DAIRY FARM MANAGEMENT.

A thesis submitted to the faculty of the Graduate School of the University of Minnesota by George P. Grout in partial fulfillment of the requirements for the degree of Master of Science.

May 15, 1909.

SELECTION OF DAIRY STOCK.

When considering dairying from a business standpoint there is no one thing of more importance than the proper selection of the dairy herd. The failure or success of the enterprise is largely dependable upon this first step. The dairyman should have clearly in mind just what constitutes a good dairy animal and make his selection accordingly. Life is short and most beginners' means limited, therefore failure at the outset means not only years of wasted time, but possibly the slipping by of an opportunity which may never return, For the subject of dairy form the following outline will be a guide. It can hardly be called a score dard because in the score card each point is given a special rating and differs for the different breeds. The different breed associations have a special score card by which they judge their cattle. The points here given furnish a practical outline for judging five of the dairy breeds and if dairyman will thoroly master and apply them placing the importance in order as given, they will be a guide to him in selecting a herd which will not disappoint him.

JUDGING DAIRY BREEDS OF CATTLE.

Purpose of these animals to convert roughage into saleable product:-In short, a machine.

1. Capacity: (25)
   - A. Length (from shoulder to hip point)
   - B. Breadth (with rather straight but well spread ribs)
   - C. Depth (thru the middle)

2. Angularity of Form, or Dairy Temperament: (22)
   A. Withers- sharp and shoulders spare.
   B. Spinal column- prominent and rugged, extending high thru loin, nervous temperament
   C. Rump-high, strong and sharp (denoting strength and nervous temperament.)
   D. Neck- light, rather long
   E. Hook points- sharp, low and pin bones far apart
   F. Thighs-spare

3. Mammary Organs: (22)
   A. Udder- large, skin hanging in folds, well balanced, being attached well forward and high behind, (level sole) not pendulous.)
   B. Milk Wells- large orifices and numerous
   C. Veins-long, large, branched and crooked, with extensions.

4. Breed Characteristics: (15)
   A. Color of coat: (Holstein and Dutch Belted, black and white.
      Ayrshire, red, brown and mohogany, with white color distinctly defined; brindle color allowed but not desirable. Jersey, solid color preferred; all shades of brown to bronze black; yellow, fawn, and tan to a creamy white; mouse color or squirrel grey; light red and a few brindle; bulls range darkest. Guernsey, yellow or orange or fawn, with white markings; color of skin important (bright yellow)
   B. Head typical
   C. Special counts for the breed: Guernsey skin; Dutch Belted, width of belt. Jersey, Guernsey & Ayrshire additional counts for udder.

5. Constitution: (16)
   A. Wide, deep chest, and full in region of heart.
   B. Muzzle broad, nostrils open, jaws strong, and bright eye not too open.
   C. Abdominal wall around navel strong, resisting pressure.

First of importance is capacity and without this a dairy animal is worthless. If a cow has a good middle she will do to consider further.

Notice in the outline that three things are considered under capacity merely as a matter of explanation. The number of points allowed for the different parts of the animal are merely an estimate. The all important thing to remember is that capacity for working over food is the first essential in a dairy form. If a dairy animal has capacity the first requirement is met. The next very important thing for the practical dairyman to look for is what use the animal makes of the food consumed. As an indication of this we look for angularity or dairy temperament. If we find an angular form with a good capacity we know at once where the feeds consumed will be found, not on the animals back but in the pail.

For the practical dairyman there are only two main points to be considered. A cow with a good capacity usually has a good constitution, hence in the outline constitution is usually considered under the first point and can therefore be left for final consideration to the fifth place where it is mentioned. Capacity and angularity then are of primary importance to the ordinary dairyman, but the breeder of pure bred dairy cattle must remember the five points and give each due consideration if he would bring his herd to a high state of perfection.

Dairymen should know the difference between the looks of a really good dairy animal and one that is not, that is, when the difference is quite marked. On the next page is a cow whose form is of the dairy type. Her name is Fortune. It cost 19.71 cents to keep this cow a year and she made 402 and a fraction pounds of butter. It cost 4.9 cents to produce a pound

of butter from her. Compare this cow with Dido whose Cut is found on page . Dido is of the blocky type and it cost 18.2 cents to produce a pound of butter from her. It is not hard to distinguish between these two animals,- one is a dairy animal and the other is not. The trouble comes when we attempt to distinguish between animals not so marked or pronounced in their type.

We must therefore consider the matter point by point to see what really constitutes a dairy form. Again turning to the outline we see that capacity is of first importance. Notice from the Cut that Fortune is deep thru the middle. She is deeper than Houston whose Cut appears on page . Notice while Houston is not quite as deep thru the middle as Fortune she has just as much capacity. Houston has more length from the front shoulder to the hip point. Notice the extra length from the last rib to the hip point. Capacity cannot be judged alone by depth thru the middle. Length must also be taken into consideration as well and spread of rib. Notice that it is spread of rib and not spring of rib. In the dairy cow we want the ribs rather straight, but well spread. We do not want them well sprung out from the back as is the case with Dido. That indicates a fleshing tendency, but we do want them well spread at the bottom to give room for larger digestive organs. Notice the lack of depth in the cow Olive page .

Olive is angular in form and of the dairy type, but lacks in capacity. She lacks the ability to eat enough to make a good record and while it cost only $18.72 to feed her doing a year's work she made only 331.60# of butter. She has some essentials

of a dairy form and if she were deeper there is no reason she should not make a much better record. Of the three cows shown Fortune has depth and Houston reasonable depth with extra length, while Olive is deficient in both these points and therefore lacks in capacity.

Having considered the first point under the outline we will take up the second.

ANGULARITY OR DAIRY TEMPERAMENT.

Compare the form of Ethel page..... with that of Houston. During the year it cost $21.38 to feed Ethel. She made 197# and a fraction of butter and returned a net profit of $8.19 as compared with Houston costing the same amount to feed, ($21.38) making 512# and a fraction of butter at a net profit of $55.54. Ethel has reasonable capacity, but is coarse over the withers as compared with Houston. Notice how sharp Houston is there. Houston's shoulders are spare while Ethel's are round and well covered. Notice how prominent and rugged is the back bone of Houston, extending high thru the loin with a good high rump, strong and well carried out to the setting on of the tail. We like to see the back bone rugged, large and strong. If the backbone is strong as the case with Houston, it is an indication that the nerve running thru the back bone is large. Where the spinal cord is large it is an indication of a well developed nervous temperament, which is closely allied with large dairy production. By a well developed nervous temperament we do not necessarily mean that a cow ~~that~~ must kick at a drop of the hat or shy at a piece of paper. A cow with a good

broad forehead and well developed spinal column has too much brain and good sense to be irritated by the blowing about of paper unless she is misused. An animal that is cranky and irritable shows a lack of control of her nerves rather than a nervous temperament too highly developed. Notice the lack of character about the form of Ethel. She is beefy and round. When Houston and Ethel both freshened one did about as good work as the other for a time, but gradually Ethel commenced putting the food that she consumed on to her back in the form of flesh and charged more to produce a pound of butter until she was dry, while Houston continued to produce about as economically until the close of her period of lactation. It cost 4.1 cents to produce a pound of butter from Houston and 10.8 the same year with Ethel, while it cost still more with Dido. Dido charged 18.2 cents to produce a pound of butter.

It will be seen that angularity of form means something to the practical dairyman. It is more than a fancy point. It means good round dollars to the man who ovserves this the second point in the selection of a dairy animal. To dwell further on the angularity of form; the neck should be rather light and long like Houston's and not short and thick like Ethel's. The hip points should be sharp and low, not carried too high because that would indicate a level back. The pin bones should be wide apart to make calving easy and the thighs should be spare indicating no tendency to lay on flesh.

The third point is not one of so much importance to the practical dairyman. You cannot judge the ability of a cow to produce a large amount of butter by the size of the udder. If she has a good capacity and an angular form she must of necessity find an outlet for her product and the udder will usually be found large enough to take care of the milk the cow produces. On the other hand if a cow lacks the first two points a big fleshy udder does not mean anything.

For a practical dairyman a cow should have a fair sized udder, with teats large enough for the milker to get hold of so as not to lose time in milking, and teats should be well placed, not too near together. For the breeder of pure bred stock form of udder is more of an important point. Houston has a very good shaped udder, but it should extend further forward and be attached more firmly to the belly. From the breeder's standpoint it should extend further up behind. From a business standpoint one cannot expect too much from any one individual and it is therefore best not to be too critical as to udder formation, but to tie to the essentials. From the breeder's standpoint the udder of Fortune would be criticised as being too pendulous, cut up between front and rear teats, not estending far enough forward nor attached well to the body, neither does it extend well out and up behind.

The milk wells are very important in selecting a dairy animal. The orifices where the blood comes down thru the abdominal wall should be large and numerous. In this respect Colantha 4th's Johanna, the world's champion cow, and Ester Piebe DeKol

are exceptionally good, having two extra wells near the navel in the center of the belly. In judging young calves and yearling heifers the milk wells are more of a guide than are the udder and teats.

BREED CHARACTERISTICS.

The breed characteristics are important to the practical dairyman. The outline suggests some of the things to be considered and if at a state fair one sees a judge examining the skin at the roots of the hair in a Guernsey cow's tail, or the switch, he will understand the man is looking for the color of the skin, a Guernsey characteristic for which 15 points are allowed. Extension veins on the Holstein, extra counts for well shaped udders with the Jersey and Ayrshire, and width of belt and color markings of the Dutch Belted are all special breed characheristics. A typical dairy head is rather hard to describe, but Houston's will give something of an idea of what it should be. The forehead should be broad between the eyes and narrow between the horns. The jaws should be strong and muscular.

CONSTITUTION.

While we usually consider a wide chest an indication of constitution we do not know that this is the case. A draft horse has a wider chest than a pacer or a thorobred, yet by actual weight the thorobred is found to have the largest lungs. There is domething about the depth of chest at the heart girth which seems to be a very good indication of

constitution. We like to see an animal full in the regions of the heart. Notice the cut of Olive how she is "cut up" or "tucked up" in the fore flank. As a rule you may depend upon it that a cow lacking depth there, is lacking in constitution. The muzzle should be broad and strong, the nostrils large and open as the dairy cow has lots of work to do. She must breathe well to purify a large amount of blood from which the milk is manufactured in her body. The jaws should be strong, that she may be a good feeder and the eyes bright. Much can be read as to the disposition of the dairy cow by viewing her eyes. They should be bright, but not too open so that they appear drawn. A drawn eye indicates an irritable disposition. The abdominal wall should be strong, denoting a good muscular development in the work shop of the cow.

For the person who is absolutely sure of his business ability the breeding of pure bred stock holds out many inducements. The special dairy breeds of cattle have been bred for generations with the ultimate view of dairy production. The Clyde horse or Percheron has been bred for draft purposes, until he can lift heavy loads at a slow gait. The English thorobred and the American trotter have been bred for light draft at exceptionally high speed until the world's records have been greatly reduced. While there are always exceptions to the general rule, we do not generally find a registered thorobred that will start a heavy load where the footing is bad. The same thing might be said of the registered trotter, but not to the

same extent. Neither do we find registered Clydes or Perdherons in the 2:30 trotting or 2:25 pacing list, altho 2:30 today is a very slow gait for a racer. It is only about fast enough to lose money on. The point is this, special purpose animals for special work. Applying the same principles to the cow, we expect to find many more good producers among the dairy bred animals than we do among the beef breeds. However, if we select stock on pedigree alone we shall be doomed to disappointment sooner or later. We must learn to judge the individual as well as consider the performance of the ancestors.

The best breed of cattle to keep for dairy purposes depends largely upon the likes and dislikes of the individual breeder. Skakespeare says, "No profit grows where is no pleasure ta'en." If a breeder takes the greatest pleasure in seeing the black and whites against the green foliage of a well shaded pasture, for him the Holsteins are the breed to keep. If there is something about the rugged, picturesque form of the orange and the whites which make the Guernsey the attractive breed in his estimation, let him select this breed because they are also good. Jerseys as far back as in 1789 were noted for their beauty and the richness of their milk, and many today prefer them because of their very economical production. It is not so much a matter of which breed is selected as it is the selecting of one and sticking to that breed. If a man builds up a herd of extra good animals from any one of these breeds he will be sure of success if he does his part.

Holland is a small country reclaimed from the sea by throwing up massive dikes to keep back the water when the tides are in. It is self-evident that the land is very valuable, in fact the annual rental is from $50.00 to $100 an acre. This it the country from which the Holstein comes. There cows are kept because they were found profitable and the average for the entire country shows that they produce per cow 9000# of milk a year. They were brought to this high standard from necessity because of the small acreage. Some farms of 25 acres in Holland are made to keep 50 cows and a large number of sheep. Holland overages one cow for every acre of land and two sheep kept for for every cow. The world's champion cow is a Holstein, Conantha 4th's Johanna and she made 998# of butter fat in a year.

The Guernsey cow comes from one of the channel Islands. It is a small triangular piece of land 9 miles long and 4 miles wide at base. There are living on this island some 35,000 people whose chief export is Guernsey cattle and dairy products. The people of this island found their stock a source of great profit to them and passed stringent laws protecting them. This stock is rendered pure by the exclusion of all other breeds and cattle brought to the island except from Alderney and must be slaughtered within 24 hours. It is pretty hard to go far enough back into history to show the origin of this breed, but it is safe to say they are one of the oldest and most prepotent of the popular dairy breeds. Yeksa Sunbeam the champion Guernsey made 1,000# of butter in a year.

Because of the rich milking quality and farm like appearance, the Jersey has been the rich man's cow since the early history of this country. She has been the most popular and still continues to produce butterfat as economically as any of the dairy breeds. She comes from the island of Jersey where rent is also high, from $50 to $100 per acre. This breed was also protected by stringent laws, no other breeds being imported into the island. Back as far as 175 years ago history gives us the information that many of these cows produced from 220 to 230# of butter a year. Great care has been taken to perfect this breed on the Island by the early agricultural associations. They have also the merit-system of registering their cattle there. No heifer is registered until she has had her first calf and if she does not meet the standard requirements of production she is condemned. If she meets the requirements she is marked C. or H. C. for Commended or Highly Commended as the case may be. For every bull submitted for registration must also be shown his dam, that her qualifications may be taken into consideration before passing upon her son. The dhampion Jersey cow is Jacoba Irene who has had three calves the last three years and is safely in calf again. Her yearly record is 1122# butter.

It will be noticed that these breeds all have been established from necessity and brought to a high standard. They are prepotent because they have been bred for generations along the same line. A dairyman wishing to breed pure bred

dairy cattle can make no mistake in selecting any one of them.

IMPROVING THE DAIRY HERD

Use of The Pure-Bred Sire

The average young man starting out in life will not find himself in a position to purchase pure-bred stock to start a dairy herd and it therefore becomes a matter of great interest just how to obtain a herd which will insure a nice profit. The graduate of an agricultural school or college will be disappointed upon taking up life's work when he goes out to select the foundation for a small dairy. This applies as well to the ambitious young man who has remained at home. The point is simply that upon starting in for himself and casting his eyes about him for a small herd such as can be purchased with reasonable means, the young man suddenly realizes there are few herds which will furnish good material at reasonable prices. Good cows are not found among farmers who do not realize their value. It requires effort and knowledge to bring a herd to a high standard. The young man must therefore keep the standard in mind as given and go out among his neighbors, picking up cows or heifers conforming somewhat to the type mentioned. He should then make up his mind once and for all which breed of dairy cattle he will keep and look for improvement through the pure-bred sire.

The test of his ability to build up a herd will not be measured by the cows he is able to get together at first. If he is dependent upon the dairy for immediate results the

original herd is important, but on the other hand he must look for all improvement through the sire. The sire, from a breeding standpoint, actually being half the herd, it is at once apparent that if a good animal is to be had the beginner may well pay as much for him as for all the females put together.

A pure-bred sire at the head of a grade herd may easily be more than half the herd. Let us stop long enough to ask ourselves, What is a pure-bred animal? Possibly several definitions might be given, but to frame an answer in simple words one might say: An animal which has been bred for generations in certain lines and for specific purposes until characteristics and type have been fixed.

The longer cartina individuals are bred strictly along the same lines without the introduction of alien blood, the deeper seated their characteristics become, or as we say, the more prepotent. The Jewish people are an example of pure blood lines. For thousands of years the religion of the Jews has kept them from intermarrying with the Gentiles until today, if you see a child of a Jew there is no mistaking his parentage. The child will not only look like a Jew, but will have all the racial characteristics of his people. Let there be intermarriage and still the characteristics of the Jew are not stamped out. You may feel sure when you see the child that he will grow up to excel in business because these traits are so stamped upon his general make-up that he cannot help following in the path of his fathers.

The Scrub Lacks Prepotency.

Unfortunately for the average farmer, there has been nothing in this country to prevent mixing the breeds of cattle as fancy dictates. What has caused the large number of scrubs which are daily seen on the average farm? Nothing more nor less than crossing some of the well known and established breeds in an attempt to make a short cut which would establish in one or two generations what the best breeders have failed to accomplish in their life time.It is quite common to hear some nice old farmer, whose grey hair should proclaim him far too wise to be caught making such a statement, say, "Well,I believe the best breed of dairy cows is a cross between the Holstein and the Jersey or Guernsey. You get the quantity from the Holstein and the high test from the Jersey."

There is more chance of bringing out all the bad features of both breeds and if perchance the first cross is good you are almost certain in the next to get an animal not as good as the dam. If you follow by using a pure-bred Holstein or Jersey sire upon the cross-bred cow your results will doubtless be satisfactory, because by so doing the progeny will be a three quarter blood; but if upon the cross-bred Jersey-Holstein cow you use a beef sire the progeny will be about as scrubby as need be. You have broken the prepotency by mixing conflicting strains of blood. This is what many farmers have been doing and that is the reason we have so many scrubs on farms today.

The Prepotency of a Pure-Bred Sire.

Bred Sire.

We have noticed that the stock on the island of Jersey and Guernesy are protected by very stringent laws against any admixture of alien blood. The high rental paid for lands in Holland has brought about the same condition of affairs among the Holstein-Friesian cattle. There has been no alien blood in the veins of these animals for generations back and therefore, there can be very little outcropping of characters other than those racial characters of the breed. Atavism can do no harm because it will be merely a reversion to a fixed type. The first principal law of breeding "like produces like" is strengthened by a long line of ancestors of the same type, and prepotency is added with each succeeding generation. The breeder that has a fine individual backed by a long line of ancestors of merit has the advantage of two great laws,"Like begets like" and the law of atavism and has left one important one to combat, the law of variation.

As stated before, prepotency is gained in each generation of pure-bred animals so that the law of variation does not exert such a strong influence. Of two animals of equal individual merit the pure-bred sire has great advantage over the scrub. It is generally admitted by scientists that the milking characteristics of the dairy sire's dam are transmitted to his daughters in a greater degree than those of any other animal in pedigree. It is therefore, very important to take into

consideration the performance of the young bull's dam.

Next in importance are the records made by the half-sisters of the young bull. If a bull transmits milking tendencies to his daughters it is more than likely that he will transmit them to his sons. While we look for good animals in a pedigree, the successful breeder much prefers to have the record animals "close up" to the animal he is using in his herd. By "close up" is meant numbered among the immediate ancestors and not back several generations.

We find some horsemen bragging because their horses trace to Morgan, to Hambletonian 10, to Pilot Jr., or to Electioneer, Onward and Nutwood, but what the skilled breeder wants to know is through which one of these great horses the line in question comes down and the speed shown by the immediate ancestors. He wants to know whether speed is increasing or diminishing each succeeding generation. Where the pedigrees show speed several generations back there is only a chance of its being transmitted. The same thing is true of cattle for milk production. We like to see the Diploma blood or that of DeKol Burke "close up". We are then quite sure of its being transmitted. If there is evidence of heavy production through the sire and dam, through the grandsire and granddam, and so on back for several generations the progeny in this line of breeding is pretty well established. It is easy to see how a bull, having such ancestors, might easily exert more influence than all the females in transmitting dairy tendencies to the future offspring. The prepotency

in a pure-bred animal is constantly increasing, while it is broken up in the case of the scrub females. It is evident then that greater improvement may be looked for from such scrub dams than from those of pure-breeding which are of inferior milking tendencies.

Beauty or Utility.

We sometimes hear beginners wonder if breeding for utility will not in a measure lessen the value of stock for sale purposes. Of course there are exceptions to the rule, but in general, if one cannot see beauty in a good producer, further education along selection of dairy stock is needed. "The best minds of the present day in judging works of art in painting, sculpture, architecture or music, consider the production a failure unless it conveys some meaning or motive, or is intended to teach a great lesson."Beauty and utility then go together.

Some Indications of a Good Bull.

It is usually considered much more difficult to judge a dairy bull by points than it is to select a beef sire. With the latter a smooth, massive form is desired with correctness of outline, usually spoken of as resembling a parallelogram in form when the head and legs are removed. One of the principal things to be considered in the beef animal is thickness of fleshing. The dairy bull on the other hand should be spare of flesh and have an angular form which indicates no tendency to lay on fat. He may have a few points in common with the beef

bull, but in general he is just the opposite. Like a beef bull one of the dairy breed should be masculine in appearance, short on legs, deep through the heart girth, with fore ribs well let down. The head should be strong, the forehead broad and narrow between the horns. The eye should be full, yet not too open. He should be bold in general appearance with an abundance of vigor.

The dairy bull should be well muscled in the crest, but unlike the beef bull he should be very sharp at the withers. With the exception of masculine character as denoted by the head, neck, and general carriage, the dairy bull should resemble the dairy cow in form. He should have much greater length and depth of barrel than the beef bull, should be sharp over the shoulders, with backbone prominent, well cut up in the rear flank and twist, thighs nicely chiselled out, rudimentary teats well placed and milk wells prominent. In short he should be very masculine in appearance, full of vigor(denoting prepotency) and have no tendency to lay on flesh.

Not All Fashionable Pedigreed Sires a Success.

Prof. Eckles, University of Missouri, has published some very instructive data comparing the differences in the ability of dairy bulls to transmit dairy tendencies in a marked degree. A complete record of milk and butter fat of all the cows in the herd was kept. Five bulls of the Jersey breed were under consideration: Missouri Rioter by Bachelor of

Lambert, Hugoratus; Lorne of Meridale (with producing ancestors); Missouri Rioter 3rd by Missouri Rioter, and out of an excellent producing dam, and Minette's Pedro. Ten representative daughters of each bull at maturity were considered and their yearly records compared with those of their dams. Considering the milk worth 6c a quart, the ten daughters of Missouri Rioter fell $313.00 per year behind the dams. The ten daughters of Hugoratus fell behind their dams 3,770 lbs. of milk. The ten daughters of Lorne of Meridale gained $150 over their dams. "if thirty of his daughters had been milked for six years they would have produced $2,700 more than their dams, while the daughters of Missouri Rioter went $939 behind, or a difference in thirty cows in six years of $4,639 in actual income."

The ten daughters of Missouri Rioter 3rd produced $275.00 worth of product more than their dams, or figuring on the basis of 30 cows for six years, $4,950.00 more than their dams. Missouri Rioter 3rd was a son of Missouri Rioter out of the best cow in the herd. Prof. Eckles says his son was the only good thing Missouri Rioter left in the herd. Like many other good sires his ability to transmit tendencies was not learned until they had disposed of him, when they would have been glad to have paid $1,000.00 to have had him back.

The last bull used in the Missouri herd upon which a report was made was Minette's Pedro and while he was in use the herd remained at a standstill. The great lesson to be learned from this is that a tried sire may easily be worth $1,000.00

in a large herd, while another be expensive as a gift. There are many bulls sold for beef before their daughters come to maturity that would easily bring a thousand dollars if their merits were really known. It is the height of folly to ignore the value of dairy form and the advantage of a good pedigree, yet the true test of a bull is the dairy production of his daughters.

After the first crop of heifers have come to maturity, a careful selection should follow, based on dairy form and the results shown in production. The scales and Babcock test should be used, but it should be remembered that dairy form must not be ignored because a trained eye is occasionally as true a guide as the Babcock test applied for only one year. A cow frequently has an off-year so that if her yearly record is fair and her form exceptionally good, she may turn out to be a very valuable animal if given another chance. If the heifers from a certain sire prove to be very choice animals it may be policy to retain the animal as the head of the herd, even breeding his own daughters back to him. On the other hand for the average farmer community breeding is of great value.

Community Breeding.

There are two very good reasons, if not more, why a certain locality should get together and agree upon the merits of a certain breed and all use the same line of dairy cattle.

1. By rotating the bulls from one farm to another an exceptionally good bull may be kept in service and do the community an immense amount of good. A tried sire will then bring

a fair price instead of going to the block. The man determined to select young bulls takes all the risk for the neighborhood. Of course, if run on a co-operative breeding plan, each must take some risk when purchasing the untried sire, but some men, if left to themselves, would purchase nothing but young bulls.

2nd. Where a certain breed of cattle is kept, there is less of the so-called "war of the breeds", for all unite in proclaiming the merit of their common choice. This establishes a high reputation for the breed held in common and buyers are impressed with the superiority. Further, buyers feel sure that if they go to one of these breeding communities when well established, they are sure to find about what they are looking for and in large enough quantities to pay them for going some distance.

Continue With Same Breed.

When once launched with one dairy breed, continue along the same line and do not cross a Jersey upon a Holstein or use a Guernsey upon Jersey females. Keep the breeding straight and grade up.

REARING THE DAIRY CALF.

Among prominent dairy authenetics there is some difference of opinion as to the length of time a good milking cow should be allowed to rest before freshening. Prof Haecker says she should be allowed to rest from six to eight weeks. If a cow milks right up to the time of calving she will not do as well during the next period of lactation. And what is of special interest to us under this heading is the fact that colostrum milk is not formed without some rest.

COMPOSITION OF COLOSTRUM:-

It divvers both chemically and in its physical nature from ordinary milk. Chemically it differs principally in containing a greater amount of albumen. Fully 20% of colostrum milk is casein and albumen, while normal milk does not contain over 3.25%. It contains less sugar than does normal milk. In consistency it is viscous, containing less water than normal milk and less fat. It changes rapidly after the cow has freshened and in four or five days is about normal. The colostrum milk seems to have a medicinal effect on the digestive tract of the young calf and is just what it needs; therefore it should not be deprived of this first milk.

FEEDING THE NEW BORN CALF:-

In the dairy division of this station it has been the custom to allow the new-born calf to run with the dam until it has sucked this colostrum milk and then remove it from the cow. When the very young calf is removed from its

dam it should be placed in a small pen by itself and not with the other calves. The idea is to keep it from getting into the very bad of sucking other calves. It is best not to attempt to feed the calf milk until 24 hours after the morning it was taken away. It will then be hungry enough to drink milk without putting a finger into its mouth. As a rule it is better to feed the calf its mother's milk the first week at least, or until the milk can be used in the dairy. Of course the amount fed will vary with the size and strength of the calf, but as a rule from 3 to 4 pounds by weight, or 3 to 4 pints by measure is what Prof. Haecker has always recommended. Some consider it necessary to feed three times a day, but that is unnecessary and as it is no small amount of trouble, the noon meal may well be dispensed with. The second week the calf should get half whole milk and half separated, at a temperature as near 980 degrees as possible, not increasing the amount. About the third week the little thing is put on to skim milk and is still fed about the same amount, but with it is mixed a teaspoon full of ground flax. The amount is gradually increased until at the end of the first month the calf is getting a heaping tablespoonful of flax meal and about 10 pounds of skim milk twice a day. Some dairy authorities favor boiling the flaxmeal, but it is not as digestible and is in condition to sour when boiled up in a quantity large enough to last from morning's feeding until night. After the calf has reached the age when it commences to pick

at hay it should always have access to a little nicely cured upland or clover and it is surprising how young they will start to eating it. A few oats and some bran may also be placed before it. Some people make the mistake of feeding oilmeal instead of flax meal. They are not at all the same in composition, as flax meal is ground before the oil has been extracted and contains from 30 to 33% of oil, while oilmeal or oil cake is made from flax seed from which the oil has been removed and is therefore very rich in protein, just what is not needed because the skim milk is rich in that ingredient. It is just as necessary that a calf receive a ration balanced in a way suited to its needs as it is that a cow receive a balanced ration.

Whole milk is as near a perfect food as anything we have. After removing the fat it is no longer balanced. The oil in the flax meal takes the place of the butter fat in a measure. If flax meal is not obrainable, cornmeal ground very fine may be substituted, as corn is rich in carbohydrates and carbohydrates will take the place of fat, altho they are not in as concentrated a form. The skimmilk being rich in protein, n none of the nutriment which goes to form the body tissue or growth is removed. Some dairymen consider skim milk thinner than whole milk and of little feeding value so they make the mistake of feeding more of it. It is always better to have the calf continually looking for more than to feed it enough to get it out of condition. _ Some of the very important things

to be observed about calf feeding are; regularity in time of feeding and amounts fed, as well as proper temperature of the milk. The nearer the milk can be fed at a temperature of 98 degrees F. the better and it should be fed sweet. Some dairymen feed sour milk when the calves are older and report good results. It should be remembered that this change from sweet to sour should be brought about very gradually, and when once upon sour milk diet they should not be changed back and forth from sweet to sour.

Under the direction of Prof. Haecker this dairy division has always obtained best results by feeding skim milk fresh from the cows at as near normal heat of the animal body as possible. This experience has been borne out by the experience of many farmers in the states of the middle west. If warm, sweet milk were not better than sour for calf feeding, the average farmer would not go down into his pocket for $75.00 or $100.00 to purchase a cream separator where there is a creamery near at hand. If the milk is hauled to the factory and there separated, the skim milk should be pasteurized before being returned to the farm. Pasteurization keeps the milk from souring and also destroys germs of contagious disease like tuberculosis, etc.

It has been suggested by Prof. Haecker that where scales are not available for weighing the skim milk, it may be measured in a clean tin cup. You have all heard the old saying, "A pint is a pound the world around." This is not absolutely

true in weighing milk, but it is near enough for all practical purposes. All the tin ware in connection with the feeding of calves should be kept scrupulously clean. To facilitate feeding the calves, they should be shut up in small stanchions so that they do not tip over each other's mess or get in the habit of sucking each other. While the milk is still on the little nose from drinking and possibly because nature intended the little fellow to get his meal by sucking, it seems hard for him to do anything else. If allowed to such at this time the habit becomes fixed and follows him even to maturity. The writer has noticed calves in a farmer's barn yard standing and sucking each other for an hour at a time. If the calves are put into the stanchions and kept there until the milk is dry on their nose they will forget their desire to suck and go off about their business. They should have little mangers in front of them wide enough to set the feed pails into. These should be kept sweet by scrubbing and as soon as the calf is old enough to eat oats and bran it should receive about a tablespoonful in the little manger. If this manger can be so arranged as to permit of the bottom being taken out for scrubbing it will be found much more convenient. While this station has raised many calves without blood and bone meal, still they are both found to be very valuable for feeding and may be mixed with salt and placed in a small box in one corner of the manger where the calves may help themselves.

THE IMPORTANCE OF CLEANLINESS.

We have mentioned how it is of utmost importance that the pails be kept absolutely clean as well as all the tinware coming in contact with the feeding of calves. It is also of great importance that the pens be kept free from filth and moisture. Plenty of bedding should be used at all times and the pens cleaned out frequently. If the pen is not a large one it should be cleaned out every day. A dark damp and dirty place is very favorable to the growth of tiny bacteria which may attack the health of the young animal. Plenty of sunlight keeps the place dry and kills bacteria.

SCOURS OR CALF CHOLERA.

This disease is quite different in its effect upon calves than is the common diarrhea upon animals. Dr. Roberts, Wisconsin State Veterinarian, says that it may take on a form of infecticus intestinal catarrh. The disease may appear suddenly in a formerly strong and healthy calf or the calf may be born with the disease. It usually appears the first two weeks of the calf's life. After the disease has once made its appearance such progress may be made that the calf is found dead in from 24 to 48 hours if not properly attended. As suggested the calf may be afflicted with the disease at the time of birth or before it has taken any feed.

SYMPTOMS OF THE DISEASE:-

One of the first indications is a soiled tail, then there is loss of appetite, sunken eyes, sometimes a flow of saliva from the mouth with no attempt to swallow. The manure

is thin and watery and of a light color with a sour, disagreeable odor. The passages are frequent and "expelled with force." Result the animal grows thin, loses strength and may lose the sight of one or both eyes. Dr. Roberts says if continued the irrating secretions cause congestion and ulceration of the intestinal musous membrane. This form is contagious and if suspected in the herd, the pregnant mother should be treated internally with 1-1/2% of lysol or creolin. When it makes its appearance in the calf it should be given from two to four tablespoonsful of castor oil mixed with a half pint of milk. This should be followed in four to six hours by one teasponful of a mixture of one part salol and two parts of sub-nitrate of bismuth. This can be given in pint of new milk or the powder on the calf's tongue and washed down by a small amount of milk. These drugs may be had at almost any drug store and should be mixed in these proportions ready for immediate use.

Prof. Haecker recommends the following treatment for calf scours. After the castor oil has been given it should be followed by a teaspoon of Zenolium or in very bad cases a tablespoonful. He further recommends that the navel of the young calf as soon as dropped should be bound up with a 4% disinfectant solution. Others suggest that the navel of the calf be wet with 1/500 solution of bichloride of mercury(Corrosive sublimate.)

CARE OF THE DAIRY COW.

If a heifer is to make the best dairy cow she should freshen when she is about two years old. Some dairymen are of the opinion that they do not make quite as good growth when expected to milk at an early age, however, they make surer breeders and the milk flow is more easily stimulated to a high degree if started within reasonable time. Then too best authorities consider that just as good growth is made. Much of the heifer's future value depends upon her ability to give a large flow of milk throughout the entire period of her lactation. With mature cows we sometimes find they gave a large amount of butter fat for a time, but fail to continue a and, therefore, are unprofitable cows. Much depends upon the way a heifer is started out when milking for the first time. A little ill-use or neglect, may easily spoil her. We have suggested elsewhere that a cow should be allowed six to eight weeks' rest between one lactation period and the next but a longer time does not work to her future value. If allowed to dry off four months after calving she will be inclined to do the same thing each year after that. Espedially is this true of habits formed in the heifer during her first milking period. They are more easily fixed in the young cow than with one that has been milking several years. Every effort should be made to prolong the first period of lactation well up to the second calving. Some of the best dairymen even cause the heifers to milk 14 or 15 months so as to influence them in prolonged production. In order to do this great care should be exercised in proper feeding, proper milking and giving them the very best

treatment. They should be milked even though they give only a small amount.

FRESHENING. The freshening period is a very important time and rest is necessary just before calving for the system to arrange itself for the ordeal. Rest gives a better chance for the embryo to grow and develop during the latter stages. With some cows it is quite difficult to get them dry, yet it is quite necessary to do this no only for the sake of the cow during the next lactation period, but also for the welfare of the future calf. Put the cow in a stall and feed her only hay for a time until she is dry, then the feed may be increased lightly. Look after her udder during the time of drying off and milk out only enough of the milk to keep from becoming inflamed. Cows freshening in September and October should be dried off in July and August when flies are bad and at a time when the heaviest part of the farm work is to be done. As soon as the cow is entirely dry she may be fed a light grain ration to get her in good condition, though not fat, for freshening. The gestation period of cows is nine months or 280 days, and as the time draws near for calving the cow should be put into a comfortable box stall having plenty of bedding to keep her dry. During the summer months when the flies are not bad and the weather is suitable, we prefer to have the cows out of doors as they then receive plenty of exercise and are in the very best possible condition for calving.

All animals produce stronger young when both sire and dam have a reasonable amount of exercise each day, and the cow is no exception to this general rule. Not only are they young stronger, but the dams are in better condition and have less trouble in parturition as the muscles are stronger.

The indications of approaching time of partuition is similar in the cow to that of the mare. The udder becomes distended and hard and the muscles and tendons relax on each side of the rump. This leaves a hollowed appearance, which is a very good index of calving when one has once learned to recognize it. If the calf is perfectly healthy it should be up sucking in half an hours'time. After the calf has drawn the colostrum milk he may be removed and after 24 hours offered the dam's milk to drink. With a high type dairy cow it is usually best not to draw all the milk out of the udder as nature hastens to replace the milk if completely drawn out, and the extra demand upon the system may throw the very best cows into a milk fever. It is only good cows that have this disease, but it is quite common among heavy producers. The very young calf never draws all the milk and therefore, it is unnatural to remove it all. An empty udder demands too much work upon the system and too much heat to replace the milk, therefore, very little milk should be drawn the first threeor four days, and in severe cases of milk fever air is pumped into the udder to fill it out. After three or four days there is very little danger of the disease.

The cow should have warm water the first day or so and a nice bran mash makes a good cooling feed. The after-birth should come from the cow within 36 or 48 hours and if it does not it should be removed by a careful man who is skilful at the job.

Just before and immediately after calving she should be fed rather lightly and her ration gradually increased up to the 30 days when she will have reached the climax in milk production. Skill is required to bring a cow up to her maximum flow and not have her drop back. A balanced ration suited to the cow's needs is very essential, but this will be discussed under a later head.

The general condition of the cow previous to freshening will have much to do with her reaching the climax of production in safety Warm, well lighted and ventilated stables are essential to a high production. A sanitary barn should have from four to six feet of Window space for each cow kept. Where cows are kept in the stalls much of the time it is not unreasonable to expect the barn to be light enough for one to read in. Good ventilation is essential but should be so arranged that there is not a draught upon the stock. While warmth without ventilation is conducive to disease, ventilation without heat is a consumer of feed. The barn should be kept within a range of temperature of between 40 deg. to 60 deg. F. In summer the shades should be pulled down because the well lighted barn will become very warm. They should also be down to keep out the flies. It is well to have gunny sacks over the door similar to those used in a dog kennel so that as the cow forces her way through the flies will be brushed off her back. When kept in the barn cows should be brushed daily, not only to keep the dirt and hair from falling into the pail, but to keep the pores of the skin open. This makes the cow more comfortable and anything that can be done to add to the comfort of the cow adds just that more to her

productiveness. Along this line it might be added that the modern swinging stanchions are much more humane than the old ridged ones and the "Haecker stall" is more comfortable even than the best stanchions. In any case there should be partition or some kind of a stall between each cow to keep one cow from stepping on the teats of another lying down. For an economical cut of lumber a 32 ft. barn is a good width, but it is rather narrow for two rows of stalls, 36 ft. wide will do very well, the stalls should be three feet wide for common cows and 3 1/2 for large ones.

The length of the stall should be adjusted to the cow so that her hind feet just come to the edge of the gutter. The gutter should be 18 inches wide and not more than 6 inches deep, slanting toward the drain where they may be deeper. In the gutter it is well to use common slacked lime, or even wood ashes, as an absorbent. For the greatest degree of comfort a shed should be provided as a runway where cows may get a little exercise and at the same time a warm place to drink. If the water is too cold, say below 55 degrees in winter, it should be heated either by steam or a tank heater used. A mature dairy cow uses about seven gallons of water a day and it therefore requires quite a little extra feed to heat the water within to drinkthe body. Both in winter as well as in summer the cow should have good pure water to drink. A cow should not be required to drink water that a person would not be willing to for himself.

It is poor ecomony to keep dry cows on a starvation ration as they will not be in condition to do a good year's work when freshening. A cow of the dairy type will draw upon her body fat for a time to produce dairy products, but as self preservation is is one of nature's first laws she cannot be expected to continue to draw on her own supply unless she has a little extra laid up.

A small quantity of barrel salt should be given the cow once or twice a week and she should have constant access to rock salt either in the yard or pasture. If cows are out on full pasture there is little use of feeding grain, but this division has made it apoint to feed about one pound to acow night and morning to keep her quiet. When the pasture becomes short, or, if not pastured, heavy enough, the grass may grow up and become too large for the animals to relish; in either case soiling should be protected.

In going to and from the pastures the cows should have a good wide lane so that they are not hooked and jammed about. If the floors of the barn are of cement, a small quantity of sand should be sprinkled on the floor before the cows are turned out or allowed to come in. This will prevent them from slipping. During the cool heavy rains the cows should be kept under cover as it requires a large amount of food to evaporate the water from an animal's back.

Do not hurry them with a dog or horse. When a cow is doing normal work and is receiving enough food to perform well at the pail, it requires in round numbers 30 percent of the total digestible nutrients for the maintenance, 30 per cent of the food of the

working over the maintenance, 30 per cent goes into the product and 20 per cent is expended in working over the nutrients which go into the products. If a cow under normal working condition uses half her food for sustaining the body it is plain to be seen that a certain amount of food must be fed before the dairymen may expect any returns. If no more than a maintenance ration be fed, very small returns can be expected. The cow should, therefore, be fed up to her full capacity. It takes no longer to milk and care for a cow giving 350 pounds of butter a year than it does to feed one giving 150 pounds. It is poor policy to keep a cow that makes less than 200 pounds and they should not be kept in an "ice house, a hog pen or a dungeon." Cows giving milk should have a nice paddock to run in for a little fresh air as soon as spring arrives. Care should be exercised when they are running together that heavy cows do not ride the young heifers when the latter are in season. Heifers are frequently injured for life by this treatment, broken down rumps being rather common in some herds. A dairy cow should be made comfortable at all times, receiving her feed regularly and should not be allowed out of doors shivering around a straw stack or to suffocate in a dark, poorly ventilated barn.

The milking should be done regularly night and morning at about equal intervals between day and night milking time. In other words, if you milk at 4:30 in the morning you should milk at that time in the evening.

Each milker should have a certain number of cows to milk and milk these regularly, commencing with the same one at a certain time and milking them in rotation. The milker should milk with both hands as quickly as possible without hurting the cow and unless the teats are very short, should do very little stripping. In other words milk the cow dry without the common practice of stripping. The last drop can be obtained as well by using the whole hand as by stretching the teat out between the thumb and fingers.

For the sake of the health of the herd they should be tuberculin tested once every year and those animals reacting should be removed from the herd. In order to do justice to all cows in the herd the Babcock test and scales should be applied that the "boarders" might be weeded out and the good cows given even better care than outlined under this heading.

LAYING OUT A FARM.

There are several things to be considered in laying out a dairy farm, but among the more important points are the ease with which the work can be performed, the comfort of the stock and the economical use of fields to get the maximum feed out of a given tract of land without impoverishing the soil. A farm may be ever so productive, yet because of its ill-shape is not a profitable investment from a business standpoint, simply because it cannot be run without double the help required on another farm to accomplish a given amount of work. In prairie districts the farms are usually square thus giving the very best chance to lay them out so as to economize time going from one field to another, or in getting cows back and forth from the pasture. In a wooded country the pasture may be a great distance from the farm buildings, and even in the Red River Valley some of the old farms are four miles long and only a few rods wide. Even tho this is very fertile land, it is a consumer of time and of energy to allow cows to run to the other end of the farm. Some may say at once, build a pasture near the farm buildings and use distant fields for cropping. It sometimes happens that the distant fields are not farm lands, but even if they were you would then have four trips to make with your teams when putting in the crops and a long distance to haul manure. In short it follows that the man on a square farm never realizes the advantage he has over the other fellow until he has once lived on an ill shaped piece of land. The average

farmer does not have these extremes to contend with, because most farms are about square, but it is quite common to see farm buildings located on one corner of a gig farm, with field stretching as far as the eye can reach in another direction.

The mapped farm is a quarter section (160) acres) one and one-half miles south of an enterprising town of about 2500 inhabitants. There is a good creamery in the town where butt er and ice-cream are made. First of all notice the shape. It is a square piece of land west of the main road. The buildings are only ordinary, yet they are located just off the road where in winter the roads are always open. A glance will be enough to show how handy the fields are to get at for work. A further examination of the plan will reveal a possibility of making the stock comfortable which is our second point under consideration. The farm yard grounds contain 10 acres. On the north and west may be planted the golden willow and box elder to replace the cotton wood trees. These trees should be far enough away from the barns to keep the snow from drifting around the buildings. The long cow barn should run north and south with plenty of windows in each side to admit the morning and afternoon sun. There is a good well in the center of the barn yard and another near the house. There should be a good windmill over the barn well with a tank to run water into the house and thru the garden into the permanent pasture in summer.

Across the south corner may be planted box elders and ash trees with a few elms. These are all hardy under Minnesota conditions and make good shade trees. The farm is so arranged

that cows may be turned into any of the rotation fields and come up during the heat of the day and be comfortable in the permanent pasture. The southwest twenty acres, being one of those farthest away and especially adapted to alfalfa, is left out of the rotation. While alfalfa has never been grown on this farm it should be given a fair trial and if not a success, the ground put into corn fodder.

SOILING CROPS, (A farmer should sow only a small field of alfalfa at a time so as to make sure it will do well before risking too much money for seeding a large field) are grown near the barns so that the cows may be kept up during the middle of the day in fly time. They can then be turned out either on the permanent pasture or on the rotation pastures over night, and be made comfortable in summer as well as in winter. A 120 ton silo should be located at the north end of the long cow barn.

While the farm is not laid out exactly as indicated in the drawing a rotation has been following for the last fifteen years very similar to the one mapped out and crops indicate a more fertile condition than that of the virgin soil. In starting a new prairie farm it is impossible to get it into rotation at once. Usually wheat and flax are grown until the land becomes foul with weeds and mustard. This was the case with this farm; some of the fields were very dirty when it was purchased and the remainder raw prairie. The prairie was broken in June and the following season sown to wheat.

Following the wheat crop flax was sown the next year and the stubble turned under very early. Corn, oats and barley were then grown for several years until weeds were the main crop. Stock and about the rotation indicated were introduced until mustard and Canadian thistle are no longer seen on the farm and the soil is more fertile then at the outset. Barley proved a good nurse crop because it could be harvested early. With this clover and timothy were seeded for hay and the rotation was started on a small scale. Sheep assisted greatly in cleaning up the young mustard plants. The clover and timothy are cut for hay the latter part of June or first of July and in the fall the seed is gotten back from the clover.
After the second year the land is pastured, but very little if any clover makes its appearance. Following the clover and timothy pasture the land is broken for corn, and as clover sod rots easily, it is unnecessary to let land remain idle as in case with wild sod. The corn ground is manured and oats are sown the following year without plowing. Rye or raps may be sown in the corn to make fall feed for young stock and sheep. The following year barley is sown as a nurse crop for clover and timothy, and your rotation is complete as indicated. A minor rotation is followed among the soiling plots, the heavy manuring must be resorted to to keep up fertility.

The farm will carry 35 cows, 30 head of young stock, 10 head of horses, 50 pure bred ewes or hogs, depending upon whether milk is sold for city consumption or butter made, and 200 pure bred chickens. If hogs are kept more of the corn should be manured.

FEEDING.

The study of animal feeding is an important one. It embraces composition of food stuffs, their digestibility, together with the amount and character of product formed by the animal body. Without some knowledge of the subject, the science and art of feeding would be reduced largely to a stuffing process. Without a fair understanding of animal feeding it becomes next to an impossibility to feed domestic animals economically.

This is an age of commercialism and while there are some who keep domestic animals merely for their beauty, the average person is deeply interested in the market returns as well. Directly or indirectly market returns are based on economical production and it therefore follows that feeding is the keynote or foundation of success in animal rearing. It has been demonstrated by many experiment stations that from 20 to 30% may be saved by merely feeding a balanced ration: that is by feeding a ration so adjusted to the animal's need that he finds the required nutrients in the right proportion without a loss.

KIND OF NUTRIENTS REQUIRED.

A balanced ration should contain each of the following ingredients in order to be a perfect food,-Protein, Carbohydrates and fat.

The protein is composed of a group of materials containnitrogen, and furnishes materials for the formation of lean meat, blood, tendons, nerves, hair, horn, wool and the case-

in and albumen of milk. It has been demonstrated by Prof. Haecker that no substance free from nitrogen can be converted into protein.

The carbohydrates are found in grains and coarse fodders as well as in crude fiber and include the starches, sugars, gums, etc. "The carbohydrates are either converted into fat or burned in the system to produce heat and energy."

The fat is that portion of the ration which may be dissolved by ether and is therefore sometimes spoken of as ether extract. The fat includes the chlorophyll, or green coloring matter, of the plants, wax and fat as such. Like the carbohydrate group, the fat is either used to lobricate the digestive tract or is burned in the body to furnish heat and energy.

While the fats in food stuffs perform about the same function in the animal body as the carbohydrates, still we find that they are in a more concentrated form. It has been determined by experiment that for heat producint purposes one pound of fat is equivalent to 2.5# of carbohydrates. Prof. Haecker has found by numerous experiments that one pound of fat in food stuffs is worth about 2.2# of carbohydrates. It is therefore evident that if the fat content be multipled by 2.2 it can be reduced to a carbohydrate equivalent which is very useful in ascertaining the requirements of the animal body.

After some extensive investigation it was found that the

nutriment required by the bovine for milk production was dependent upon four things.

1st Upon the weight of the cow
2nd " " quantity of milk yielded
3rd " " quantity of the milk, and
4th " " age and character of the cow.

First considering the weight of the cow, some 15 animals were averaged and found to weigh 966#. With these it was found that it required 6-1/4 to 6-1/2# of net nutriment to produce 1 pound of butter fat and maintain the body. When these cows were placed on a ration of 4.65# of net nutriment to one of product, their daily yield of butter fat being 1.35, they drew on body tissue to produce the butter fat. At the close of the first week they dropped to an average weight of 917 and produced .62# of butter fat more than the nutriment provided for. During this experiment it was shown that the typical dairy cow will produce dairy products at the expense of keeping up the body weight. Not only was this fact made manifest in a decrease of weight, but the animals' coats were rough and when inspected by a veterinarian were pronounced poorly nourished. It was also found that they did not shed their coats as readily as did cows receiving a ration containing more protein. The results also show that the larger the cow the less required for food of maintenance in proportion to her weight. The food of maintenance is the food or nutrients required by an animal to build up the worn portions of the body, supply heat, etc. The amount required was found to be .7 of a pound of protein, 7. pounds of carbohydrates; and .1 of a pound of

ether extract for a mature animal weighing 1,000#. The food of maintenance was worked out with barren cows kept constantly in the barn under comfortable conditions. In order to find out the total amount required for milk production it was necessary to add to the food of maintenance 1.65 for a unit of product. It required 1.65 of net nutriment in the food to produce a unit of nutriment in the product. It was, theredore calculated that it took .65 to stimulate milk production, or in other words to make the transformation from food to product.

It has been determined that not only is it necessary to feed a cow according to her weight for maintenance, but it is equally necessary to take into consideration the quality and quantity of milk produced. Hence it was found necessary after years of experimental work to allow .0007 of a pound of protein for each .1 of one percent increase of fat in the milk. For example:

For milk testing 2.5% fat it required	.0362 protein .164 C. H. .012 Fat.
For milk testing 7. % " " "	.07 protein .7 C. H. .01 Fat

The results given were obtained thru the medium of mature animals as it was found to require more nutrients per pound of milk produced when working with heifers or immature cows.

There are also solids not fat which must be taken into account. The solids not fat do not increase in direct proportion as the fat increases. Cows testing 3.8 per cent returned one pound of solids to 1.86 pounds of nutrients, and those testing 4.5 returned a pound of milk solids to 1.98 pounds of nutrients. It is clear from the above figures that the high testing cows produce butter fat more economically. That is, it is not necessary for them to produce as much solids not fat in a given amount of milk.

In economical feeding a cow will take about 2# of hay to every 100# of live weight and about 1# of ensilage to 1# of milk. If the cow is a low tester, about one pound of grain is given to every three pounds of milk; but if she is a high tester, about 1# grain to 2-1/2# milk. It was found that about 10% more nutriment is required with heifers to produce a pound of product than with mature cows. It was also found that cows of every nervous temperament, when disturbed, did not give as good returns for food consumed.

In connection with this work use Prof. Haecker's Feeding Standard.

SILOS.

Early in the history of the races in Sweden and the Baltic provinces green forage was preserved because of the uncertainty of the weather conditions. At this time in the history of civilization we find it was generally understood that fodder might be put up in this manner where the summer weather was too cool for the proper curing of hay. It was not, however, until the middle of the present century that the preservation of green forage came into general use.

FIRST SILOS.

The first silos were pits in the ground ten to twelve feet square or even larger. These large pits were sometimes lined with boards or cemented up with clay. After the pit had been filled the green fodder was usually covered with a board covering and then dirt was thrown on top of the boards tow feet deep. Auguste Goffart, a French farmer, in 1877 published the first book on soiling of green crops and while he was not the inventor of the silo, still because of his early investigation along this line he has been called the "Father of Modern Silage." Silo and ensilage in one form or another date back a great many years, yet it is only within the last fifteen or twenty that they have come into anything like generuse. Today the uptedate dairyman would about as soon think of dairhing without farms as attempt to get along without a good large silo.

CORN.

Indian corn is pre-eminently the greatest of silage

crops. If has been found to be well adapted to general conditions, makes rapid growth, keeps well and is nutritious as a cow feed. Much of the space devoted to silos will, therefore, be taken up with the s toring and handling of the cown crop. With soil conditions right as to moisture and heat the corn crop will sprout in from 4 to 6 days, says Prof. Woll, "sending out the radicle, growing downward, and the plumule, from which the different organs of the plant gradually develop. The starch, albuminoids and ash materials in the corn germ, and in the rest of the kernel furnish the young plant with nourishment until it is sufficiently developed to draw upon the soil and the air for the elements required for the upbuilding of its structure and of the various organs essential to its life and to the reproduction of the species."

According to Prof. Harcker's feeding standard 1 lb. of corn contains .89 Dry Matter, .079 protein, .67 Carbohydrates and .043 of fat, while the silage contains per pound .21 of dry matter, .009 of protein, .11 of carbohydrates and .007 of fat. The compesition of the silage will vary somewhat according to the age when put into the sile. It was found by numerous chemical analyses from full tasseling to maturity, made by the North Dakota, Cornell, N. Y., New Hamp., Pennsylvania and Vermont stations, that the yield of nutrients and dry matter increase rapidly up to maturity. It is, therefore obvious that the longer the cutting is postponed and still retain its palatibility and keeping quality, the greater will be the feeding value. The digestibility of corn fodder decreases, however, as it arrives at maturity and corn should, therefore be cut while the ears are in the denting stage. The best students

of the dairy problem and close observing farmers are putting in their corn fodder so thick that ears are not matured only around the edge of the field. The common grain drill may be used to good advantage by leaving open one shoe and closing the next six across the width of the drill, or leaving open tew s shoes and closing five, itc. When the corn planter is used the rows will be between three and four feet apart, with plants six to eight inches apart in the row. The arrangement of planting does not seem to make much difference as the yield seems to depend upon the number of plants grown to the square foot. Prof. Woll reports as follows, "Hills four feet each way, with four stalks to the hill, will thus usually give about the same yields as hills two feet apart, with two stalks in the hill, or in drills four feet apart, with stalks one foot apart in the row, etc."

In using the reaper it is not well to grow corn in hills as the cutting apparatus is supplied more evenly when the corn is drilled in. While Prof. Harcker has been an advoe cate of putting the corn in thick with a grain drill, stopping up shoes as indicated, it is never well to sow the corn broad cast. In harvesting the farmer is guided as to time of cutting by such ears as come to maturity around the edge of the field, and harvests the crop in roasting stage.

Corn best adapted for silage in Minnesota has been found to be those varieties which mature in that locality. The large southern varieties do not make the best silage as they contain too much water. Under the average Minnesota conditions

"Russler's White Dent" and "Minnesota #13" are good. In the southern part of the state south of the Twin Cities "Leaming" has been grown with success, while in the extreme north end et the state, in the Red River Valley north of Crookston, "Pride of the North" and Minnesota King" have been found to give the best results.

CORN GROUND.

A nice sandy loam makes very good corn ground as it is warm and easy to cultivate, for the latter reason it is usually not foul with weeds. When this kind of soil is full of humus ro well rotted barn yard manure, it retains the moisture well and is then in condition to force the corn crop to its maximum growth. It is hard to get the corn ground too rich even the there has been a good crop of clover just previous to the plowing of the corn ground. It is, therefore, a very good policy to top dress clover stubble before plowing it under. It has b been the experience of the writer that corn does best on fall plowing, taking it on an average one year with another.

After getting the corn ground in good condition by pulverizing and harrowing it down smooth, the corn should be p planted or sown and then harrowed every few days until the corn is several inches high. By following this plan it is usually an easy matter to keep the weeds down, but this of course depends womewhat upon the condition of the soil. Some depend upon putting it in so that it may be tended. As a rule shallow cultivation has given the best results and especially after the crop has made some growth. The roots of the corn are long and run near the ground, hence late, deep cultivation disturbs them.

It has been found best not to cultivate the crop more often than is necessary to keep it clean.

ENSILAGE FOR DAIRY COWS.

It has been proven by numerous experiments that ensilage is just as nutritious and palatable as is corn sured under the very best conditions in the field, that is, cut and dried. From a practical standpoint it is more palatable and cows do better on it. It is a difficult matter to cut corn and preserve it outside of a silo. When stocked up near the barn it is liable to mold and if left in shocks in the field, snow gets on the shocks and spoils it . It is a difficult matter to dig it out of the snow and haul it into the barn in winter.

To sum up, a Geneva, N.Y. bulletin says, "Maize (or Indian corn) is probably the most valuable plant for ensilage. As a succulent food for milch cows, corn silage is cheaper and generally more efficient than roots. Corn has proven equal in feeding value to the best dried corn fodder.

Prof. Miles of the Michigan Agricultural College after twenty years of silo ecperience said, "The supply of succulent food to supplement the rodinary dry winter rations of the live stock is undoubtedly one of the most important advantages of ensilage that should not be overlookdd, especially in winter dairying."

What a few prominent men say about the use of a silo for dairying,-

Harcker, "Other things being equal the silo always makes for a larger and more ecomonical flow of milk."

Hoard, "The silo is almost indispensible."

Dean of Ontario, "The silo is becoming a greater necessity every year in Ontario."

Wing, "A silo is well-nigh indispensible."

Goodrich, "A farmer can keep cows profitably without a silo, but he can make more profit with one."

During certain years because of lack of sunshine it is next to impossible to cure a crop of clover ro alfalfa. Where there is danger of the legumes being spoiled because of wet weather it may be well to put these crops into the silo. The legumes supply a large amount of protein and are, therefore, very valuable as roughage to use with the farm grown grains. Cover is second only to corn for silage and in some localities it may be grown about as cheaply. Clover contains much more protein and is also more succulent than is corn silage. It does not pack as well as the heavy corn and, therefore, a higher silo is required. Clover is usually cut when in full bloom and contains the greatest amount of digestible matter at this time.

Here at the Minnesota Station we have found the stave silo to give good results, but one of the requisites of a good silo is that is must be air tight. While there has been only very little bacteriological work done on ensilage it is generally understood that the free development of aerobic forms are antagonistic to the keeping quality of silage. We must therefore, have the silo air tight, and either build high or put artificial weights on top of silage to press it together. This is also one reason for having the silage cut fine, as fine ensilage packs tighter than coarse, thereby excluding the air.

The writer believes that the more practical silos are not more than 16 feet in diameter. A silo about 32 feet high and 16 ft. wide will hold about 120 tons of well packed silage. If the ground upon which the silo is built is well drained it is practical to build the silo about five or six feet below the floor of the cow barn. It may be practical where the lower part is in a pit to make the silo over 32 feet, but as a rule it is better to build two medium sized silos rather than one extremely large one.

On an average one cubic foot of ensilage weighs 40 lb. and it, therefore, takes 50 cubic feet for a ton. The round silos are the best because of less waste, ensilage packs better in than and there is more available room in them for a given amount of material used. A silo should be built on a good stone foundation with the bottom and sides cemented up so that rats and mice do not burrow thru to let in the air. The kind of a silo to build will depend largely on the cost of different materials. It is needless to say that a silo should be well roofed over.

FORAGE CROPS FOR THE DAIRY COW.

In studying the economical production of dairy products there are two matters of great importance to the practical dairyman if he expects to make a success: First the cow, and second the feed.

As we have already briefly considered the cow best adapted to the dairy work, together with her care and the general arrangement of the dairy farm, it is now left for us to consider the feed. The different kinds of feed will necessarily vary with the seasons of the year to a greater or less extent, depending upon the use or the non-use of a silo. We will first divide the feeding period into two sections and call the two divisions summer and winter feeding.

Summer Feeding.-- There are two methods of summer feeding usually employed upon the modern dairy farm, and practiced with equally good results depending largely upon the size of the farm. If the dairy man has only a very small amount of land, say 30 to 60 acres near a large city, he will attempt to grow as much fodder on his fields as is possible for him to produce. The time and labor employed are not as important an item in this case as on larger farms where land is cheap. Where such a condition exists the stock are kept in the barn and green feeds are grown, cut and carried in to them. This method of feeding is called soiling. The other method which is generally employed on the average western farm is to allow the stock to run in pastures and gather their own feed. Both methods have

their advantages and disadvantages.

Soiling.-- It is not the intention under this subject to discuss all of the farm grown grains which may be used in soiling. The special student along these lines may well spend years in this work. It is our aim to present only the essential ideas in a thorely practical manner. The practical dairyman on a small farm can give several reasons for practising soiling. First there is less waste since the animals are not allowed to run at will over the fields to gather their foods. The growing crop is, therefore, not wasted by being tramped upon or manured by the animals. There is an increased production of forage by sowing grains at a time of the year when they will make the most rapid growth. For example wheat and barley grow better during the cool spring and autumn weather, while corn needs the intense heat of the summer to make the most rapid developement.

The animals appetite is stimulated by feeding a greater variety of food stuffs. This can only be done to advantage by feeding grains or soiling. With soiling there is hardly any limit to the varieties that can be grown. It is clear from a former statement that a greater amount of food may be produced on a given number of acres and it therefore follows that less land is required when soiling. By this method of feeding, stock are continually kept in the barn. Some dairymen contend that less fencing is required. While this may be an item on some farms in the states of the middle west, we do not consider it much of a point in favor of soiling.

In Minnesota soiling crops would be molested by neighboring stock at certain seasons of the year which would cause the dairy farmer greater expense than would be sustained by fencing the whole farm. During the hot dry summer and in fly time it is absolutely necessary to make dairy cows more comfortable than can be done while running out and gathering their own food. Where soiling is resorted to the cows are kept up in darkened barns and are about as comfortable as at any season of the year. Greater comfort for the cows results in a larger milk flow and the difference in this respect is much greater than might be expected by those who keep no record of their cows. Then too, the manure may be better protected and gotten on the land at a season when it will do more good than if dropped on a permanent pasture. On the other hand the labor problem in the west is an important consideration. It is difficult to get good help at a reasonable salary and as it requires more help when handling stock under the soiling system, it is not generally practiced on the ordinary dairy farm.

Practical Soiling.-- A simple form of soiling has a place on all dairy farms and without it success is hard to attain. Prof. Haecker of the Minnesota college recommends that succulent feed be provided during the entire period of lactation. He says the better the pasture the greater the danger of disappointment, because where cows freshen on good grass, without it is pastured close, the grass soon grows up so large that

cattle do not care to eat it and it goes to seed. On the other hand if pastured to full capacity during the early part of the season when grass grows most rapidly there will be a shortage during the hot dry weather in July. At this season of the year flies are also bad and stock should be kept up in the barn during the day and fed on soiling crops. Clover should not be fed green because it is too valuable as a dry feed.

How to Provide Soiling Crops.-- As soon as the frost is out of the ground in the spring, two acres of field oats and peas should be sown, using 2 bushels of peas to one of oats per acre. The method of putting in this plat will depend somewhat on the character of the soil. If light and sandy the peas may be plowed under, but on the heavy clay loam the seed should be sown on top and dragged in. Under Minnesota conditions this crop at the Experiment Station has returned about 6 tons of green feed to the acre. This crop will be ready for feeding early in the season. For a second plat about two acres of early fodder corn should be planted. This should be sown as soon as the weather will permit after the 10th of May and will be ready for feed when the oats and peas are fed out, or too ripe for green feed. For this seeding about 40 pounds of early home grown seed should be used and drilled in 2 1/2 to 3 1/2 feet apart.

About the 1st of June it is well to sow two additional acres of fodder corn of a later variety known as evergreen corn. These corn crops may be drilled in with a common seed drill by leaving one shoe open and closing six across the width

of the drill. The kernels should be dropped from two to four inches apart. Later sow about two acres of millet either Hungarian or German millet. These are of the finer grains and are more desirable than the coarser varieties which furnish too much woody fibre for cow feeding. Millet should be cut just as it is heading out and should be allowed to wilt a little in the sun. It may then be used freely for soiling. From 2 to 3 pecks of millet should be sown to the acre as thin sowing allows the stock to grow too coarse. Two or three weeks after the field corn has been put in, about two acres of late fodder corn should be sown, the method of seeding being as before described. It should be harrowed frequently until quite high to keep out the weeds. The thicker the fodder corn is planted the better so that no ears are formed.

Roots should be part of the ration of dairy stocks because there is no food better suited to stimulating a large flow of milk in cases where the cows have dropped off. Where cows freshen in the fall as they should for best results, we have new grass in the spring to turn them on which stimulates them to a higher degree of production, but if they freshen in the spring they are quite apt to give only a small amount after fly time. If we have the root crop to draw on for early winter feeding we can bring the cows back in their milk flow. The mangel-wurzel is well adapted to northern conditions and makes about as good a root crop as any, Among the different varieties is the yellow globe which is of good size and keeps well. The

ground should be heavily manured for the root crop as they are rank feeders. A yield of from 12 to 15 tons per acre may be expected in this section.

Mangels should be sown early in the spring in rows 27 to 30 inches apart and thinned out to form 7 to 10 inches while young so that the dirt is not disturbed around those left in the ground. From 4 to 6 pounds of seed should be sown to the acre.

These soiling crops should be used freely to supplement the pasture, but on the average dairy farm should not replace pasture. If the pasture grass is good and the weather conditions favorable, cows will do better in pasture, keep cleaner, and calves will be stronger where the pregnant mother is allowed plenty of exercise and the bright sunshine. A permanent pasture with good shade should be a part of every well organized dairy farm.

The summer soiling crops mentioned, permanent pasture, alfalfa and clover hay, together with corn silage form the basis of economical feeds for the Minnesota cow.

THE IMPORTANCE OF KEEPING DAIRY RECORDS.

The keeping of dairy records is one of the most essential items in the dairy industry. It has only in recent years received the attention its importance merits. Dairy records may not necessarily be complicated as their value does not depend upon the hiring of an expert bookkeeper to keep or interpret them. The more simple the records can be made and yet give an accurate report of business transactions the better. Since the recent appropriation for dairy extension this division has planned extensive work along the line of records and test association work. The object is to raise the standard of dairy animals in Minnesota.

The natural function of the cow is to produce young and feed it up to the time when it is old enough to forage for itself. Under these conditions the cow does not give more milk nor for a longer period than is needed for the growth of the calf, but man by careful handling and selection has prolonged this milking period and has stimulated the milk flow to a much higher degree than was originally found among bovine animals. The progress which has been made in the past is only an indication of the advancement which may be expected in the future under systematic treatment. The proper method of raising the standard is what dairy extension and dairy records seek to teach by showing which are the most profitable cows, that unprofitable ones may be sold. Weekly milk and feed record sheets are furnished by this department, the records being kept there. The patrons

sending in a report of the amount of milk together with the test of each cow and the amount and kinds of feed fed. The amount of butter produced by the individual cow is computed and suggestions offered as to the feeding of the different animals in the herd to get the most economical yield. Many of the herds are visited from time to time.

The average Minnesota cow is giving only about 150# of butter when she should be producing 250# during the year. We are milking over a million cows and we are losing on an average of 100# of butter per cow. If from these million cows we should receive 100# more butter than we are receiving figuring the price at 25 cents per pound, Minnesota would receive $25,000,000 annually more than she is receiving for her dairy output. It is stated upon good authority that one-fourth of the cows kept for milk production are kept at a loss, while another fourth do not pay anything on the investment, thus leaving only a half of the cows that are really worth keeping. Of the half which pay interest on the investment only about 25 out of the hundred are really making a nice profit. The conditions on the average farm are such that the owner does not have a definite knowledge as to which cows are the "boarders" and which are the ones worth keeping. Moreover, the average dairyman does not care to take the trouble to weigh and test the milk from a large herd. On account of this state of affairs test associations were formed in Denmark in 1895 and it is reported that in 1903 that country had something like 308 such associations. The advantage of test association work and record keeping spread rapidly into Sweden, Germany, Finland

and Norway.

The state of Iowa, realising the importance of dairy instruction and better kept records among the cow owners thruout the state have enacted a law appropriating $10,000.00 annually for dairy extension work. This provides for a salary of $1,500 for one or more field instructors. The test association work is also getting its share of attention in California. Here about a year ago the work was attempted somewhat as it has been conducted at this station. Mr. Philipson, a well informed dairyman, undertook the work there leaving the dairymen to weigh and sample their milk. He thus tested the milk and kept a record of 1080 dairy animals. The work of Mr. Philipson has created such interest that two young men have been engaged to carry it on. There are already a total of 1900 cows being tested under this arrangement. Aside from this official work there is also a private estate sending out a man to their numerous dairy farms to test the herds for the benefit of their tenants. Of the 1300 cows owned by the estate 1100 are being tested under private test for the benefit of these tenants. In Humboldt county California, alone there are 5160 cows under test.

In Utah the cows are largely of the beef blood and consequently not as much can be expected from them as from cows of the dairy type. This was found to be true by means of the scale, the Babcock test and the keeping of records; they were

found wanting in total production. It is reported that there are about 90 creameries in Utah with a total output equal to $2,000,000. It is stated upon good authority that with better dairy cattle, the same amount of labor, feed, same number of cows and same expense, the total income could be raised from 2,000,000 to $3,000,000 making a clear profit of $1,000,000.

According to the U. S. Department of Agriculture, the Michigan station found from their records that the profit from milk from different cows varied from $6.08 to $94.05. At the New Jersey station the profit varied from 13 cents to $49.72, when milk was valued at $1.00 per hundred. At the Storrs Connecticut station during the hear 1903 the best cows gave a profit of $54.72 and the poorest $2.76. Another point made clear by the U. S. bulletin is the fact that while the records of the poorest cows given in the above data show them to be poor indeed, yet they were not as poor as some of the cows kept on the average farm.

The following from Prof. H. H. Dean of Ontario shows the value of records for making comparison between beef and milk production for human food;

Cow vs. Steer.

"In a recent dairy demonstration a Holstein cow made the largest yield of milk, fat and solids not fat. Her daily average was 67.31 pounds of milk, 2.35 pounds of milk fat and 5.17 pounds milk solids other than fat, making a total daily yield of 7.52 pounds of milk solids. Assuming that these milk solids are as valuable per pound for human food as is the fain in live weight of a steer, we see that it would require about three steers to produce as much human food daily as did this one cow. Thus we have another remarkable illustration of the economic value of the cow as a food producer for mankind. The

author points out that the three best cows (two Holsteins and a Jersey) produced during 120 days the equivalent in food value of five fat steers weighing 1,126 pounds each. The total food production of the 70 cows during 120 days was equal to the food value of 70 fat steers weighing 1,405 pounds each. When these facts become known it will not be difficult to forecast the relative standing of the beef and dairy industries in the near future."

In connection with the dairy extension work, this institution will seek to know the following points concerning the herds that are to be tested:

Name of farmer
Address
Date when test was started
Number of cows
Breed of sire
Total pounds of milk
Average test
Pounds of butterfat
Gross receipts.
Total cost.
" profit or loss.
" pounds of milk per cow
Average pounds of butterfat.
" receipts
" cost
" profit of loss.

When do cows freshen?
Number of cows disposed of because found unprofitable.
Kinds of roughage fed.
Cost of grains fed.
Average cost of grain per cow.
Kind of pasture.
Average cost of pasture per cow.
Number of acres in farm.
Number of acres under cultivation
Number of acres in permanent pasture.
How much of farm is fenced?
Water supply.
Cost of raising heifers to freshening.

One of the chief benefits to be derived from keeping records in the dairy of cows is the inspiration it gives those who assist in carrying it on. It is a guide not only to the feeder but to the milker as well. In short it works wonders in building up a high standard of production.

TUBERCULOSIS AMONG CATTLE.

Tuberculosis is an infectious disease common to man and domestic animals. It is the most widely spread of all diseases and follows civilization wherever it advances. There is hardly a country where tuberculosis is not found. The importation of bovine breeding stock has been instrumental in carrying the disease to countries where heretofore it was little known, as, for example, Japan. The agricultural press has considered and treated the subject largely in its relation to the human race and to cattle, yet it is also common to pigs, often appearing as so-called "scrofula," and is frequently found in dogs and cats as well as among domestic fowls. In college laboratories where cats are commonly dissected for biological purposes it is not uncommon to find the "children's pet" literally filled with tuberculosis. While it is known that the tuberculosis affecting poultry is not of the same variety as that affecting man, still the human type is common to both cats and dogs.

Only about 25 years ago Koch discovered that the disease is due to a bacilus. Since that time rapid progress has been made in understanding the disease. After the bacili have gained entrance and lodged in a section of the body and are not thrown off, they grow and multiply, forming lesions which are filled with a cheesy substance more or less yellow in color, and often of a hard, calcareous nature. In the human body the walls of these lesions break down very readily, al-

lowing the bacili to escape, where they spread and by development form new lesions. Among cattle these walls do not give way as rapidly and, consequently, being kept together, develop into larger nodules. These nodules, which are white in color in many cases develop rapidly in the interior of the body, clustering together like grapes and growing to the size of a pea. This resemblance gave tuberculosis the name of "grapes" long before much was known about it or its true character understood.

Every stock owner should make it a point to see and know the characteristic tubercle nodule that he may not only protect himself and family from using meat badly infected with tuberculosis, but be able to determine for himself when tuberculosis is present in his herd.

BOVINE FORM EXISTS BY PERMISSION OF STOCK OWNERS.

It may seem strange at first thought that tuberculosis exists among cattle by permission of the owners, yet such is the case, and a little reflection on the subject will convince the most skeptical that this is true. The tuberculin test commonly known among stock raisers has been found to be a most satisfactory method of diagnosing the disease. It has been determined time and time again that it is impossible to point out the tubercilous animals from a herd by the looks, yet the tuberculin test will fail of giving accurate information only occasionally, notwithstanding some men who are called doctors are condemning the test. - Why, in the light of pre-

sent science, anyone should consider the tuberculin test inaccurate is a conundrum, and leads one to suspect such a person's having some financial reason for disapproving the test. There are cases where post mortem examinations have been made and no lesions of the disease found, it is very reasonable to suppose that had every gland and cell in the body been examined, traces of the disease would have been located. Careless operators have failed to take necessary things into consideration when applying the test and so failed in obtaining accurate results, condemning animals which did not have the disease, yet a careful man or a skillful doctor will hardly make a mistake and the results may be depended upon. Occasionally an animal far gone with the disease will fail to react, due probably to the fact that the bacili in the body have become used to their own tuberculin. In a case of this kind the disease has usually made such progress that it is visible to the eye, and one has but to consider the natural symptoms. The animal becomes poor, the coat is dry and does not lie well, or, in common terms, is "hide bound." There is shortness of breath and a hacking cough. An animal which has tuberculosis well developed in the lungs will sometimes cough in the morning when turned out, if it is a little chilly or upon drinking cold water or eating dry feed. These, then are a few of the more common symptoms of the disease which will be apparent if a tuberculous animal fails to react to the test. It is, therefore, plain that there are very few cases of bovine tuberculosis existing which cannot

be located either by the test or at sight. If this is true, we then have a safe and effective method in tuberculin for determining the presence of the disease and for pointing out the animals which must be weeded out if we would eradicate the disease.

The next point to consider is the liklihood of the dam transmitting the disease to her offspring. Will the calf from the tuberculous dam be dropped with the disease germs in its system? This is a question which has been often asked. All the best authorities are agreed that the calf is born free from the disease, and, while it may possibly have a weak constitution which will readily succumb to tuberculosis if introduced into the system, still no germs of the disease are present at birth. This being the case, we have an opportunity of heading off tuberculosis if we isolate the calves from all tuberculous animals as soon as they are dropped. The calves can then be kept free from the disease if fed on the milk from cows which do not react to the test or by feeding them on pasteurized milk.

The tubercle bacilli are not extremely resistant against heat and if the milk be heated to a temperature of 150 degrees F. to 155 degrees for about twenty minutes, or to a temperature of 190 F. for five minutes, you may feel sure there are no living tubercle germs present in the milk. Direct sunlight kills the bacilli in from 10 to 24 hours, which fact is a strong argument in favor of well lighted barns.

TUBERCULOSIS ELIMINATED ONLY BY MAKING THE BREEDING OF IT UNPROFITABLE.

There is no surer and more practical way of eliminating the bovine disease than to make the breeding of tuberculous stock decidedly unprofitable. It is not an easy matter to suggest a practical way whereby this matter can be adjusted, because it is not best in all cases to kill off at once all animals affected with the disease. There are many states where it is so prevalent that it would be ruinous to the stock interests were every tuberculous bovine at once killed. many of the best pure bred herds are badly infected with the disease.

The fact that an animal is pure bred should not give him any more license to live and spread the disease than a scrub, altho the extra value for stock purposes will sometimes compensate for keeping him isolated from non-tuberculous animals. The wise farmer will see to it that infection is not introduced into his herd by purchasing tuberculous breeding stock, but, on the other hand, if he finds it in his herd of fancy stock he cannot always afford to kill the infected ones at once until he has raised a few crops of calves to raise the standard of his stock. He should be content, however, to sell only the young stock and see to it that they were not allowed to become contaminated by running with tuberculous animals.

PASS A LAW REQUIRING SALE ANIMALS TO BE TESTED.

It is often hard to purchase bovine stock subject to the tuberculine test, and trouble often arises even when such agreement is made. A law should be passed making it necessary that every animal offered for sale be tested and no animal allowed to change hands for breeding purposes that is not free from the disease. Require the seller to prove the merits of his goods.

There should be no objection to the sale of tuberculous animals for the block provided rigid inspection of the carcass follows. If the disease is found only in one organ of the body the meat is perfectly safe if well cooked.

To check the disease then, all animals changing hands and the dairy herds from which milk is offered for sale should be officially tested, tagged and recorded. This would allow every stock owner to get the value out of his stock on hand, unless it be the city milk man, but would make him very cautions about raising young stock and allowing them to become exposed to the disease. After this precaution it would hardly seem necessary to suggest the removal of superfluous cats and dogs affected with the disease.

To Capitulate:

1st. Tuberculosis is a very infectious disease, common to man and domestic animals. Its presence should be ascertained as soon as possible and steps taken to stamp it out.

2nd. Every stock owner should make a post mortem examination of a tuberculous animal and examine the characteristic nodules that he become familiar with their looks for self-protection as

well as that of his herd.

3rd. Bovine tuberculosis exists by permission of stock owners, becausé in tuberculin we have a practical means of determining the presence of the disease and, secondly, because the calf is born free from tuberculosis.

4th. The disease can be wiped out only by making the breeding of tuberculous animals unprofitable. To this end a law should be passed preventing the sale of tuberculous cattle for dairy or breeding purposes.

THE RELATION OF DAIRYING TO SOIL FERTILITY.

Members of the Country Life Commission recently made quite a startling report of the waste of soil fertility in different parts of the United States. They reported that New England with the exception of the valleys has lost by far the greater portion of her available fertility. They further report a marked change and decided loss of fertility in Kentucky outside of the famous Blue Grass region which comprise not more than about five counties. In the southern states east of the Mississippi the waste is so great that large tracts are constantly being turned over to nature as unprofitable for cultivation and now broom sedge, a plant which will grow on the poorest of land, is seen growing. Passing thru the South this commission found large areas of land once rich but which will not grow only about a quarter of a bale of cotton per acre. Similar conditions were found in California where the land had produced 20, 30, and even 40, bushels of wheat; some of this land had been turned back to pasture because of the waste, which had reduced the yield to 8 or 10 bushels.

They reported the waste in the corn belt not as great, but no less surprising, considering the original fertility of the soil. Their attention was called to a farmer in Illinois, a man 90 years old, who had obtained his land from the government at $1.25 per acre, never transferred it, and who because of poor farming had wasted the fertility of the soil until the land would no longer sustain him. The land was originally fertile for around him were neighbors growing from 35 to 40

bushels of corn per acre, yet his last wheat crop yielded two bushels per acre and his corn crop not more than ten. It became necessary for the man in question to rest a part of his land while he cropped the remainder that he might get even a part of a yield, yet this would not permanently bring back fertility.

A meeting was being held right in this section of the country where land owners were asking $100.00 and $150.00 per acre for land and making the claim that the fertility of the soil could not be exhausted. A speaker was urging the importance of keeping up the fertility. Many of the farmers were indignant at the mere thought that their land could ever lose its fertility. The speaker said, at the close of the meeting a young man stepped up to him, quietly told him he had purchased a run-down farm in the neighborhood for $50.00 per acre and submitted a plan of farming to bring back the fertility. Such a general waste of soil fertility over so much of the United States should cause us to consider well the possibility of great loss in our state. We know in certain localities farmers have continued to crop their land with wheat until the yield dropped so low that farming was no longer profitable. It is impossible to continue taking fertility out of the soil without replacing some of it.

There are different theories as to the cause of loss of fertility. Soil chemists usually advance the idea of loss of phosphoric acid, potash and nitrates from the soil. Bacteriologists contend that loss of fertility is due to toxic substances thrown off by plants in the form of excrement. This they contend fills the soil so full of the poison that the same plant cannot continue to grow year after year in a cer-

tain soil. There is much food for thought along either line, but for the practical farmer it matters little for general results. We may not settle definitely for some time just what causes the loss in productiveness, but observation will show any intelligent man that continuous grain cropping year after year with no rotation or without the keeping of stock will deplete the soil.

No matter which of the above mentioned theories as to the loss of productiveness is accepted, dairying will correct it. We know this to be true from both practical and experimental knowledge. Farms in Minnesota which for years failed to continue producing crops of wheat have been restored thru dairying to a higher state of productiveness than virgin soil. This is not alone due to the addition of barn yard manure. Clover which is naturally cultivated under successful dairying management has played an important part in this restoration process. Experiments carried on here at the Minnesota Station show beyond a question of a doubt that soil fertility cannot be maintained without a reasonable amount of humus. "Humus is a black or brown substance formed by the decay of vegetable matter; vegetable mold. It contains various chemical compounds, as ulmic and humic acids, and is an element of soil fertility."

Humus assists in holding the moisture by absorbing a large amount during seasons when moisture is plentiful.

Soils are kept in a better physical condition when there is an abundance of humus, there being less tendency to pudd-

ling during the wet seasons and less danger from cracking and baking during the dry season. According to Smith the soil is less susceptible to abrupt changes of temperature, absorbing and radiating heat more slowly. Whitney suggests that the persence of large amounts of humus has a tendency to counteract the poisonous affects of the toxins in the soil. If toxins are given off by the growing plant, an abundance of hunus will tend to correct the break down these poisons thru the aid of soil bacteria. Humus also tends to prevent the leaching out of soil fertility as it holds phosphoric acid, lime, nitrogen, potash, and other inorganic plant foods. Humus furnishes food for the bacteria, thus assisting in the decomposition of inorganic matter which may later serve as available plant food.

The question of supplying humus to the soil is an important matter on the average farm and in this connection it is important that the land owner and farmer consider well the problem of farm manures as the spreading of farm manures is one of the best ways of adding humus to the soil. In order that a large amount of manure be produced it is necessary that stock be kept, and it is further important that this stock receive such home grown feeds as assist in adding fertility to the soil. Where dairying is followed the farmer is not only sure of getting his returns at a time when most needed, but also knows he is not losing productiveness from year to year.

A good cow should return a gross sum of $70.00 per year besides her calf. It has been found by experiment that

where the butter is sold and the skimmilk returned to the farm that only a very small percentage of fertility is taken off the farm. The soil chemist has estimated that a ton of wheat takes about $7.oo worth of fertility out of the soil and sells for about $16.00, while a ton of butter takes out only 50¢ worth and sells for from $500 to $600.

It has been proven that leguminous crops may be grown with profit as green manures, turning them under in the fall, but this is unnecessary where dairying is followed. The clovers, alfalfa, beans and peas lose nothing as soil restorers when fed thru stock. It, therefore, follows that while dairying is in itself a very paying industry, it is doubly so when considering the advantage in adding humus to the soil.

Long says in regard to the use of farm manures, "The value of every extra load of dung obtainable is well understood by those who have grasped the fact that the more dung a man uses, the larger the quantity of produce he can grow, and therefore the larger the number of stock he can keep. If, then, we can keep more stock by the aid of manure, we can make more manure by the aid of stock, and so we perform the cycle stock, manure, crop, stock." Other things being equal the richer the food fed to stock the more valuable will be the manure. The manure from animals fed upon hay and straw will not be as valuable as that from animals fed on clover hay andbran, oilmeal, oats or cotton seed meal. Manure from the latter will be especially rich in nitrogen and phosphates.

For a further study of the relation of dairying to soil fertility read; "The chemistry of the soil" by Snyder; "Manures, Fertilizers and Farm Crops," Brooks; Conn's Agricultural Bacteriology; Soils, by Helgard, and Bulletin #257 on Soil Fertility by Whitney of U.S. Agricultural Department.
