is much greater than many farmers imagine and it is advisable to give some examples here :

A Holstein Friesian, Pietertge 2nd, gave 30318½ lbs of milk in 365 days.

A Guernsey, Lily of Alexander, gave 12855½ lbs in 365 days.

A Holstein Friesian, Pauline Paul, gave in one year 1153$\frac{63}{64}$ lbs of butter. Her milk yielded one pound of butter to every 16.18 lbs of milk.

A Jersey, Signal's Lily Flag, gave 1047$\frac{3}{64}$ lbs of butter in one year from 11,339 lbs of milk.

During a special public competition covering three days at the Chicago Exhibition in 1891, to which all cows were admitted for which an application was made, Brienz, a Swiss cow 11 years old and weighing 1395 lbs, gave in one day 81.70 lbs of milk and this milk showed an average richness of 3.81%, representing a product of 3.11 lbs of fat per day.

In England, the Dairymen's Association exacts the following yearly quantities of milk from the cows of various breeds registered by it.

Breeds	Weight of milk to be yielded during a period of lactation not exceeding 11 months and per cow.	Butter fat yielded each day (average of 2 analyses.)
	lbs.	
Shorthorn	8500	1.25
Jersey	6000	1.25
Guernsey	6000	1.25
Ayrshire	7500	1.00
Red Polled	7000	1.00
Kerry and Dexter Kerry	4500	0.75
Dutch (Holstein)	8500	1.00

For grade cows the quantities exacted are the averages of the thorough bred cows whence they have sprung. No animal is admitted whose milk contains less than 12% of solids on the testing of any sample.

In Canada there are some good herds of milch cows. That of Mrs. Jones, of Brockville, Ont., is justly celebrated.

One of her cows, Massena, aged 16, a thoroughbred Jersey, gave birth in the year 1892 to two calves and yielded 8290½ lbs of milk from which 654½ lbs of butter were made during the period of lactation between those two calvings. During that time this cow made a railway journey of 1100 miles and remained three weeks at the Chicago Exhibition, without receiving too great an abundance of food. During the two months previous to the second calving she received no grain. For nineteen weeks previous to the same, she gave an average of 9¼ lbs of butter per week. Throughout the period of gestation up to the seven last weeks, during which she got only light bran mashes, it took only 11½ lbs of her milk to make a pound of butter. During the first six months only of that period of lactation she gave 5413½ lbs of milk which produced 416 lbs 10 oz. of splendid butter.

The other cows of the same herd of Jerseys gave in 1892 from 14 to 23 lbs of butter per week.

In Ontario, it is recommended that no cow be kept that gives less than 6.000 lbs of milk or 285 lbs of butter a year. Cows giving less are far from being considered advantageous to keep.

In the Province of Quebec, there are some good herds and good cows scattered here and there. The average for the Province is very low, from 2500 to 3000 lbs per annum and per cow, but it is rapidly improving and the above information respecting the capacity of milch cows is given with the view of inducing farmers to devote themselves still more actively to the improvement of their herds and cows.

One of the herds in this Province that deserves to be mentioned is that belonging to Mr. Roach, of Abbottsford, in the county of Rouville. It consists of twelve Holstein Friesians and the following figures show the milk yield of that herd from the 1st May 1895 to the 1st May 1896. They are taken from the books of the creamery at Abbottsford to which the milk was sold.

	lbs		lbs
		Brought forward	46,585
May	8615	November	6688
June	9001	December	7523
July	9988	January	10,092
August	7241	February	7241
September	5300	March	7987
October	6440	April	6969
Carried over	46,585	Total yield for the year	95,080

Being an average of 7923 lbs per cow. The average richness of this milk was 3.7% representing 293 lbs of fat per cow.

The prices of butter, cheese and milk are very low at the present time and the use of good cows with the decreased cost of crops are the most powerful means of raising the proportion of profits.

Classification of the food of milch cows.—The fodder and other food for cows may be classified, with reference to the yield of milk, according to their richness: 1. in nitrogenous elements, analogous to the albumen of eggs, known under the name of " albuminoids " or " proteine "; 2. in fatty substances; 3. in hydrocarbonate elements easily digestible, analogous to starch and to sugar, which are classed under the name of " sugars "; 4. in fibrous hydrocarbonate elements digested with difficulty, analogons to woody fibre (cellulose) and called fibres; 5. according to their richness in water.

Those that contain a large quantity of proteine, such as cotton cake, are known as *concentrated foods.*

Those that contain much water are known as *watery foods.*

Those that contain much fibre are known as *fibrous foods.*

The following is a classification of the different kinds of foods for milch cows which may be referred to when it is necessary to combine rations and to substitute one food for another in a ration.

1.— Food deficient in albuminoids and rich in fibre : straw of various kinds ;

2.— Watery food, normally rich in albuminoids (without taking the water into consideration) : grasses, green fodder, brewer's grains ;

3.— Watery food, deficient in proteine, rich in hydrates of carbon : various roots, cabbages, potatoes ;

4.— Dry food, normally rich in albuminoids, hydrates of carbon and fatty substances : clover hay, meadow hay and other kinds of hay, not too coarse ;

5.— Food very rich in albuminoids (concentrated food) and rather rich in fatty substances : cotton and linseed in cakes and ground ;

6.— Food rich in albuminoids and in hydrates of carbon : peas, beans ;

7.— Food moderately rich in albuminoids and in hydrates of carbon : grain, wheat, barley, oats, rye, Indian corn ;

8.— Food rich in fatty substances and in albuminoids : linseed.

Calculation of rations. Dry substances and ashes.— When fodder or food of any kind is dried by heat we get what is called the dry substance of such fodder or food.

When fodder or food of any kind is completely burned, we get what is commonly called *ashes*. These ashes contain all the mineral substance of the calcined fodder or food.

Although the mineral portion of the ration plays an important part in the food of cattle, no heed is paid to it as a rule because the food is nearly always sufficiently provided with these elements to prevent the animals from being deprived of them and moreover it is rather difficult to add any to the ration which would be directly assimilable by them.

Fodder is deficient in the necessary mineral elements solely when it grows in poor soil which is itself deficient in mineral elements. There is but one thing to be done in that case : to enrich the soil itself by chemical fertilizers. Lime is the element that is generally wanting in the fodder of this province.

Digestibility of foods —The composition of the difierent kinds of food varies greatly and consequently, in order that they may produce their full effect, it is necessary, as a rule, that they be combined in such manner as to complete one another.

. Everything that is absorbed by the cattle is not completely assimilable and a portion of their food is found undigested in their excrements.

The percentage digested is called the *co-efficient of digestibility* or merely the *digestibility* of the food. That portion which is digested and assimiliated serves for producing the milk and meat, for maintaining the animal's temperature &c ; the remainder is useless and returns to the earth in the shape of manure.

The average digestibility of the dry substance of the different foods given to cows is very variable according to the nature of such foods. From experiments made in the United States it seems to vary between 50% and 93%.

But in any one food the various components are not all digested as completely : thus in the case of Indian corn consumed when green, only 68% of the whole dry substance is digested and in this dry substance the ashes are digested only to the extent of 35% ; the albuminoids 61% ; fibres 61% ; carbohydrates 74% and fats 74%.

As a rule, according to a series of experiments made at the experimental farms in the United States, the digestibility of the ashes of the foods experimented upon varied between 10% and 90% ; that of proteine between 10% and 90% ; that of fibres between 25% and 90% ; that of carbo-hydrates between 50% and 100% and that of the fatty substances between 50% and 100%.

The digestibility of the foods varies considerably according to the foods themselves *and their combination in the rations.* It is precisely for this reason that the composition of the rations is so important and so difficult a matter. In certain well combined rations the digestibility of a fodder may be considerable while it would be slight if such fodder were mixed with other badly chosen elements.

It is generally admitted that the fibres and fibrous foods are the least digestible while those containing much hydrates of carbon (sugars, starches)

are very digestible. The fibres are better digested when the quantity of hydrates of carbon is slight in a food or in a ration than when it is great. The various food components are most digestible in roots and least digestible in straws generally.

In calculating the digestibility, no account is taken of the water in those foods because, generally speaking, water may be looked upon as being always completely digested. Nevertheless, it will be observed that the most watery foods, such as roots, are more easily digested than dry foods.

Nutritive ratio.—To derive the greatest possible benefit from the crops grown on a farm, they must therefore be made as digestible as possible for the cows and other animals that consume them.

Now experience has shown that in order to attain this end, especially for milch cows, it is necessary that the weight of the digestible albuminoids in a specific ration and the aggregate of the hydrates of carbon and digestible fats in the same ration be in a certain proportion varying from $\frac{1}{4}$ to $\frac{1}{7}$. This is what is called the *nutritive ratio* of the ration. This nutritive ratio of $\frac{1}{4}$ to $\frac{1}{7}$ is about that of good hay (the partly dried substance of grass) and if the soil could economically produce grass and good hay in large quantities for many years without becoming exhausted and becoming full of weeds, the most natural food for cows would be grass or good hay. But, in order to maintain the richness of the soil as well as to increase the certainty and yield of the crops and to reduce their cost, we are obliged to alternate and vary them. We are compelled to combine the rations out of fodders of various kinds, roots, and grain from the various crops so obtained in order that their average composition may approach that of grass or of good hay, leaving out water.

Quantity of food necessary for cows.—To calculate the weight of food to be given to cows we take no account of the water but merely of the completely dry substance of the foods.

The theory resulting from many experiments, as well as the practice of the best farmers, has shown that cows consume on an average from 20 to 30

lbs of dry substances for every 100 lbs of live weight according to the quantity of milk they give. This is a first basis for calculating the quantity of food necessary for cows.

If we take the average of the rations adopted by 15 of the best farmers of Wisconsin, in 1891-92, we find that their cows received a daily ration of 26 lbs of *dry substance* for every 1000 lbs of live weight, whereof

Nitrogenous elements (albuminoids)	2.20 lbs
Hydrates of carbon (without starch)	13.55 "
Fatty substances	0.76 "
Making a total of	16.51 lbs

were digestible out of the 26 lbs. With this ration they obtained that year an average of 5,792 lbs of milk per cow, and this milk gave 290 lbs of butter per cow.

These figures agree fairly with those given by Kühn and Wolfe, two German savants who are considered authorities respecting the scientific feeding of cattle. We think that the farmers of this province might take these figures as a basis for the quantity of food to be given to their cows.

Method of calculation.—Taking for granted all that has been said above respecting the nature of foods, their digestibility, the nutritive ratio and the quantity of dry substances to be given to the cows every day for consumption, it will be easy to make up good rations out of the crops obtained from the farm.

For this purpose we must use the tables showing the composition of fodders and other foods, indicating for each of them the weights of the various nutritive elements composing them, as well as that of their dry substance and the probable digestibility of these foods and of their elements. These tables are to be found in most of the works on farming and dairying and these tables are accompanied by examples of calculations of rations. However, the farmers to whom this bulletin is sent have not always such tables at their disposal nor leisure to consult them, nor are they accustomed to this kind of calculation ; moreover the result of the calculations to be made with the assist-

tance of these tables is never anything but a first approximation, a general indication, and must afterwards be somewhat modified in practice. On the other hand a number of model rations have been tried and have given good results. It would therefore be a good way for these farmers to simplify matters by at once taking, as a first approximation, some of the model rations adopted after thorough trial and to select such as may best suit their particular case, then modify them according to circumstances. That is the best method to be recommended here.

The following are some examples of these model rations :

1st Example.—With plenty of ensilage.

Ensilage	50 lbs	Bran and oats in equal quantity	10 lbs
Hay	10 "	Ground oil-cake	2 "

2nd Example.— With less ensilage and no hay.

Ensilage Indian corn	20 lbs	corn and oats ground together	
Stalks of Indian corn chopped 12 to 14		(⅓ Indian corn and ⅔ oats)	
Mixture one half bran and the other half a mixture of Indian		with some peas on top	10 lbs.

3rd Example.— Rations with roots.

Roots (mangolds)	40 lbs	Wheat bran	6 lbs
Clover hay	3 "	Indian corn meal	3 "

4th Example.— Rations without watery food.

Timothy	10 lbs	Wheat bran	6 lbs
Clover	8 "	Oats	6 "

5th Example.— Without ensilage or roots.

Clover	40 lbs	Oats	4 lbs
Stalks of Indian corn chopped	10 "	Indian corn (grains)	4 "
Bran	4 "		

6th Example.

Indian corn ensilage	40 lbs	Barley	1⅓ lbs
Clover hay	7½ "	Pea meal	1⅓ "
Oat straw	3 "	Wheat bran	3 "
Oats	1⅓ "	Cotton seed meal	1 "

Many examples of combined rations will be found in the various agricultural papers and treatises and if farmers will take the slightest trouble to look, they will have little difficulty in finding a ration suitable for their cows out of the food at their disposal. These rations, as may be seen, are given in the weight of the foods in their natural condition and not in the weight of the dry substances of such foods.

The total weight of these rations is calculated for every thousand pounds of live weight. To determine the weight of each of these foods to be made up for the cows, it is necessary to determine the weight of the herd and multiply each of the weights indicated in the ration by the number of 1,000 pounds that the herd weighs.

Let us suppose that a herd of 10 cows, weighing 700 lbs each, is fed with the ration given in the 3rd example. The total weight of the cows being 7000 lbs, it will be necessary to weigh out or measure every day $7 \times 40 = 280$ lbs of roots : $7 \times 3 = 21$ lbs of clover hay ; $6 \times 7 = 42$ lbs of wheat bran and $7 \times 3 = 21$ pounds of Indian corn meal. Afterwards each cow will be given all she can eat of this mixture at each meal without leaving any : about one half her portion in the morning and the other half at night. If on the first day it be found that an insufficient or a more than sufficient quantity has been prepared, on the following day a little more or a little less will be prepared so that each cow will have her fill without leaving any.

But, as we have already seen, the composition of the different fodders varies greatly with the soils in which they have grown, the manner in which they have been harvested and the extent to which they had ripened before being cut. The model rations calculated on the tables giving the average composition of the different foods composing them, may perhaps not produce the results expected if the fodder used differ from the average composition given in those tables. If, for instance, clover hay be used that has been badly made and a good portion of whose leaves have remained on the field while being gathered or that has been exposed to the alternate action of the sun and rain during the haymaking, or has been cut too old, or has grown in too poor a soil ! in all these cases, one must know how to modify the rations and this is easily done by referring to what has been said above. If the foregoing rations be examined it will be promptly seen that they consist : 1. of a certain quantity of normal foods, such as hay ; 2. of watery foods such as roots, ensilage ; 3. of semi-concentrated or concentrated foods such as grain,

meal oil-cake ; 4. of fibrous foods such as straw, and that these various rations have been obtained by merely substituting for the foods of one category others of the same category in nearly the same proportion. In one of the foregoing paragraphs we classified the different foods with regard to their composition and we refer the reader to that classification which shows what foods can be substituted one for the other without modifying the rations too much or how to modify them in one way or the other.

Thus different kinds of hay may be substituted one for the other ; roots, ensilage, grass, cabbages, potatoes are of the same category.

Wheat, barley, oats, Indian corn (whole or ground), wheat bran may be substituted one for the other.

The various oil-cakes and malt grains are analogous.

Between the cereals and oil-cakes we have peas and beans.

Straws have similar properties.

When the animals are at pasture their food must be completed with grain and oil-cakes because grass is not always sufficiently rich in albuminoids.

When the hay is very rich in fibre, straw may be dispensed with ; on the contrary when but little hay and plenty of grain is used, the quantity may be increased to maintain the required proportion of fibre in the ration. We allude here only to the straw that enters directly into the composition of the ration and not to that which should always be left at the cows' disposal after their meals as will be seen further on.

When a considerable quantity of roots is used containing much carbohydrates, the amount of the different kinds of grain that also contain a good deal of the same may be diminished and the quantity of albuminoids that the grain dispensed with would have supplied may be made up by using more oil-cake ; then the quantity of straw must also be increased in order to introduce into the ration the necessary fibre that the roots do not supply.

When a hay rich in albuminoids is used such, as good clover hay, the quantity of concentrated foods, such as grain and oil-cake, may be reduced.

If instead of roots, indian corn ensilage containing much more fibre, than they be used, the straw must be diminished in quantity or suppressed.

If when a ration is adopted it be found that the hay is poor and fibrous, the quantity of grain or oil-cake will be increased and that of the straw decreased.

To increase the quantity of water in a ration the proportion of watery foods must be increased. In a word it must always be so arranged that in a ration the proportion of the albuminoids, fats, sugars and fibres and consequently the nutritive ratio shall always be the same, the latter being about $\frac{1}{5}$ as we have already stated.

The good farmer will be known by the adaptation of a model ration to the needs of the moment for he must be able to seize things at a glance and have a thorough knowledge of the quality of the various kinds of food and fodder that he uses, as well as of the needs of his animals.

Though not very digestible, the fibres play a certain part in the rations that cannot be mistaken and the latter should always contain a certain quantity of them. In the opinion of some experimentalists, their office consists in separating the nutritive substances in the intestines and thereby facilitating the action of the digestive juices on them. They also produce a distension of the intestines favorable to digestion.

As to the water contained in fodder and especially in the watery foods, it plays an important part in the production of milk, and this water which greatly incites the secretion of the milk and facilitates the digestion of food, cannot, with regard to its effects, be compared to the water drunk by the animals. This is a fact that science has not yet sufficiently explained, but by which practical farmers are nevertheless not misled.

FEEDING, CALVING AND MILKING OF COWS

Summer Feeding.—When a person has a good herd of milch cows and good bulls, he must feed them well in order to utilize and develop all their qualities. As we have already explained, the number of cows should be proportionate to the average crops obtained from the farm, so as to get as much milk as possible from such crops.

In summer, the cows should be pastured. But in the Province of Quebec, owing to the winter frosts and thaws that greatly injure the fields when not sufficiently protected by a good layer of snow, and also owing to frequent droughts during the summer, the average yield of these fields is comparatively light and it often happens that the cows suffer from it. It would be very desirable that farmers should use green fodder to a greater extent and in a systematic manner.

Green fodder and meadow grass are not always sufficiently rich in albuminoids, especially at the end of the summer season, and it is therefore strongly recommended that their nutritive ratio be added to by supplementing them with a certain quantity of grain, oil-cake or meal. Three pounds of shorts per cow per day, for instance, will suffice for cows at pasture.

Green fodder must always be cut several hours previous to being fed to the cattle and be allowed to wither a little before it is given to them. This removes the danger of meteorism, a disease which, if not attended to, frequently causes the death of the cows and always diminishes their yield of milk. The fodder should be fed to them either in portable racks in the pastures or spread on the ground. In the latter case there is more waste caused by the stamping of the animals.

When a cow suffers from meteorism, coal oil may be tried among other remedies. The animal's head is held up and from half a pint to a pint of oil is poured down its throat. If this treatment be applied at the outset of the disease, meteorism nearly always disappears.

About 100 lbs of grass or green fodder per diem must be allowed for every cow weighing 1000 lbs. Three acres of green fodder for five cows for the summer season is a very moderate estimate. Thorough experiments made in

the United States have proved that by feeding cows in the stable exclusively with green fodder, from two to five times more milk could be obtained from an acre of land than if the same area had been in pasture. In this Province, green fodder gives the best results to those who use it.

Well regulated pasturage has a salutary effect on the cows' health because they are exposed to the air and can take exercise, and also because the grass on which they feed is the most natural and most wholesome food that can be given them. Pasturing greatly decreases their tendency to tuberculosis. In fact it is well known that cows kept permanently stabled and at the same time highly fed, have great difficulty in escaping that dread disease which spares those that are pastured during the summer season.

While at pasture, cows should have good water at their disposal. Foul water has an injurious effect on the quality and preservation of milk as well as of the butter and cheese made from it. Serious defects in the aroma and taste of butter and cheese are in many cases due to nothing else than the bad quality of the water given to the cows.

During the hot weather of July and August, cows should always have a shelter. The heat of the sun's rays at that season has a very injurious effect not only on the yield but also on the quality of the milk.

Flies are also another cause of the decreased yield and bad quality of milk. In the case of the horn fly, the use of petroleum emulsion is recommended; it should be applied to the cows every third or fourth day.

As a protection from heat and flies some farmers recommend that cows be put into the stable during the heat of the day and be given a feed of green fodder with grain and be allowed out only when the heat of the day has diminished and at night; this is a good recommendation provided the stables are well ventilated and very clean.

Everything that may contaminate the air breathed by the cows must be removed from the pastures and stables, for these bad odors may affect the quality of their milk.

Finally, care must be taken to divide the pastures and put the cows successively into the various parts so divided off, in order to allow the grass to grow again; otherwise the cows end by having nothing but weeds and this also affects the quality of their milk. The fact of not dividing the pastures has also a disastrous effect on their production and duration, for when the grass is continually grazed by the cows it has no time to regain its strength; the sun's rays, which are very powerful at that time, weaken it still more and in that condition the winter frosts soon kill it. Whenever cows are removed from one portion of the pasture, a light harrow with short, fine teeth, should be driven over it to spread the cow dung so that the grass may grow evenly, to prevent the development of flies in the cow-dung and distribute the manure over the surface of the field. The harrowing has also the effect of airing the surface of the soil, of promoting vegetation of the grass and of destroying moss. It is also advisable to drive the mower over all the weeds left by the cows and prevent them from ripening and seeding, for, otherwise, the field would be over-run by them.

With pastures so kept it will be necessary to have from 1½ to 3 acres for feeding a cow during the summer, according to their richness.

Passing from winter to summer food and *vice-versa*.—When cows pass from winter to summer food, many precautions must be taken. A ration of hay is given to the cows in the stable before sending them to pasture where they are left only for a comparatively short time. Then, from day to day, the number of hours at pasture is gradually increased and the quantity of hay is decreased until such time as they are left entirely at grass. When they pass from summer to winter food, we must proceed gradually in inverse order.

When a cow's food is changed too suddenly, she suffers from it and the quantity and quality of her milk are affected by it. This rule applies not only to passing from winter to summer food and from summer to winter food, but also whenever the rations are changed. In all these cases, the changes must always be effected gradually as has just been stated.

Winter food —Winter food is based on combined rations calculated as previously explained. The model ration to be selected depends upon the fodder at one's disposal; when once a ration is adopted, it is modified as we have

said in accordance with the richness in fibre, in hydrates of carbon, in albuminoids and in fats of the various foods that enter into its composition and in such manner as to increase the cow's yield of milk as much as possible.

The basis of these rations is nearly always good hay supplemented by a mixture of watery foods (roots, ensilage) ; foods more or less concentrated (grain, meal, oil-cake) and fibrous foods (straw).

Each cow is given the greatest possible weight of this ration. As cows are machines for transforming fodder into milk, the more they transform during the year, the better it will be.

It must, however, not be imagined that the same ration will suit all the cows in a herd equally and at all times. It must be modified as much as possible according to the temperament of each animal, its state of health, the quantity of milk it gives and especially both before and after the time of calving. This is precisely the difficulty experienced by the farmer who must know his cows thoroughly, know the requirements of each of them, follow the state of their health and suit the rations to each one according to her needs and without increasing too much the cost of handling the fodder and other foods. But few general rules can be laid down in connection with this. A farmer who likes his calling, who likes his cows, can always find the many trifling means, the many precautions to be taken to derive the greatest benefit from his crops by transforming them into milk while maintaining each of his cows in the best of health. There are farmers who, with a certain kind of food and under certain circumstances, obtain wonderful results while their neighbors with the same food, the same general ration and under the same circumstances, derive no profit. The former like and know their trade ; the latter have no taste for it, act without reflection and are not observing. With regard to the general organization of the undertaking, cows must be looked upon as transforming machines, but in the details of practice this is no longer so, for they are delicate machines like all living beings ; the question of instinct, of nerves, of sensibility, of temperament and a host of other circumstances, as yet but little known scientifically, come into play and must be taken into account to a considerable degree.

General remarks on the feeding of cows.—Here, however, are some rules well known to practical farmers.

Examine the cow's excrements carefully every day. If they become too liquid, decrease the proportion of watery foods and slightly increase that of the grain, meal or oil-cake. If they become hard, increase slightly the proportion of watery foods and decrease that of the grain, meal and oil-cake. Bran in any case is a good thing; it is cooling and the proportion may be increased.

If the cows have a tendency to fatten, decrease the quantity of hydrates of carbon by decreasing that of the farinaceous foods, such as grain, but the quantity of oil-cake should not be also diminished at the same time. A cow should not be too fat. All the foods that transform themselves into fat are lost as regards the production of milk. The farinaceous foods have a tendency to transform themselves into fat if the cows are predisposed to fatten.

When a cow falls off in condition, her ration should be increased and if the animal already eats its fill, increase to a slight extent the proportion of oil-cake, grain and meal in the ration. The cow's hair should be glossy and the skin sleek when in good health. The nose is then moist and covered with drops of sweat, the appetite is good and regular, the eyes are bright, the horns slightly warm, the respiration easy, the pulse regular, rumination constant and beginning immediately after each meal; finally the yield of milk is abundant. These are the principal signs of good health.

Dry off the cows from six weeks to a month before calving by gradually suppressing the grain in the ration and replacing it by an equal quantity of hay and straw; then gradually increase the interval between milkings. Nevertheless the former should not persist in drying off those which continue to give milk in spite of everything.

The system of drying off cows by milking them every day less and less completely is not recommended by all good farmers.

The cows should not receive rich food but coarse fodder instead. After calving, the richness of their food will be gradually increased until it is brought back to the normal composition of that given the other cows that are giving milk.

Brush or rub down the cows every day with a wisp of straw, but do not curry them except from time to time and not oftener than twice a month. This practice of rubbing down and currying the cows is excellent for their health and favors the secretions of the skin, which it also frees from a multitude of bad germs that may fall into the milk during milking and alter its quality by their consecutive development. The operation also prevents the skin diseases with which dirty cows are often attacked.

A good, thoroughly clean litter should be given to the cows, which will absorb all the liquid excrements of the stable, thus retarding their fermentation and the consequent creation of bad smells. A good litter moreover prevents the cows from soiling themselves and keeps them dry, which is essential to their health. The manure should be removed every day, in the morning and evening, from the stable and the liquid manure gutters carefully cleaned out. An excellent practice is to scatter in these gutters and behind the cows a substance like peat which absorbs any bad odors that may arise from the urine and the dung. When straw is used as litter, it is preferable to chop it.

Pure air is also as requisite in the stables as in the pastures and we shall deal with this question more specially in the paragraph relating to stables.

The quality of the water further plays a very important part as regards the quality of the milk and its derivative products. Farmers should never give to their cows any but first class water.

Put a lump of rock salt within reach of the cows, so that they may use it when they please. Salt is a stimulant to digestion ; it may be well said to be essential to the health of the animals. It is better to let them have it in the form of rock salt, which they can lick whenever they please, than to add it to their feed.

Generally speaking, it is preferable to cut into fine slices all roots such as mangolds, swedish turnips, carrots and turnips. Some practical farmers recommend giving the hay without cutting it. But straw should be cut and then given mixed with the sliced roots and with meal, grain and oilcake. When uncrushed oilcake is used, it is a good practice to dissolve it in water and then to moisten with this water the cut straw, the sliced roots and a

portion of the cut hay. This mixture may be left to ferment during twelve hours before feeding it. It will acquire through the fermentation a slightly alcoholic taste which will render it more appetizing to the cows.

Good farmers recommend the feeding first of a portion of the hay in the natural state and uncut in order to prevent the cows from absorbing too eagerly the mixture of chopped straw, sliced roots and cut hay, half of which is given to them as soon as they have consumed their hay. When this first part of the mixture has been eaten, if the cows have not water constantly at their disposal in the stable itself, they should be given to drink ; then the second part of the mixture first referred to should be fed to them and, to finish the meal, some good uncut straw should be thrown into the manger, the unconsumed surplus of which may be used as litter. As regards the other kinds of rations, matters should always be so arranged that the cows shall not too eagerly absorb the most succulent parts, by compelling them to begin their meal with good hay, generally speaking, and by mixing the grains or oil cake with straw or with some coarse food.

All good farmers do not advise the cooking of the foods and especially of the hay, straw and roots on account of the labor and the expense occasioned by this operation which are not always sufficiently compensated by the advantages gained in the feeding. Fermentation is more recommended for the improvement of the foods.

Cut hay or straw, moistened with water, do not ferment easily unless they are accompanied by other foods such as roots and bran, because the carbohydrates, and especially the sugar, are essential to the production of fermentation. A well made mixture of cut hay and straw moistened with water, whether sweetened or not, and of chopped mangolds, ferments very easily in twelve hours ; through the fermentation changes take place in the composition of the hay and straw which render them more digestible.

In cold weather in winter, warm mashes produce a very good effect.

The cleanliness of the mangers and of all the implements used in the preparation of the foods is an important matter, for all the spoiled foods, remaining, for instance, at the bottom of the mangers, are absolutely hurtful to the health of the cows.

Never give to the cows mouldy hay, ensilage that has become too sour, roots that are more or less spoiled, fermented oil cake or damaged grain : all these foods are injurious to the health of the cows as well as to the quality of the milk. For cows in calf, they may produce abortion and sometimes several abortions one after the other in the same stable.

In winter, begin with the cabbages, turnips, ensilage or Swedes turnips which lose their qualities with age. Mangolds should be reserved for the end of the season, as these, on the contrary, improve in the cellar.

The meals should be given at regular hours, twice a day, morning and evening. Certain farmers advise giving the meal before milking so that the cows may be quiet during that operation and yield their milk better. This is the method generally followed. Others favor the plan of giving the meal immediately after milking, so that digestion may not be disturbed. But a fact generally conceded is that, when ensilage is used, the cows should be milked before they are fed with it. In fact, ensilage often diffuses throughout the stable an odor which is easily taken up by the milk. We shall revert to this subject under the head of milking.

Effects of Good Feeding on the Milking Qualities of Cows.—When a good herd of dairy cows has been secured, it must not be imagined that all that is necessary to further improve such a herd is to have a good bull and to practise selection. A herd fed and kept in hap-hazard fashion cannot improve itself, no matter what may be its reproductive qualities and the skill with which selection is made. The animals raised must constantly receive substantial nourishment, have sufficient exercise and breathe pure air in order that all their organs, as well as the qualities which they inherit from their parents, may be suitably developed. There is in this a necessary gymnastics and this fact is admitted by the best farmers. It is one of the most important things as regards the improvement of the herds.

Calving.—A cow carries her young about nine months and one week. Of 760 cows, whose period of gestation was observed by Lord Spencer, 600 calved between the 279th and the 291st day. The average was about 284 days. Bull calves are dropped a little later than heifer calves.

When calving time approaches, the genital organs dilate and the udders

swell, the latter attaining their normal swelling a day or two before the calving. When these signs are noted, the cow should be placed in a special, close, clean, well aired stall, supplied with good litter and given good hay and water. To avoid accidents, she should not be tied and she should be watched. When the calf presents itself well, with the fore feet first, no assistance is generally needed. But if it be necessary to give help, it should be done cautiously. If the calf presents itself badly, it is better to call in the veterinary surgeon.

Once the calving is finished, the calf should be left for some time with the mother. Care must be taken to see that the placenta or after birth is properly expelled. The cow must not be allowed to eat it. When there is delay in the expulsion of the placenta, a stone should be suspended to it by means of a fine cord, which will exert upon it a slight traction that will aid its expulsion. The placenta may be retained for several days; in that case, blood-poisoning is to be feared and recourse must be had to injections into the genital organs, by means of a syringe, of carbolic acid diluted with water (1 of acid to 50 of water) once or twice a day. From time to time, a slight pull should be exerted on the placenta to detach it gradually, taking care not to tear the organs of the cow by performing this operation too roughly.

After delivery, it is generally the habit to give the cow one or two warm bran mashes, to which cooked roots might be advantageously added. Good hay, lukewarm water, boiled roots and bran are the best diet to use for some days after calving. Freshly calved cows should never be exposed to cold winds or rain until they have regained their strength.

The first milk, known under the name of colostrum or beestings, is not fit for use before four or five days. It is very rich in albuminoids and is perfectly suited to the young calf and the best thing to be done is to let it have it.

Cows, in good condition, that is to say, not too poor nor too fat at the time of delivery, have in general no accident to fear from calving; consequently all the requisite precautions should be taken to see that they are in excellent health at that time. Cows which are too fat, are rather liable to accidents in calving. Defective presentation of the calf frequently arises from the fact that the cow has been badly or brutally used by those who have had her in charge or by dogs.

After delivery, cows are often attacked by milk fever. Many remedies are laid down and used with more or less success to combat this disease. Here is a new one which thus far has given the best results :

Boil 1 ½ pint of water and let it cool down to 100° F. Then dissolve in it 40 to 60 grains of iodide of potassium and shake the liquid so that the dissolution may be complete. Inject a quarter of this solution into each teat by means of an ordinary india rubber syringe provided with a cannula of a form adapted to the teat, after having placed the cow in a comfortable position, washed the udder and the teats with warm water containing a little carbolic acid and wipe them well with a soft, dry cloth. The injection syringe and teats must be perfectly clean to avoid inflammation of the udder. Two or three hours after the injection, the udder generally becomes hard and full, when a little milk is drawn off, but not all. After injecting the udder, it is recommended to give the cow a pint of castor oil in two quarts of hot beer provided that the animal be not in an insensible condition. In the event of complete prostration, the animal must not be forced to swallow anything and the veterinary surgeon should be called in. It is a good thing to offer to the cow, at frequent intervals, a little cold water to drink and, when she gets on her feet again, to give her some food. Her calf should be left with her for five or six days, or, if not, a little milk should be drawn off from her udder three or four times every twenty-four hours. She should not be fully milked until five or six days later.

Calving time.— It is still the general custom in the province to have all the cows calve in the spring. Many object to take measures to spread the calvings over the whole course of the year and chiefly in the fall, because it is impossible, they say, to make good butter with winter milk. This is a mistake :

If there be constantly in the herd newly calved cows ;

If the stables be well aired and kept very clean so that the cows breathe only air that is pure and free from bad smells ;

If the cows receive wholesome and abundant food and have at their disposal good pure water.

If both to them and to their milk all the needful care be given, winter milk will certainly produce excellent butter ; by the new processes of making this is now possible and there is no doubt that this butter will find as good prices as summer butter in the foreign markets.

There is an advantage in having the cows calve in the autumn :

1. Because if the cows be properly cared for, they can produce in winter an abundant flow of excellent milk ;

2. Because milk, according to the probabilities, would sell dearer in winter than in summer, at least during the first years ;

3. Because the keeping and transportation of perishable products like butter, skim-milk, etc., is easier in winter than in summer. Fire costs less than ice ;

4. Because the farmer can afford to devote more time to his cows in winter ;

5. Because autumn-calved cows will give throughout the whole winter a well sustained flow of milk, as they have not to suffer, like in July and August, from the heat and the flies and because when their yield tends to fall off in the Spring, it increases when they are put on grass ;

6. Because Autumn-dropped calves make good veal just as easily as those of the Spring. It is therefore important that farmers should take these reasons more and more into consideration.

Milk production and the Milking of Cows:—Milk is produced by the udders which are simply glands analogous to the glands under the tongue that produce saliva. The blood is conveyed from the heart to the udder by arteries inside of the cow's body and therefore invisible. In the udder these arteries subdivide into a multitude of small, very fine vessels : capillary vessels, as they are termed. These capillary vessels afterwards unite together and a portion of the blood returns to the heart through two large veins known as the milk veins, which are visible under the belly, one on the right and the other

on the left side of the cow. They re-enter the abdomen through two orifices known as the milk wells. Immediately in connection with these capillary vessels in the udder, there is another network of very fine vessels interlaced with the foregoing and terminated by very small pockets. These vessels unite together increasing progressively in size and debouching into the teats. The whole are enclosed in a special adipose tissue and form the udder. It is in filtering, so to speak, from the capillary veins into the little terminal pockets of the vessels leading to the teats that a part of the blood is converted into milk in a way that is not yet very well understood. There are four teats, each corresponding to a bunch of the capillary vessels and these bunches are grouped together two by two on each side of the udder. This whole system is very elastic and the milk capacity of an empty udder may attain about 10½ to 11½ pints.

To milk a cow, the teat is taken hold of at the base and close to the udder with the thumb and fore-finger bent; it is drawn downwards while squeezing with these two fingers in the first place and then against the palm of the hand successively with the middle finger, with the fourth and lastly with the little finger so as to push the milk from the base of the teat to its extremity. This operation should be performed with the greatest possible gentleness.

One of the teats at the back of the udder should be seized with one hand and one of the front teats on the opposite side with the other, but never at the same time two teats on the same side. The following are a few of the generally accepted rules for the milking of cows :

1. The milking should be performed as gently as possible and in a way to make it an operation agreeable to the cow. A cow will never yield all her milk to a person whom she does not like or who milks her roughly.

2. The milking of cows should be done as quickly as possible for more milk is obtained by quick than by slow milking, because a portion of the milk is secreted during the milking itself and because the rapidity of the operation excites this secretion.

3. The cows should be milked dry, because the last milk is the richest and because milking dry stimulates the secretion of the milk and improves the milking qualities of the cow. On the large farms in the United States, milking time lasts about one hour and each man or each woman has from ten to twelve cows assigned to him or her to milk during that time.

4. Wash the hands before milking; wash the teats with perfectly clean water, dry them well with a clean towel and above all do not wet the hands with the first milk drawn; wear clean clothing free from dust. The most scrupulous cleanness should be observed in order to not contaminate the milk.

5. The first drops of milk should be let fall on the ground; they should not be allowed to mix with the rest of the milk, because they are always contaminated with foul germs which may afterwards develop in the milk and deteriorate its quality.

6. The milking should be done in a well aired place and protected from the bad odors which milk so readily absorbs and from the bad germs which may contaminate it. When ensilage in particular is fed, milking should be performed before it is given. It should be also performed before hay is given as the later diffuses through the atmosphere a great deal of hurtful dust. It is much better to wait until this dust has subsided.

7. Milking should be done twice a day, as far as possible, at an interval of twelve hours between each milking. Morning and evening are the best times, as they are those when the cows are in their quietest mood.

8. The milking pails should be carefully washed in pure water, scalded and dried in pure air protected from dust and foul smells.

The following table shows the richness of the milk at different stages of the milking, according to a test made on the Experimental farm of Wisconsin:

	PER CENTAGE		
	FATTY MATTER.	SOLIDS.	WATER.
First milk	1.32	11.83	88.17
Strippings	9.63	19.18	80.82

This shows that the strippings are at least seven times richer in fat and more than twice richer in solids than the first milk and it emphasizes the importance of thorough milking. The operation of milking should never, as far as possible, be left to children, and all the more so as it exerts a most important effect upon the improvement of the breed of cows, especially when a herd is being improved by breeding and selection. It is a delicate operation which, to be well performed, calls for a good deal of skill and gentleness.

The evening's milk is generally richer than that of the morning. The

number of hours between the milkings has a great influence on the richness of the milk. Facts would lead to the conclusion that the quality of the milk depends especially upon the feed given to the cows five or six hours before milking. Thus, when cows receive in the stable good food from six o'clock in the morning to eight in the evening, the evening milk is produced in excellent condition. While during the night the cows, remaining without food, may give a larger quantity of milk on account of the long period of time during which the secretion of the milk is not disturbed, the quality is rarely as good.

The quality also depends much on the animal's state of health, as well as on its age and the treatment it receives. With increasing age, milk has a tendency to become richer. When the health of the cow falls off in any respect, the quality of her milk is affected, as well as the quantity. If the cows are treated brutally or fretted, their milk may become unfit for any use and so soon as the animal recovers its tranquillity the milk resumes its ordinary qualities. Normal milk is only yielded by cows in good health, well fed and well treated. We have already referred to the variation in the richness of the milk during the period of lactation.

Stables.—The main thing to be secured in a stable, is a good mean temperature of about 60°, pure air, free from bad smells, scrupulous cleanliness, the quietness of the cows and the convenience of the arrangments. This last is certainly important and a good deal of attention is given to it in this Province, but the former are much more so.

Temperature.—To maintain the temperature, the first thing to be done is to erect good walls with felt paper between the thickness of the boards. Walls roughly run up are not sufficient to maintain the temperature during the cold weather of winter or the height of the apartment must be reduced and the cows crowded together, to the injury of the purity of the air which, in such close stables, is easily fouled and rendered damp and unhealthy. It is recommended to use for the frame-work studding of 2 × 6, to line the inside with two thicknesses of boards, at least one of which should be tongued and grooved, separated by felt paper and to do the same thing on the outside. The ceilings should be well looked after to prevent loss of heat and the passing through of dust from the lofts. The more carefully a stable is built, the better can it be ventilated without lowering the temperature ; which is

an important consideration in this province where the winters are long and severe.

Dimensions and Arrangement of the Stables.— The height of the stables should be from 10 to 12 feet. The number of cubic feet to be allotted to the stable per cow depends on the number and the capacity of the ventilators. A large stable is preferable to a small one because if the ventilators do not work regularly, the air in it becomes foul less quickly. It is calculated that about 500 to 800 cubic feet of air space is required per cow. In countries where the temperature is not so cold in winter and where stables are built with good walls of brick or stone, even as much as 1000 cubic feet are allowed.

The floor space per cow should not be less than one tenth of the cubic space. If the height of the stable be less, a relatively larger floor space will be needed.

Thus, a stable of $50' \times 25'$, for instance, and of 10 feet high gives a volume of $10' \times 50' \times 25 = 12.500$ cubic feet. If we reckon 500 cubic feet per cow, a stable of these dimensions could lodge 25 cows. The floor space being $50' \times 25' = 1250$ square feet, each cow would have $1250 \div 25 = 50$ square feet of floor, that is to say, one tenth of the volume and the rule would be followed.

Generally speaking, a passage of 4 feet wide at the head of the cows is recommended ; a manger of 18 inches in width ; stalls of 5 to 5½ feet in depth and 7 feet in width for two cows or 3½ feet per cow ; a gutter 15 to 18 inches wide, for the liquid manure, in rear of the cows. This passage should be wide enough to allow of the easy removal of the dung and to permit the cows to move without danger in coming in or going out. The height of the manger should range between 9 and 15 inches according to the size of the cows. The slope of the floor, on which the cows stand, towards the gutter, should be 2 inches to every 4½ or 6 feet. These are the dimensions generally approved by practical men.

Ventilation.—The object of ventilation is to renew the air. In a stable in which animals are shut up, the oxygen of the air is absorbed by their breathing and then replaced by carbonic acid, watery vapor, ammonia and exceedingly poisonous organic matter. Now all these exhaled gases are as injurious to the health of animals as oxygen is essential to their existence.

Cutaneous transpiration and the excretions greatly vitiate the atmosphere. The air of a stable therefore rapidly fouls if means be not taken to renew it constantly. Usually, for this purposes, the cracks in the doors and windows are relied upon ; but this is a grave mistake and special measures should always be taken to assure a constant and sufficient renewal of the air in stables. In winter, this continuous renewal of the air may chill them, but it is often better to have a little colder temperature than foul air. The conditions to be realized are : 1. A constant renewal of pure air ; 2. This renewal to be effected without a current of air hurtful to the cows ; 3. It should be so arranged as to be regulated at will.

The dimensions of the stable have nothing to do with the quantity of fresh air to be supplied by ventilation to a determinate number of cows. The advantage of a large stable is that, if the ventilation stops, the air fouls less quickly than in a close stable, but the quantity of air to be supplied by ventilation for a same number of cows remains the same, whether the stable be large or small. This is an important principle which should not be forgotten.

It is estimated, in England, that 20,000 cubic feet of fresh air is needed per cow every hour. To admit this volume of fresh air with a velocity of two miles to the hour, a velocity which would hardly be felt by animals, allowance must be made for an opening of 300 square inches per cow. Another opening of equal size is required for the exit of the vitiated air or in all about 4 square feet per cow. The success of the ventilation depends upon the distribution and diffusion of the entering air ; the shape and the location of the inlets and outlets play an important rôle in that case. The force pushing the air inwards or outwards depends to a slight extent on the wind, but especially on the difference of temperature between the inside and the outside air and to effect ventilation it frequently suffices to remove the obstacles preventing motion.

The air introduced into the stable should be pure : the inlets should therefore not open over manure piles or in dirty yards, over other stables or over places where the air is contaminated.

As far as possible, the fresh air should reach the animals in front so that they may benefit by it before it becomes mixed with the foul air and stables in which the cows are stationed head to head, with a passage between the two rows which they form, constitute a very bad arrangement, because the

air which they exhale lingers in this passage, to which it is very difficult to supply fresh air regularly. The arrangement previously indicated, adopted for one or two rows of cows, is preferable.

A part of the entering air must be taken close to the surface of the ground, towards the heads of the animals, in order to sweep away the lower strata of foul air in the stable ; the openings should be many and small rather than few and large, so that the inrushing air may be distributed more uniformly. Another series of openings to admit the air should be pierced in the upper part of the wall.

The foul air, loaded with vapors, being warmer than the fresh air, tends to rise towards the upper part of the stable. It may therefore be removed either by good openings in the walls immediately under the ceilings, which is the best system, or by good shafts. All these openings should be grated and covered with a sliding or hinged board to open or close them at will.

Suppose a stable holding two rows of cows, with their heads to the walls and a passage four feet wide at the head, along the walls, and one of five to six feet at the animals' tails between the two rows, which is the best arrangement ; suppose that the stalls have a width of seven feet per two cows, and that openings of 300 square inches for the admission of air are needed per cow ; then for two cows, 600 square inches will be required. Suppose that the admission of the air is effected by two rows of openings, one near the ground and the other six or seven feet above it ; if these openings be made 6 inches high, they should be $300 \div 6 = 50$ inches long, or nearly 6 feet per two cows, that is the say, that these openings would almost entirely occupy the length of the stable.

To let out the foul air, good ventilating shafts placed above the centre passage should be employed. But as in shafts the air circulates much more rapidly, their section must necessarily be much smaller than that of the inlet openings. For a shaft 18 feet high, a section of at least 16 to 36 square inches per cow must be calculated. For 25 cows therefore, at least three square shafts of 12 to 18 inches on each side would be needed. If there be only one row of cows in the stable, it would be better to replace the shafts by openings of 8 to 12 inches high pierced through the upper part of the wall behind the cows along the six feet alley.

All these figures are accepted in countries where the winters are not very severe. They are far from what is ordinarily practised in this province

where they may appear exaggerated, because the great volume of cold air admitted might chill the stables too much on some winter days. If the stables, however, be constructed with good walls impervious to the heat and if these openings be provided with good shutters allowing the admission of the air to be regulated as well, we cannot see why they should not be adopted even in this province with some slight modifications, for pure air is absolutely essential to the health of the cows. We therefore strongly invite the attention of farmers to this point. As severe cold greatly promotes ventilation, the openings to admit the air should be slightly reduced.

Stables with two rows of cows are preferable in the colder parts of the province to those with a single row, which necessitate a longer building, because a long structure becomes cold more easily than a wide one.

Lighting.—Light is an important factor in the salubrity of the stables. Direct light, and, in a lesser degree diffused light warm and dry the air. They set it in motion in the places where it is at rest and thus make the ventilation more complete. Light moreover kills a host of bad germs, such as the germ of anthrax. True, it does not destroy the bacillus of tuberculosis, but its action nevertheless, combined with the renewal of the air, may greatly lessen its virulence.

The want of light morever, is one of the causes of bad health and disease in cows, as well as in man. It is especially in the case of young animals that light and air are necessary.

The best exposure for stables is facing the East and West on their longer sides. The window surface, should be one tenth of the stable floor surface. For a stable of $25' \times 50' = 1250$ square feet, for instance, the window surface should be at least 125 square feet. If the windows were $3' \times 5'$, it will be seen that about 20 would be needed. These proportions may perhaps appear excessive to many farmers, but they are recommended by good practical men; in some parts of the province, they should be slightly reduced. The windows should be provided with double sashes for winter use and with cheap shades in the summer; the windows should be so arranged that they may serve to ventilate the stable during that season.

Drainage.— The exterior drainage consists in discharging at a distance all the rain water, which, if allowed to stand in the vicinity of the stable, would spread humidity and bad air into it.

The aim of the interior drainage is to convey all the liquid excrements of the cows out of the buildings. For this purpose, the first condition is that the floor or the pavement must be perfectly water-tight, so that the liquid manure may not get and remain underneath it to spread bad odors in the stable. If there be a manure cellar under the stable, the tightness of the floor must also be secured in order to prevent the emanations of the manure from ascending and such a cellar should be provided with good ventilators.

When a floor is used, it should be made of a double row of planks well tongued and grooved and with the joints broken. The first row of planks should be covered with a good coat of hot tar which should be put on gradually with the laying of the second row of planks so that the tar may penetrate well into all the joints. A floor thus made will last for twenty years or thrice as long as an ordinary floor. It should be whitewashed above and if possible underneath, twice a year, which prolongs its duration.

Earth makes the best and most economical of pavements, if it be sufficiently hard, like heavy clay or gravel. An earthen pavement quickly becomes solid enough to obviate the necessity of any repairs.

But the soil is not always suitable for a good pavement and recourse must then be had to an agglomerate or to cement.

A good agglomerate consists in a mixture of sand and gravel with common slaked lime ; the whole put in a pile and well mixed, then worked with the hoe once a day during several days. This mixture is spread over the soil which has been well levelled beforehand, when it hardens rapidly and becomes very lasting. Coal ashes, moistened with water and added to the mixture, render it still more durable. Sawdust or cut straw produce the same effect. This mixture should be well stamped down.

Hydraulic cement, in the proportion of one barrel to three barrels of fine sand and five or six of coarse gravel, is the best, especially if the mixture be saturated with hot tar. A pavement made out of these materials lasts very long and is impervious to water and vermin. For this, the cement must be mixed with three times its bulk of dry, clean sand, which is wetted so as to make a thin mortar, to which the gravel is then added. Not more is mixed at a time than can be spread in about a quarter of an hour, as it sets very quickly

and the pavement must be packed down very tightly as it is laid, with a wooden pavior worked by hand.

By using cobble stones, burying them well in the soil and by covering them with a good coat of one of the mortars just referred to, a very lasting pavement can be obtained.

Earthen, stone or concrete pavements are not to be recommended in the colder sections of the province especially if the stable be somewhat large because the cold of the outer soil is conveyed to it by conductivity and it is necessary to use a thick litter to prevent the cows from suffering from the cold of the pavement. In that case wooden floors are preferable.

The gutters should have a good slope towards their extremity, 1 to 2 inches per 4 or 5 feet, so that the liquid manure may flow out easily into a water-tight pit. It should never be allowed to spread into the farm yard. To absorb the liquid manure, dry earth or peat should be used, filling with it the gutter behind the cows every time that the manure is removed. In that case, the gutter need not be more than 15 inches wide or 3 inches deep for the cows. A cow ejects annually an average of 1280 gallons of urine, or 3½ gallons per day and, to absorb this urine about 20 lbs of dry earth or peat are required, which would necessitate 7280 lbs per year per cow. Enough dry earth or peat can always be found on a farm.

Any light and absorbent earth is suitable for the purpose, if it be put under cover during the summer. A shed of 30′ × 15′, filled to a height of six feet, will contain 75 tons of dry earth. But, if allowance be made for the fact that the cows are on pasture during a part of the year and if there be straw to replace a portion of the earth, it will be seen that the quantity to be stored during the summer may be much less.

The dry earth system is much to be commended, because the earth thus employed absorbs all the foul odors of the stables and yields a much richer manure, which is also much easier to use.

Saw dust, dry earth or peat may be scattered behind the cows. In summer, the pavement may be sprinkled with water for the sake of coolness.

Water-Supply.—The stables should be always supplied with the purest water possible, which is absolutely essential to the quality of the milk and the health of the cows. The best course to follow is to take the water as far as possible from sources that are remote and more elevated than the farm

buildings and to convey it into the stables through iron pipes of 1¼ to 1½ inch. Wells should be always far away from the dung piles and the privies, by which they are more easily tainted than is generally imagnied. As far as possible, the arrangements to bring the water into the stable should be such as to place the water within reach of the cows.

Site.—A preference should be given to elevated and airy sites for the stables; damp spots should be avoided. The subsoil of the stables should be carefully drained, if it be not naturally so.

The soil is always impregnated with air and this air, often unhealthy in damp places, is liable to ascend into the stables.

Service.—The convenience of the service may be secured in many different ways; it is somewhat a matter of taste, habit and circumstances. It is consequently impossible to here lay down general rules or to point out the arrangements suited to all cases.

Disinfection of the Stables.— In the event of epidemic, the stables must be disinfected. The following are the principal rules for disinfection set forth by Trumbower:

1. Remove the hay, straw and sweepings and burn them.

2. Remove the manure and bury it in a field, to which the animals have no access.

3. Clean out the mangers, racks, stalls and all the woodwork with care; wash them with hot water in which two ounces of carbolic acid per gallon have been dissolved. Preference for this purpose may be given to formaline at the rate of 2 to 3 ounces per gallon of water.

4. Whitewash all the inside of the stable, the floors, ceilings and walls with lime, in which one pound of chloride of lime to every four gallons of water has been dissolved. Slaked lime should also be used to whitewash the walls.

This rule especially applies to the stalls and mangers.

5. All rotten woodwork should be removed, burned and replaced by new,

6. All the vessels, forks, shovels, brooms and other implements should be washed and lime-washed.

7. All the gutters and drains should be carefully flushed and disinfected with a solution of chloride of lime; 1 lb to every 4 gallons of water.

8. To disinfect the atmosphere, sulphur may be burned or formaline vaporized.

The use of chlorhydric acid is also recommended, especially in the case of typhus, in lieu of carbolic acid. It should be dissolved in twenty times its weight of water.

The stables should be whitewashed with lime twice a year even when there are no epidemics.

Calves.—From the economic standpoint calves are one of the indispensable by-products of the stable, which should be turned to the best account to reduce the cost price of the milk which is the principal product.

They are raised either to replace cows that have gone out of service or are destined for slaughter. It is by replacing the bad or the inferior cows of a herd that its improvement can be best promoted and the cost price of the milk reduced. The calves for slaughter would return but a small profit if they did not serve to utilize the skim-milk, one of the important by-products of the dairy, upon which it is always preferable to feed them. This is one of the best ways of turning the skim-milk to profitable account and this fact should not be overlooked. To fatten them with other foods purchased outside or even taken from the farm would not always be the best rule to follow from an economical point of view.

Calves for Raising.—Calves for raising are the basis of the improvement of the herds and the farmer should devote all his skill to their selection, especially then to properly feeding them and to developing the forms and qualities which these animals inherit from their parents and which are chiefly prized. A well selected and well fed heifer should always make a better cow than her dam, so long as perfection has not been reached. It is in this way that the most famous herds have been formed. Selection and raising are the key to the improvement of the herds. We necessarily presume that the farmer can always secure the services of a first class thorough-bred bull.

The basis of the food of calves for raising, during the first five or six months, is fresh skim milk. Good skim milk suffices to give to a calf a strong frame and strong muscles. Too much fatty matter in the milk is not needful

for this. The milk should be fed warm at a temperature of about 80° Farenheit or blood heat.

Immediately after birth, the calf should be removed to a special stall, far from the mother, whose milk is given to it unskimmed and warmed during about four days twice a day. The hand should be dipped in the milk to be fed to it, the fingers raised towards the top beneath the surface, and they should be given to it to suck. The calf thus quickly learns to drink alone.

The night meal should consist half of skimmed and half of fresh milk, the whole heated to 80° Fahrenheit. Three quarts are sufficient for a meal for a calf of that age, if the animal drinks only twice a day; if it drinks thrice a day, two quarts will be enough. At the start, it must not be given too much to drink, as its organs are not yet fitted to digest a large quantity of milk. The quantity should be gradually increased, according to the appetite which it displays.

At the end of the first month, they are able to take two meals a day of four or five quarts each or three meals of three quarts. The milk should be always given sweet and warm.

If diarrhœa set in, no more than a quart of fresh unskimmed milk from the mother or from another cow should be given and this should be sufficient to cure it if no other food be given. This milk should be warmed to 90° Fahrenheit. For diarrhœa in calves, a new remedy consists in dissolving 15 grains of salycilic acid in a quart of chamomile tea and making the calf swallow this decoction in four doses per day: one fourth of the quart at each dose. Diarrhœa frequently arises from a surfeit of food or from the use of milk that is more or less sour.

The calf should be taught to lick a mixture of equal parts of finely ground Indian corn, bran, wheat and flax seed meal. To begin with, a tea spoonful of this mixture is enough and the quantity should be increased progressively. When the animal is two months old, a tablespoonful of the same mixture may be given; at three months, four ounces per day; at five months, eight ounces and at six months one pound. From three months forward, six quarts of milk may be given twice a day.

After they are one month old, the calves may be put into a pasture of about a quarter of an acre enclosed with a moveable fence which may be

displaced from time to time to give them fresh pasturage. When two months old, the calves commence to drink a little water and some must therefore be placed within their reach. In winter, when they cannot be put on pasture, they should, from the age of one month, be fed good new clover hay cut young, the quantity of which should be increased as they learn to eat.

The quantity of food supplied to them should be carefully supervised. There is no danger in giving them too much hay. It is grain especially, which, when eaten in excessive quantity, may do them harm. However good may be the health and appetite of a young calf, it should never be given more food than it can d gest on the pretence of making it grow more quickly.

Calves easily acquire the bad habit of sucking each other's ears, when there are several of them in the same stall. To prevent this bad habit, some farmers recommend that they should be constantly kept tied, while others claim that it suffices to tie them during meals and for twenty minutes thereafter.

When the heifers are six months old and have been weaned, they should be put with the other cows and treated in the same way. The special care they need should last between 9 and 12 months. The heifers should be well fed to properly develop their digestivive faculties. As a general rule, it is better to put aside a heifer that is too much inclined to fatten.

Calves for Slaughter.—Calves for slaughter should be treated like the others, but the skim milk may be replaced by boiled mixtures of different quantities of barley, oats, ground flax-seed and bran, the whole diluted to the consistency of milk in a tea made of boiled hay. But as the fattening of calves for slaughter is a good way to utilize the skim milk, recourse should, as a general thing, be only had to these broths when skim milk is scarce or veal commands a good price.

With respect to the feeding of cows and calves, we recommend the dairy manual of Henry Stewart, (New-York Orange Judd Company) from which we have derived most practical information.

Manure.— The manure may be regarded and is in reality a residue of the production of milk. Manure possesses an important value, which should

not be neglected. It has already been pointed out that a portion of the food passes through the digestive canal of cattle without being digested and is found almost entire in the excrements. But the portion of the food digested is not entirely assimilated to form fat, meat, milk, hair, &c. Everything that contributes to maintain the animal heat, as well as to produce the movements of the organs, for example, is partly found again in the air breathed, and in the perspiration and largely in the urine. If on the one hand the daily quantity of food absorbed per animal be considered and on the other its increase in weight and milk yield, it will be easily understood that a considerable proportion of its nourishment goes with the excrements which, mixed with the litter, must constitute an important product and that, from the point of view of the maintenance of the fertility of the soil from which the foods consumed are derived, this manure must necessarily play an important part.

If the manure be a sub-product of the dairy, it is none the less an essential sub-product which in returning to the soil, will all the more reduce the cost price of the milk in proportion to the slighter loss it sustains in the successive manipulations to which it is subjected.

We cannot fully enter here into the question of manures, as to do so would go beyond the scope of this bulletin. This question moreover is very exhaustively dealt with in most of the works on agriculture. We desire merely to here direct the attention of the farmer once more to the importance of this sub-product from the standpoint of the reduction of the cost price of the milk, and to lead him to bestow as much care as possible upon it.

Here, however, is a summary of the general facts developed by experience and which never should be forgotten :

The richness of manure varies with the richness of the food given to the cows, with that of the litter used and with the temperament and condition of the cows, while it increases in proportion to the care taken to prevent the loss of the fertilizing elements which it contains.

It plays two rôles as regards the soil : 1. The rôle of improvement by rendering heavy soils lighter and light soils heavier ; by facilitating the passage of the air, the development of light acids in the soil, and consequently the transformation into assimilable elements of those which are not already so ; 2. the rôle of a fertilizer properly so called by the introduction into the soil of fertilizing elements which it thus yields up to the subsequent crops in a

more quickly assimilable form than that in which they were found by the previous crops, from which they are derived.

Farmers should make arrangements so as to lose nothing whatever of the excrements, liquid and solid, of their cows and prevent their too great fermentation.

Subject the manure to as few manipulations as possible, because, considering its weight and bulk, these are always burthensome and their cost is not always recouped by the value of the improvement in the quality. In the book, entitled "The Soil" by John Scott and J. C. Morton, all the latest and most desirable information on this head will be found. Here according to McConnell, is the smallest quantity of good barnyard manure essential per acre to restore to the soil the fertilizing elements substracted from it by the following different crops :

Wheat	5 tons	Carrots	10 tons
Barley	5 "	Turnips	15 "
Oats	5 "	Swedes	10 "
Meadow Hay	8 "	Mangolds	20 "
Red clover	12 "	Potatoes	10 "
Beans	10 "	Cabbages	25 "

A cow of average weight kept in the stable all the time, produces about 20,000 lbs of dung per annum and about 8000 lbs of liquid manure, according to F. W. Wool. According to Wilckens, a cow ejects from 15 to 20 lbs of urine per day ; other authors place the figures at 25 to 35 lbs. But this depends on the size of the cows, their style of feeding and their state of health.

Of course, when the cows are on pasture, a portion of their excrements return directly to the soil and the quantity of manure collected from the stable is proportionally diminished in according to the duration of the season of pasturage.

GENERAL REMARKS

In this bulletin, we have considered the method of economically converting the crops into milk and we have shown with what attentive care the farmer should organize and pursue this branch of the dairy industry, in order to obtain satisfactory results.

The cost price of milk is made up :

1. Of the cost price on the farm of the crops necessary to its production ;

2. Of the expense of handling these crops to prepare them for the food of the cows ;

3. Of the cost of the labor for milking and attending to the cows ;

4. Of the expenses for interest, sinking fund and insurance for the capital represented by the value of the cows, as well as that of the stable and of the implements and machines used in the stable ;

5. Of the general expenses of the stable ;

6. Deduct from the sum of all these expenses the value of the manure and the calves.

All that we have previously said goes sufficiently to show how much this cost price may be affected by the farmer's negligence. The following is a summary of the chief mistakes most frequently committed under this head :

1. The number of cows is too great in proportion to the crops that can be looked for from the farm and, consequently, they are not sufficiently fed ;

2. The herd consumes a great deal of food per 100 lbs of milk or, in other words, yields a small quantity of milk per ton of crops, owing to the poor quality of the cows ;

3. The herd produces milk only during a part of the year ;

4. Crops are badly chosen for milk production and rations badly combined and they fail to attain the degree of digestibility which they would have if better composed ;

5. Bad or imperfect milking of the cows ;

6. Cows are badly cared for, exposed in summer to the heat and the flies, in poor pastures, and in winter to the cold in an unhealthy, ill-ventilated, ill-lighted, damp and dirty stable ;

7. Manure is badly gathered and kept, washed by the rains and handled in too costly a fashion.

According to the experiments made by Sir John B. Lawes, at Rothamsted, in England, a ton of milk (about 220 gallons) may be profitably produced

to the acre on a first class farm with very good cows. According to this, a cow yielding annually 800 gallons of milk may be kept on every 3½ acres of such land.

Every farmer cannot hope to obtain such a result immediately because, to this end, his soil and herd must be improved, two things which can only be done by degrees. But we note this production as being practically possible in many cases and farmers devoting their attention to the dairy industry, should keep these figures before their eyes and strive to realize them where such realization is economically possible. They should always aim higher than the object.

If we contrast with this the fact that many farms in this province, cultivated with a view to the dairy industry, do not produce more than 150 to 200 lbs of milk to the acre with cows yielding 1500 to 2000 lbs of milk, which is too small a remuneration for the farmer, it will be seen what progress remains to be made in this respect.

GABRIEL HENRY.