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Alfalfa Hay, the Real Basis of Better Dairy Farming.

BETTER DAIRY FARMING

THE BREEDING, FEEDING, HANDLING AND CARE OF DAIRY CATTLE

BY

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"Better Farming, Better Business, Better Living"

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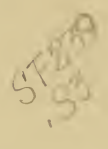

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PREFACE

Professor E. H. Farrington of the department of dairy husbandry at the University of Wisconsin asks his class of farm boys at the end of each term this question, "What languages do you speak besides English?" One boy answered, "I can speak a little Norwegian and a little German, and I understand horses and cows."

That is the very object in writing this book. We want to make the language of cows a little better understood by the dairymen of this country. To know about cows, the farms and the best farm practices in different parts of our great country will make a man a better farmer on his own farm. With the reading of this book we hope that farmers may have their vision broadened and perhaps a suggestion will be found that will change a practice so that a little more money may be made and saved.

At the time of writing this preface farming is said to be in a bad way. The lawmakers and the others are all busy trying to help the farmer. Some good will come of their efforts. We think, however, that the most good will come through the efforts of the farmer himself. He will build for himself on his own farm and will build for himself and for his neighbors when he joins with them in the community and state enterprises which he will help to build, at the foundation first, in his own community. Co-operative effort will make for "better farming, better business and better living."

The dairy farmer is the best off of all. Conditions in Wisconsin and New York and the other dairy states show that. This is no time for anything but optimism because the demand for milk and dairy products is growing and the market for these is the foundation of the business. With the market for milk and dairy products becoming increasingly good the market for surplus dairy cattle will become better.

The object in writing this book is to help some with all this. We have enjoyed writing it. It has served greatly to make our think-

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ing more definite and to clarify our ideas. We hope you will enjoy reading it. With design we have been somewhat dogmatic. You will not agree with all the statements. We have read much of the evidence on the different points, have weighed it for and against, made up our minds and given you our opinion. This opinion is the best solution of the problems at the present time that we can find.

We wish to take the opportunity at this time to express our appreciation to Professor H. H. Wing. For many years we have been associated with him in the department of animal husbandry at Cornell University, of which he is the head. His ideas have been sound, his direction of our study and work all that could be desired. Living and working with him is a pleasure.

Members of the groups of teachers in the departments of animal husbandry at Cornell University and at the University of Wisconsin have helped us many times in crystallizing the opinions that we have given to our readers. Professor H. E. Babcock, Manager of the G.L.F. Exchange of Ithaca, New York, has also helped. To all these and all breeders who have contributed pictures and facts about their animals we express our appreciation.

Professor F. B. Morrison has very kindly allowed us to use some of the tables of the book "Feeds and Feeding" by Henry and Morrison. This has saved us a great deal of work in our compilation. We appreciate his courtesy.

E. S. Savage
L. A. Maynard

Ithaca, New York
June 15, 1923.

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NOTE

We have worked up a careful index. Reference to it in the back of the book will enable readers to find things quickly. As an aid to cross reference the paragraphs have been numbered. Bold-face numbers found in the reading matter refer to paragraphs containing additional information on the same topic.

INTRODUCTION

THE GENERAL PROBLEMS OF DAIRY FARMING

The great problem in dairy farming is to breed better cows that will produce more milk at less cost and that will produce offspring that will sell for more money. We have addressed ourselves to this problem frankly. More profit from the cows will mean "better farming, better business, better living."

1. The problem of feeding.—A cow inherits what she will be from her dam and sire. The development of that inheritance depends on the feed and handling that she gets. In Part I we have treated this feeding and development through the year-round cycle, starting with the cow as soon as she has dried up and carrying her through the entire lactation period, both in the barn and on pasture. The development of the young stock is a part of our problem. Some of the finer points in feeding high production cows for records are studied.

2. Buying and distributing feed.—Buying feed and the distribution of feeds co-operatively are treated fully. We must not forget that one of the main parts of feeding dairy cattle is the correct selection and purchase of the raw materials of the ration. Co-operative effort on the part of farmers in solving their problems is new. We have given, in Chapter VIII, a brief history of its development in the purchase of feeds.

3. The problem of better cows.—The unit of success in better dairy farming is the cow. Therefore, we have named Part II "The Cow," and have contributed what we know to help form an ideal in the minds of our readers with some suggestions as to how to realize that ideal. All the dairy breeds are briefly described. By a study of the leading types of cows and their records we may learn how far progress has gone in successful units in each breed up to the present.

4. The problem of better bulls.—The real problems of better dairy farming come in the department of breeding. We

know much more about feeding and we can control nutrition to a large extent. But we cannot control inheritance as measurably as we would like. In Part III the question of better bulls and how to get them and how to feed and handle them is given careful consideration.

5. **Dairy farm practice.**—We have brought together in Part IV under this head the best material we can find on the control of tuberculosis and abortion, the greatest disease problems there are in Animal Husbandry. Some suggestions are given in the production of clean milk, buying and selling dairy cattle, and herd improvement. Good practices are important. The more we can learn about them the better.

6. **The feeds.**—Good roughage is the foundation of feeding. The man who can get and maintain good stands of alfalfa, clover or soybeans for hay and then couples up with these legumes, good silage, has his feeding problems three-fourths solved. A thorough knowledge of the source, composition and feeding value of the various concentrates is necessary to know how effectively to supplement this roughage. Part V gives methods of getting good roughage on our farms as well as the composition of the different kinds. Also the concentrates are fully described.

7. **Dairy husbandry the foundation of permanent agriculture.**—L. H. Bailey in his book "The Holy Earth" says, "The surface of the earth is particularly within the care of the farmer. He keeps it for his own sustenance and gain, but his gain is also the gain of all the rest of us.

"He is the agent or the representative of society to guard and subdue the surface of the earth and he is the agent of the divinity that made it. He must exercise his dominion with due regard to all these obligations. He is trustee. The productiveness of the earth must increase from generation to generation; this also is his obligation."

This obligation is not a heavy one to the dairyman. The dairy farmer is the permanent farmer and the satisfied farmer. May he find something in this book to interest him and encourage him.

Part I

FEEDING FOR MILK PRODUCTION

CHAPTER I

FEEDING THE DRY COW—THE IMPORTANCE OF MINERALS

In beginning a discussion of the feeding of dairy cattle we will start with a cow that has completed one or more lactations and tell how to feed her while dry to prepare her for calving and for the next lactation period.

8. Drying off the cow.—Everybody will agree that the cows should have a rest between lactations. It is our opinion that the rest period should be six to eight weeks in length. Cows in thin flesh should have a full two months and it is quite possible that all cows would benefit by that much rest. It is good practice with heifers so to breed them for their second calf that they can be milked for a full year and still have a two-months' rest. This practice has a good effect in influencing the length of their later lactation periods. With the exception of heifers, the cow should drop a calf once a year.

Having decided how long the dry period shall be, the question that next arises is how the cow is to be dried off. This is a difficult thing with some cows and one which must be done gradually to avoid injury to the udder. The first step is to cut down on the grain ration. If the cow is producing a lot of milk at the time, it may be best to cut out the grain altogether and perhaps even to substitute poorer hay for any clover or alfalfa she may be receiving. However, this last step should not generally be necessary, and, for reasons that will be pointed out later, we like to have the cow receive clover or alfalfa hay throughout the dry period.

For the cow on pasture it may be necessary to bring her into the barn and give her hay only. With the cutting down of the feed

the cow should be milked only once a day. After a day or two this should be changed to once in two days and then to once in three, etc. When the cow will go five or six days without milking, without the udder becoming hard or inflamed, it is generally safe to stop milking her altogether. However, she should be watched for several days thereafter for signs of udder trouble.

9. Feeding the dry cow.—The farmer can make no more serious mistake than to think that because the cow is not giving milk during the dry period the character and quality of her feed is of small importance. It is true that she does not require as much feed and that its protein content may be lower, but she must have the amount and kind that will properly develop the foetus, put her in condition to stand the strain of calving and build her up for the next lactation. The feed should be such as to keep her in good health and vigor and put on some fat.

10. The grain mixture.—The grain ration should be made up from feeds fattening in nature. We have used the following mixture with good success:

100 lbs. hominy feed
100 lbs. ground oats
100 lbs. wheat bran
50 lbs. oil meal

Oil meal is generally rather expensive but it should be an ingredient of the ration because of its value as a conditioner. The ration should be bulky and laxative. A variety of feeds is of less importance than with milking animals.

The amount of grain to be fed will depend on the roughage. With plenty of the best roughage the dry cow should receive at least three to four pounds of grain a day. The amount may be doubled to advantage with more valuable animals particularly where records are sought. Succulent feed is important during the dry period because it is healthful, cooling and aids in keeping the animal in proper condition. Thus the dry cow should have all the silage she will clean up. Where silage is limited or unavailable, roots, such as mangels, rutabagas, or beet pulp mixed with diluted molasses, make a satisfactory substitute.

11. Importance of good roughage.—Many farmers think that inasmuch as the dry cow needs less protein they can replace the legume hay (clover or alfalfa) at this time by a poorer roughage. If protein were the only consideration here they might be right. However, legume roughage has other advantages and it is very desirable that the dry cow have her share. Such roughage is the best source of lime of any of our feeding stuffs and recent work has shown it to be very important that the dry cow receive liberal amounts of lime.

12. Minerals in the dairy ration.—There are a dozen or more different minerals required by the animal body. However, only two of them, aside from those supplied by common salt and perhaps a source of iodine in the goiter belt, are at all likely to be furnished by the ordinary ration in less amount than the animal needs. These two are lime and phosphorus. They form 90 per cent of the mineral matter of the body and over 50 per cent of that of milk.

Segis Pietertje Prospect 221846

World's Champion cow in milk production. Yearly record 37,381.4 pounds of milk, a daily average of 102.4 pounds for 365 days. Owned by Carnation Stock Farms, Seattle, Wash.

Thus we can understand why the dairy cow needs plenty. During the period of heaviest milk production she does not seem to be able to assimilate enough lime and phosphorus out of her feed. On the other hand some of these minerals which she secretes in her milk she takes out of her bones. This has been observed to occur even where legume roughage and mineral supplements are fed. Toward the end of the lactation period, and particularly while dry, the minerals removed from the bones are restored, provided of course that the feed contains them in a form the cow can use. Sudden falling off of cows in production after a good start in a lactation period may be caused by failure to build up the mineral reserves during the dry period. There is evidence that certain breeding troubles have a similar cause. How then may these mineral reserves best be built up?

The first consideration is feeds rich in the minerals in question. A good grain mixture will supply ample phosphorus. Legume hay is rich in lime. Where these feeds are liberally fed, the mineral needs may be taken care of as well as we know how to at present. There are some recent experiments, however, that may have a great practical bearing in this connection.

13. Lime and phosphorus important.—Adequate mineral nutrition is not simply a case of supplying adequate amounts in the feed. There seems to be a limit to the lime and phosphorus that a dairy cow can assimilate from her feed no matter how much may be supplied. Recently it has been found that there is something, probably a vitamine, in green feed and in leafy roughage cured in a certain way that aids in lime assimilation. In fact, it has been shown that during the heavy lactation, when lime and phosphorus are ordinarily taken out of the bones, this can be prevented by the use of the feeds mentioned. This means that the cow on pasture should more readily build up her reserves. The method of curing the leafy roughage so as to preserve this factor responsible for lime assimilation has not been definitely worked out but it may not be long before we will know just how to do it and thus have a feed which will assure adequate mineral assimilation at all times. It is evident from work done to date that curing

under caps preserves the factor better than long exposure in the windrow. (38)

A further question arises as to whether the dry cow should receive a source of lime and phosphorus in addition to her feed. With a good grain mixture liberally fed and ample legume roughage we have no proof that such addition will help, at least until we know more definitely how to cure the roughage so as to preserve the factor mentioned. With poorer roughage we think it may be advantageous to add a source of lime, at least, to the grain ration. Pure, finely ground limestone is a cheap and readily available source. Both lime and phosphorus are supplied by steamed bone meal or by ground rock phosphate. Where the dry cow is on pasture, we would add one of the above mineral sources to take advantage of the factor aiding assimilation supplied by the grass. We suggest feeding two to four ounces per day.

14. Liberal feeding good insurance.—We have advocated liberal feeding during the dry period. It means a stronger calf and a good send-off for the next lactation. A good dairy cow will return to the milk pail in quantity of milk and in fat content the fat put on her back during the dry period. We have stressed the use of silage and legume hay. Every dairyman should try to grow more of these feeds. They seem to us essential for profitable milk production and in Part V we give some suggestions as to the growing and handling of these crops which it is hoped will aid many farmers to have a larger supply of these essential feeds. However, we know that many dairymen have only a limited supply of legume hay and silage, particularly in certain years. The alternative is to use the best roughage available, bearing in mind that the poorer the roughage, the more grain is needed.

Where the dry cow is on pasture, of course she does not require the feeding we have outlined. Where the pasture is good, she needs no additional feed, but as the pasture fails, both grain and roughage should be given. Where little feed is obtained from the pasture the supplementary feeding should be nearly as liberal as that we have suggested for stable conditions. In Chapter III feeding on pasture is taken up in detail. (49)

15. Feeding at calving time.—About a week before calving time the cow should be placed in dry quarters, well ventilated but protected from drafts. There should be plenty of bedding. At this time her ration should be laxative and cooling. The feeding of silage should be liberal. The grain should be cut down to perhaps half that recommended for the dry cow. At this time we would change the proportions of the grain mixture so that it would contain relatively more wheat bran and oil meal. If no silage is being fed such a change is especially desirable. The most important thing at this time is to avoid constipation. The grain mixture the last few days may consist entirely of bran and oil meal in the ratio of 2 : 1, if constipation is evident. In such a case it may also be desirable to give a purgative such as one pound of epsom salts or one quart of linseed oil. If one can be sure of giving such a purgative within 24 hours of calving it is always a good thing to do. The cow should receive little roughage the last day or two so that the digestive system is not so distended as to interfere with the expulsion of the foetus.

The above applies to cows freshening out of the pasture season. There is no better place for the cow to drop her calf than in a clean, grassy pasture. If it is during the early pasture season, the cow will probably be receiving no grain or roughage. The pasture grass will keep her in satisfactory condition for calving. Where she is receiving considerable supplementary feed, as she should where the pasture is poor, this feed should be regulated before calving as we have outlined in the above paragraph.

The animal should have access at all times to plenty of good clean water, or if this is not possible she should be watered two or three times daily. The water should never be very cold.

16. Udder troubles.—At this time the dairyman must be on the lookout for udder troubles. If the cow is receiving plenty of water and is not constipated no fear need be had for swollen and caked udders as long as hard feverish spots are not present. If these occur they are best treated by rubbing with warm water. There are many proprietary preparations on the market for massaging the udder and the use of one of them or some sort of grease

will aid in keeping the udder from becoming irritated by the rubbing, but it is the latter which actually reduces the swelling.

17. When the calf is dropped.—As soon as the calf is born any slime around its nostrils or in its throat should be removed. The calf sometimes strangles to death through inability to breathe on account of the above. At birth the stump of the navel cord

THE RIGHT KIND OF JERSEY CALF

should be disinfected with tincture of iodine. It can be obtained at any drug store.

The afterbirth should drop away in a few hours. What to do when the afterbirth is retained is a question which puzzles many. To remove it requires skill, and judgment is also needed to know whether in a given case it should be done at all. The best general advice we can give is to call a veterinarian or let the afterbirth alone. Retained afterbirth is less likely to occur if the cow has been fed with plenty of laxative, succulent food. Thus, the best

way to help solve the afterbirth problem is to feed properly before calving.

Unless milk fever is feared the calf should be left with its mother for the first two days, in order that it may get the colostrum, as the first milk secreted is called. This milk is laxative and it is very necessary that the new-born calf should have it.

For the first three or four days after calving the cow should receive only a limited amount of feed and this feed should be laxative in nature. At the end of this period, provided the cow has a good appetite, the feed may be rather quickly increased to that amount which was being received before calving time, and this amount gradually raised according to her milk flow.

18. Milk fever.—Milk fever is a disease which may occur with any cow following calving no matter how well she is handled. It seems especially likely to occur with high producers. Formerly it was a very serious trouble but the modern treatment of distending the udder with air is very effective and few fatalities occur where the treatment is used. Every dairyman should own a milk fever outfit for emergency use. Directions are furnished with the outfit. However, because of the possibility of infection, it is better to call a veterinarian to give the treatment and to explain the details of the care needed. Contrary to the opinion held by many, it is a good thing to milk the cow a little two or three times a day during milk fever to make sure that all quarters are milking freely.

CHAPTER II

FEEDING THROUGH THE LACTATION PERIOD

This chapter deals with the feeding and management of the cow that has freshened and is in full flow of milk. We assume that through her breeding she has the proper capacity for milk production and that she has been so fed while dry as to put her in good condition.

19. Good roughage. Clover and alfalfa hay.—The greatest direct expense is for feed. Since home-grown feeds are the cheapest, the first thing to remember is that the ration should be built around the materials grown on the farm. The dairyman will feed his cows cheapest who has plenty of good roughage. The better the roughage the less of the more expensive feeds he has to buy.

The best roughage for the dairy cow is clover or alfalfa hay and corn silage. The farmer who grows enough of these feeds so that his cows can have all they will eat has taken the biggest step toward cheap milk production. Everybody knows that to get the most milk the cow must have lots of protein. The high protein feeds are the most costly. Since clover and alfalfa contain much more protein than other hays, the larger the amount of these materials the farmer has, the less of the more expensive feeds he needs to buy.

It is from the roughage that the cow gets most of her lime, lots of which are required for milk secretion. Legume hay (clover and alfalfa) contains three to four times as much lime as do other hays, and this is another big point in having plenty of it. Further, it is these leafy roughages, clover and alfalfa, that contain the vitamines,—substances that we will probably pay more attention to in making rations as soon as we know more about them.

As between clover and alfalfa, the latter is more difficult to grow but means cheaper feed per acre once a stand is obtained. Of course not all land will grow these crops. They require a limed

soil, well drained. Because of the great value of legume hay every dairyman should try to keep a part of his farm in such a state that one of these crops can be grown, and we believe that the extra trouble taken to grow alfalfa will be more than repaid by the yield. (**Chapter XXIV**)

20. Corn silage.—The big value of silage lies in the fact that it is the cheapest source of succulence. The importance of suc-

Four of a Kind
Guernsey cows owned by Oaks Farm, Cohasset, Mass.

culent feed in keeping the cow in good condition and in increasing her milk flow is known to all. Everybody knows how cows respond in increased milk flow when turned out on pasture. The feeding of silage is the best method we have of supplying the succulence of pasture in the winter time.

21. Selecting the grain mixture.—The proper selection of the grain mixture is a case of buying what mill feeds are necessary to go with the home-grown feeds to give a satisfactory ration at

the cheapest cost. Thus, the farmer should think first of the kind and amount of roughage and home-grown grains he has and then decide what feeds he should buy to go with them. Here he has the choice of purchasing certain separate feeds and mixing his own ration or of choosing among the various proprietary feeds one that will go best with the materials he has at home. We will first consider grain mixtures from the point of view that the dairyman will mix his own.

22. Variety.—The mixture should have variety. No one would think of making the grain mixture entirely of one feed. There should be at least three ingredients so selected that in the entire ration, including the roughage, at least four plants are represented. A mixture of corn meal, gluten and hominy would not do because all of these feeds come from the same plant.

23. Palatability.—Of course the mixture must consist of feeds the animal likes,—it must be palatable. More feed will be eaten where it is pleasing to the taste. Nice sweet hay will be consumed liberally, where moldy, improperly cured hay will be refused entirely. There is a considerable difference in palatability among the feeds that can be used in the grain ration and the animal will eat more if its ration is palatable. Also a palatable ration is more digestible.

24. Bulk.—The mixture should have bulk. We class wheat bran, ground oats, distillers' grains, etc., as bulky feeds, in contrast to corn meal, the oil meals, etc. Feed lacking bulk forms a compact mass in the stomach which is digested more slowly and with difficulty. Every mixture should be made up in part of bulky materials.

It is a good thing to have at least one laxative feed in the grain ration. This is very important when no succulence is fed. Wheat bran and oil meal are laxative feeds.

25. Protein.—The protein content of the grain mixture is of greatest importance. The cow cannot produce the milk she is capable of unless she gets enough protein. Farm surveys in New York State have shown that the average farmer does not feed enough protein and that the one who is feeding the most is the one

who is making money. The farmer cannot raise the kind of feeds which will give him enough protein, so buying feeds is largely a case of buying this nutrient. The selection of feeds to go with his home-grown materials so as to get enough protein into his mixture as cheaply as possible is thus the thing he should think of most. In discussing the choosing of mixtures according to the roughage we will show what the protein content ought to be, and give a list of feeds classified according to the amount of protein they furnish. (**27**)

26. Digestibility.—Of course, the ration must be made up of digestible materials. The cow gets no value out of her feed if she cannot digest it. We will not attempt here to classify feeds according to their digestibility, but the reader may consider that all the feeds and rations we list in this chapter are satisfactory as regards this point. (**Appendix, table I**)

27. Cost.—All through our discussion we have mentioned the matter of cost. This is the most important part of all to the majority of farmers. If a man has the right kind of cows he can afford to give them all they can eat of the best feeds. Even so, he will save much on his feed bill by noting the relative cost of these best feeds, for at all times some are relatively cheap and others high. The true cost of a feed can only be measured by the milk it puts in the pail. Cheap feeds which are so low in protein, so high in fiber and so indigestible that the cow gets little out of them to make milk are the most expensive of all.

With the above things in mind we are now ready to select specific grain mixtures to go with the home-grown feeds. For this purpose we will use the following list in which the common feeds are given according to their protein content.

High-Protein Feeds	**Medium-Protein Feeds**
(23 per cent or more)	(12 per cent to 23 per cent)
Linseed oil meal	Wheat bran
Cottonseed meal	Cocoanut oil meal
Distillers' dried grains	Standard wheat middlings
Gluten meal	Wheat mixed feed
Gluten feed	Germ oil meal
Buckwheat middlings	Barley feed

Low-Protein Feeds
(below 12 per cent)
Corn meal
Hominy feed
Ground oats
Ground barley
Corn feed meal
Ground buckwheat
Ground rye

28. Mixtures with clover or alfalfa hay.—Where the farmer has an abundance of one of these roughages and plenty of silage he is in a position to buy the minimum amount of the more costly high-protein feeds. His grain mixture should contain 14 to 18 per cent of protein. A simple mixture which would supply a little over 14 per cent of protein and require the purchase of only one pound in ten of high-protein feed is as follows:

100 lbs. wheat bran	200 lbs. hominy
150 lbs. ground oats	50 lbs. oil meal

The first two feeds are bulky. Bran and oil meal are laxative. A variety of plants is represented. The farmer could substitute for ground oats and hominy any of the other low-protein feeds if they could be bought more cheaply or if he had them from his own farm. Cottonseed meal might be substituted for oil meal but we like to have a little of the latter in every dairy ration. The protein content could be increased by substituting a small amount of a medium- or high-protein feed in place of a part of the oats or hominy.

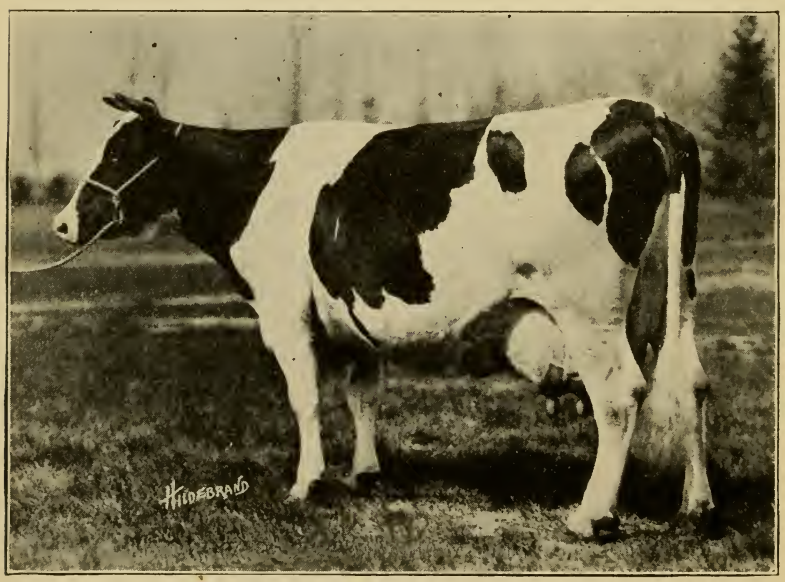
Another ration which would go well with legume roughage, giving a somewhat greater variety of feeds and furnishing about 16 per cent protein is as follows:

200 lbs. ground oats
100 lbs. corn feed meal
100 lbs. ground barley
100 lbs. buckwheat middlings
100 lbs. gluten feed
50 lbs. oil meal

29. Mixture with timothy hay.—When timothy hay or other poor hay is fed with silage the grain mixture must contain nearly one-half again as much protein as with alfalfa and the actual protein content of the ration must be 22 to 25 per cent. A mixture which would be satisfactory for use with timothy hay is as follows:

100 lbs. wheat bran
100 lbs. hominy
150 lbs. gluten feed
100 lbs. oil meal
50 lbs. cottonseed meal

This mixture contains about 24 per cent of protein. In order to furnish this amount, 60 per cent of the ration must come from high-protein feeds, showing that two to three times as much of these feeds are required as when the farmer has alfalfa or clover.



Spring Brook Bess Burke 2d 131387

One of the largest Holstein-Friesian cows in the world. Weight 2225 pounds. Yearly record 24918.1 pounds of milk, 1032.75 pounds butter fat. Owned by Winterthur Farms, Wilmington, Delaware.

30. Mixtures with hay containing some clover.—Probably the majority of farmers have mixed hay to feed their cows,—hay made up of timothy and other grasses, and containing some clover. Here the farmer must make his mixture according to the quality of the hay. If it contains little clover he must use a mixture similar to that suggested for timothy. On the other hand with considerable clover present he can lower the protein content of his grain mixture accordingly.

It should be remembered that no harm can come from feeding more protein than necessary. The first ration we listed (**28**) contains the absolute minimum of protein and is for use with the best roughage and is only recommended where the high-protein feeds are much more costly than the others. We prefer a somewhat higher protein content than 14 per cent even with the best roughage, where it can be obtained without too much extra cost. It is better to err on the side of feeding more protein than necessary even if it does cost more, than to feed too little. Of course, if the dairyman has lots of legume hay and silage and home-grown grain it might be more economical for him to make his ration entirely from these feeds rather than buy feeds to get more protein, even though maximum milk production may not be realized. Decision here must rest on the cost of the feed to be bought and selling price of home-grown feed.

31. A ration of alfalfa and silage alone.—Professor W. J. Fraser of the University of Illinois has just published a very interesting report of a six-year experiment during which a herd of dairy cows received nothing but home-grown feeds. The cows were fed almost entirely on alfalfa hay and corn silage, the average daily consumption per cow being 14.5 pounds of alfalfa and 37 pounds of silage. When a cow was producing over 20 pounds of milk daily she received some corn meal—two to twelve pounds daily, depending upon her production. The herd was on pasture in season. With this system of feeding, using no grain except corn meal and little of that, the average yearly production per cow over the six years was 7,470 pounds of milk and 262 pounds of fat. The yearly production per acre of feed was 3,888 pounds

of milk and 136 pounds of fat. This experiment brings out in a very remarkable way, what a fine combination is alfalfa hay and corn silage, and that a fair yield of milk is possible on these feeds alone. Certainly they must have kept the cows in good condition or production would not have been maintained over six years. The reader will do well to ask himself whether his cows are averaging over 7,000 pounds yearly.

32. Minerals.—No mineral supplements have been added to any of the grain mixtures given. We recommend the addition of one to two per cent of pure ground limestone, ground rock phosphate or steamed bone meal where little legume roughage is fed. Any material added should be ground fine enough to pass a twenty-mesh sieve. It may be worth while to add one of these sources even where legume roughage is used. Certainly this will be true as soon as we know how to cure the roughage so as to preserve the factor that aids in lime assimilation. (**13**) A year's developments may change our present ideas and recommendations. In the meantime, we are inclined to advocate the use of minerals as insurance even where their value is not proved. They are cheap and can do no harm and we may learn a lot from the experience of farmers using them.

There are a number of proprietary mineral mixtures on the market. These mixtures have no merit whatever over unmixed ingredients which supply the needed minerals,—lime and phosphorus. The proprietary mixtures contain a number of ingredients of no proven value which add nothing but cost to the ration. We advise against their use.

33. Salt.—The cow should receive one to two ounces of salt a day. Two or three ounces can be fed three times a week if more convenient, simply throwing it into the manger any time during the day. Of course, the salt can also be mixed with the grain ration. The practice of salting the animals once in two weeks is not a good one.

34. Feeding without silage.—In talking about feeding thus far we have assumed that the farmer has silage. Of course we know that many farmers do not have silos and that even those who

do, have only a limited amount of silage in certain years. We believe it will pay every dairyman to grow some silage crop and that it should be corn if possible. If experience has shown him that he cannot depend on corn, there may be some other silage crop suited to his locality. If the farmer has no silage, he should try to provide some other succulence for his cows. Roots are the best substitute. They do not furnish an equivalent amount of food value as cheaply as does corn silage. Otherwise they may be just as satisfactory. Mangels, sugar beets and rutabagas are the roots most commonly used. They should be sliced up and fed with the grain. Where roots are fed the grain may be reduced somewhat.

35. Other succulence.—Another way to provide succulence is by the use of dried beet pulp soaked in water before feeding. Take one pound of beet pulp in place of about eight pounds of silage and soak it in water ten to twelve hours. The grain ration need not be quite as heavy where beet pulp is fed. However, it is the most costly way of getting succulence.

Without succulent feed of any kind the grain feeding must be somewhat more liberal than otherwise, and the mixture should contain more of the laxative feeds.

36. How much to feed.—In determining this point we first decide on the amount of grain needed on the basis of the milk produced and then give the cow all the hay and silage she will clean up in addition. In deciding on the grain for a given amount of milk we think of three things,—the kind of roughage available, the price of milk and the fat content of the milk produced. With the best quality hay and silage or roots, feed one pound of grain for every four pounds of milk, where the price of the product is low. If the price is high, the extra milk produced by heavier feeding, one pound of grain to three of milk, will justify the cost. Where ordinary feeding hay is the roughage, feed one pound of grain for every two and one-half or three pounds of milk, depending on its price. The above figures are for 3.5 per cent milk; for producing richer milk the grain allowance should be increased somewhat. Under conditions where one pound for three pounds

of milk would be fed to Holsteins, Jerseys or Guernseys should have one pound for every two and one-half pounds of milk.

Another way of determining the amount of grain to feed is to measure it by the butter fat production per week. Feed one pound of grain per day for each pound of butter fat produced per week

A Good Dairy Barn and a Leading Dairy Man

Mr. Frank O. Lowden, Oregon, Ill., President of the Holstein-Friesian Association of America.

and let the cow get the rest of her feed from a liberal amount of good roughage.

In addition to the grain mixture the average cow will eat 9 to 12 pounds of hay and 30 to 40 pounds of silage per day, depending on her size and production.

37. Feed the cows as individuals.—In feeding grain as we have suggested, the farmer must of course feed each animal as an individual. This is the only proper way. If each animal in the herd gets the same amount of grain no matter how much milk she

gives, some will get more than they need while others will not get enough to give the milk which they are capable of producing. As the cow gets along toward the end of the lactation period her milk rapidly falls off and the farmer will save much grain here by feeding it according to production. It is a good plan to have a small blackboard nailed to each cow's stanchion, on which can be written the amount of grain the cow should receive. When her milk shows that the amount should be changed it is very easy to change the figure on the board.

38. Vitamines in the dairy ration.—Certain other substances besides protein, carbohydrates, fats and minerals are necessary for health and growth. These substances are called vitamines. Their importance has been principally worked out in the diet of humans, but we do know that our farm animals may suffer from a lack of them. Further, the dairyman must be interested in vitamines because milk is the most important source of vitamines in the human diet. This fact is increasing its use and value.

There are at least three vitamines, distinguished on the basis of the effect of their absence from the food. The fat soluble vitamine, vitamine A, is the one that occurs in butter fat. In animal feeds it occurs in green forage and leafy roughage. Grains in general contain little, but yellow corn contains considerable amounts. The absence of the vitamine A affects growth and other body functions and eventually causes a specific eye disease.

The second vitamine, vitamine B, occurs abundantly in milk, in grains, in green forage and in roots. Thus it occurs liberally in animal feeds and is not likely to be deficient in the ration.

The absence of another vitamine, the antiscorbutic or vitamine C, results in scurvy in humans and certain animals. This vitamine occurs liberally in leafy foods and green forage and to a variable extent in milk. It does not occur in grains or in dry roughage. Thus it does not occur in much of the material used in feeding farm animals.

Some animals, however, are not susceptible to a lack of vitamine C, and so far as we know at present its importance is not great in the case of dairy animals.

Most scientists believe that there is a fourth vitamine, the antirachitic,—a vitamine which will cure rickets. The latter is a disease due to improper lime and phosphorus nutrition. The vitamine does not supply either of these minerals but aids in their metabolism. Cod liver oil is the best source of this vitamine. Those who have studied the question believe that the factor in green forage, which helps the dairy cow build up her reserves of lime and phosphorus, as mentioned in paragraph 13, is identical with the antirachitic vitamine. Thus the dairyman is interested in having as much as possible of this vitamine in his ration. This means good pasture in the summer and, in the winter, leafy roughage, cured so as to preserve its leaves and bright green color. To do this, curing under caps is essential.

A dairy ration which is based on good pasture in summer and plenty of grain and good leafy roughage in winter will supply vitamines as well as we know how to do at present.

39. Vitamines in the milk.—Vitamines A, B and C are more important in the case of growing animals than for milch cows and we will say more about them when we take up the feeding of calves and young stock. Lack of vitamines in the dairy ration affects the quality of the milk rather than its quantity, since the vitamine content of the milk is governed by the vitamine content of the feed. In particular, milk produced on pasture grass is three times as rich in C as that produced on good winter rations.

Of course, the dairyman is not primarily interested in this difference in quality, but the consumer is, particularly where babies are concerned. As the consumer becomes more educated on this point there might well be a special market for milk from cows so fed as to furnish a product high in vitamines. At any rate, the dairyman must have some interest in the vitamine content of his milk from the standpoint of his own children. The question may well be important also where calves or other animals are being raised on milk or its products.

40. Water, light and air.—Cows should be watered at least twice a day. The water should be clean, good-tasting and free from ice. It should not be so cold that the animal will stand and

shiver after drinking. A system which keeps fresh water before cows constantly is perhaps the ideal, but any system by which the animal gets all it wants at least twice a day will prove satisfactory. A large, heavy-milking cow will drink 8 to 15 gallons a day, depending on her feed.

The cow should have plenty of light and fresh air. It is not costly to provide light in the stable. There should be about four square feet of window space per cow. A good system of ventilation may be a little more difficult, where not provided in building, but a little thought on the matter will enable the farmer to better conditions in this respect, even in an old stable. The ideal temperature for the stable is 60° F. It is not practical to maintain this temperature in winter in the northern states because some system of heating would be required, but the stable temperature should not go below 45° F.

The animals should not be stanchioned all the time. They need exercise. They should be turned out in the yard for a time every day that it is not storming. It is fine to have a covered yard or shed in which they can run loose in bad weather. Some dairymen allow the cows to run loose in a large barn or covered yard all the time except at milking. This is a good idea where the yard or barn is warm and clean. (**262, 263**)

41. Kindness and regularity.—Every animal must be treated with kindness. A club or whip has no place in the dairy barn, nor has a dog any place in connection with the herd. The dairy cow has a nervous disposition and anything that upsets her affects her milk flow. Gentle, thoughtful treatment means more milk.

Regularity in time and manner of feeding is important. The cow gets used to receiving a certain feed at a certain time and any variation here upsets her. It is good practice to feed the grain just before milking and the silage or other succulent feed immediately after milking. In so doing any possibility of the milk absorbing the odor of the silage is disposed of. The hay should be fed after the silage. In winter, when the cows are in the barn all day it may be worth while to omit the feeding of hay in the morning and give it at noon, if not too inconvenient.

42. Milking more than two times a day.—Most farmers milk their cows twice a day. Where the dairyman has a considerable number of high producers it will pay him to milk three times a day. The extra milk will give him a good return for the additional labor. The milkings should be eight hours apart, but the actual times of milking can be arranged to suit the farmer's other work. On many farms the hours are 5 A. M., 1 P. M. and 9 P. M. Changing from two- to three-times-a-day milking will not bring any extra milk where the third is simply put in between the other two without lengthening the interval. The farmer who is milking at 5 A. M. and 5 P. M. will gain little by milking at noon, unless he postpones his night milking three or four hours. Where the cow is milked three times a day she should also receive grain three times a day. The other feed can be fed twice as usual. (218)

CHAPTER III

FEEDING ON PASTURE

For many farmers the pasture season is the time of greatest milk production. The cows are bred to freshen in the spring so that the period of largest milk flow will coincide with the spring and summer months. This system is called summer dairying. On the other hand, the cows managed for maximum production in the winter are well along in their lactation period at the time of going on pasture and may be dry toward the end of the summer. Whether the cow is at the height or at the end of her lactation on pasture the principles of feeding involved are the same.

43. Turning to pasture.—The thing of first importance is to have as good pasture as possible. Every farmer can better his pasture by paying a little more attention to proper fertilization, reseeding and to keeping down brush and weeds. Detailed suggestions for the improvement of old pastures are given in Chapter XXV. Pasturing as heavily as the land will stand is the best way to control the brush and weeds, but of course overgrazing must be avoided. Each animal requires one and one-half to two and one-half acres. Some shady places where the animals can go in the heat of the day help a lot. There should be plenty of good water and the animals should not have to go too far to get it.

The change from the winter ration to pasture feeding should be a gradual one. The feed obtained from pasture will be more laxative and will contain less nutriment in a given amount because of the large amount of water. Thus, the cow should be allowed to adjust her system gradually to the change of feed. On turning the cows out the roughage of winter feeding can be cut down rapidly but the grain should be decreased more slowly and several days elapse before it is discontinued entirely.

44. Importance of additional feed.—The next thing is to give the cows some extra feed as soon as the pasture commences to

fail. In fact there are many who think that heavy producing cows should have some grain even when the pasture is at its best.

It is our belief that the biggest return the farmer will get for time and money spent in connection with his herd is that from giving his cows a little extra feed and care as the hot weather comes on and the pastures become poor. Along in July and August the pasture fails, the flies become troublesome, there may be a lack of shade or insufficient water near at hand, and it is no wonder that they cannot keep up their milk flow.

The cow which falls off in milk does not easily come back. Thus, underfeeding her on pasture means less milk not only then but for the rest of the lactation period. She may dry off a month or two earlier than she would have with a little more feed. Further, starving her at this time means less milk in the next lactation also. A little extra feed means more milk at the time, more milk for the rest of the lactation period, a stronger calf and better condition for the next lactation period.

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45. Grain on pasture.—It is a good rule to remember that after July 1, the cow on pasture should have some extra feed. This feed should consist of grain, and hay and silage or green crops. The grain mixture should have 30 to 50 per cent of high-protein feeds depending on the quality of the pasture and the kind of other feed. The following mixture will give excellent results under most conditions:

300 lbs. wheat bran
300 lbs. hominy
200 lbs. gluten feed
100 lbs. oil meal

Where the pasture is very poor and good roughage is not to be had, a mixture which contains more protein should be used. The following is suggested:

100 lbs. ground oats
100 lbs. corn meal
100 lbs. wheat mixed feed or bran
200 lbs. gluten feed
100 lbs. cottonseed meal

46. Minerals on pasture.—Here again the question of minerals comes up. It has been previously mentioned that proper mineral nutrition is not simply a case of adequate amounts in the feed, but that the maximum utilization of the minerals in the feed only comes through the presence of a factor which aids in their assimilation. Pasture grass contains this factor in large amounts. Thus, when the animals are on pasture it is perhaps the best time of all to add extra lime and phosphorus to the ration, to take advantage of the conditions which make for maximum assimilation. It is of equal importance whether the cow is dry or in full flow of milk, for any assimilated minerals not needed for milk secretion will be stored up in the bones for the next lactation. We suggest one to two per cent of pure, finely ground limestone, ground rock phosphate or steamed bone meal. (**13, 32, 38**)

47. Silage and green crops for soilage.—It is not economical to supplement the pasture with grain alone. The cow should get some succulent feed and perhaps some hay also. Silage has a large place in summer feeding. No other feed will so cheaply supply the failing succulence of pasture. Many dairymen have a small silo that they use for summer feeding. With a silo of smaller diameter, a deeper layer can be fed off each day and thus offset the greater tendency to spoil in hot weather.

Where a farmer is practicing summer dairying and has only a limited amount of silage, he had better save it to supplement pasture rather than feed it all up during the winter. Even if the silo has been opened for winter feeding it can be sealed up to save some for summer feeding.

A substitute for silage is a succession of green or soiling crops. A properly planned succession will furnish an abundance of palatable feed from July 1 to November 1—the time when the pastures need supplementing. The feeding of green crops during the summer adds variety to the ration by giving the cow a change from the silage of winter feeding. However, a successful system of soilage requires careful planning and means considerable work at a time when the farmer is busiest with his other crops. Among the crops usually grown for soilage are: peas and oats, soybeans,

cow peas, corn, alfalfa, various clovers and the smaller grasses. (**385, 386**)

We certainly believe that the dairyman should do his best to grow enough corn for silage so he will have some silage for summer feeding. It is, in general, his cheapest succulence, yield per acre and labor involved considered. Without silage he should try to grow some green crops. Perhaps if he has some silage he can combine the two.

It is more important that the cow receive succulent feed than that she get hay, but the latter can be fed also to advantage. The less succulence available the more hay should be fed. If none is available, hay must be depended upon. Clover or alfalfa is better than other hay for reasons we have previously stated.

48. The additional feed needed.—Remember that the cow in milk uses from 40 to 60 per cent of her ration for maintenance,—that is for carrying on her body processes. The remainder goes into milk. If, due to poor pasture and no supplementary feed, the cow gets only about half the feed she ought to have, this feed will be used mostly for maintenance and her milk production will nearly if not entirely stop.

The amount of other feed needed will depend on the condition of the pasture and the milk flow of the cow. Where the pasture is still good, feed one pound of grain for every six or eight pounds of milk. Feed about five times as much silage or green crops as grain where no hay is fed. Hay can replace a part of this succulence at the rate of one of hay to five of succulence. Thus, if all hay must be fed it should about equal the grain. As the pasture gets poorer, the amount of feed must be increased.

49. Dry cows need additional feed.—In specifying that there should be a certain amount of supplementary feed per unit of milk produced we do not mean that the dry cow should have none. On good pasture the dry cow needs no extra feed but as the pasture fails she must have an adequate amount to fatten her up and put her in good condition for calving, and for the next lactation period. On very poor pasture the dry cow will need three to five pounds of grain a day and silage or hay in proportion.

50. Flies.—Flies bother the animals a lot in summer. During the fly season spraying with a good fly repellant means comfort for the cow and she will stand quieter at milking time. It also seems reasonable to think that a cow that is not constantly annoyed by flies will produce more milk. It is convenient to spray the cows twice a day,—after milking in the morning and when they come in the barn in the afternoon.

Jersey Cows in Good Pasture

There are many fly sprays on the market. None of them keep the flies off as long as we would like, but after the use of a good one the flies should not return for two to four hours. House flies may come back sooner, but they do not bother the animals much. It is the blood-sucking flies that one should look for. Some farmers are afraid that the spray will taint the milk. We have tried several and believe there is little danger, provided open pails or cans containing milk are not in the barn during the spraying, and pro-

vided the spraying is done at least an hour before milking. Spray thoroughly but lightly, avoiding the head, bag, and between the legs. Not much danger need be feared of the spray burning the hide unless spilled on.

51. Winter vs. summer dairying.—It has been clearly shown that, where a man has easy access to a year-round market for his milk, winter dairying is in general the more profitable. With proper feeding and management, fall-calving cows produce the largest annual yield. The flow is large during the winter, while in the spring, the time when the yield is falling rapidly due to advancing lactation, the flow is stimulated by turning the animals on pasture. On the other hand, with cows freshening in the spring, the heat and flies and poor pasture of mid-summer are apt to cause a marked shrinkage in the flow despite supplementary feed. Neither will heavy feeding, after the cows are brought in for the winter, bring the flow back. Thus in summer milk production there is apt to be an abnormal shrinkage in the flow toward the end of the lactation, instead of the stimulus to sustained flow caused by the turning out on pasture at a corresponding period in the lactation in winter dairying. In the latter, also, the maximum flow corresponds with the period of highest price. Thus, fall freshening means both more milk and a better price for it. There are many other advantages of fall freshening. The young calves can be raised with less trouble in the winter than in the hot summer months. Fall calves can be raised more cheaply because they can be pastured the first summer. Summer dairying means maximum production when the farmer is busiest with his crops.

52. Winter dairying increases yield.—It must be remembered that the increased yield under winter dairying will only be realized if the cows are fed so as to produce all the milk of which they are capable during the winter months. They must have plenty of good roughage and a grain mixture of the proper protein content in accordance with their production.

For the dairyman who sells his product to the cheese factory and who has no market after the factory closes, summer dairying

is by far the most profitable. He will find it desirable to get his cows over the winter as cheaply as possible without regard to keeping up the milk flow. He can use a wide ration but he must feed enough to keep the cows in good condition and the ration must be of good quality. Otherwise, the cows will not be in a proper condition for calving and will not have stored the necessary reserves for a normal production the next summer. (**12, 13, 14**)

The farmer who has a year-round market but who does not have ready access to it during the winter months because of distance and poor roads may find summer dairying more suitable. Many farms are not productive enough to raise the required amount of good roughage for the heavy feeding required in winter dairying, but they provide excellent pasture for maximum production in summer. In view of the several factors involved it is believed that many dairymen would profit by giving a little thought to the question as to whether they are practicing the kind of dairying best suited to their conditions.

CHAPTER IV

FEEDING CALVES

We cannot have good dairy cows unless we have well raised calves. No farmer can succeed in breeding up his herd unless he knows how to raise his calves properly and takes the time to do it. Their proper feeding and management is just as important as that of older animals.

53. Grow the calves well.—One frequently hears the statement from the dairyman that he cannot afford to raise his calves any better because it is so expensive. It does cost money to raise a calf properly and many are not worth it, but the point is that if the calf is worth raising at all it is worth the feeding and care which will mean a properly developed mature animal. Only those calves should be raised which are normal and healthy at birth and which have the breeding to make them valuable animals, and they should have the kind of feeding and care which will grow them normally so that their potential value will actually be realized.

54. Treatment at birth.—At birth the navel stump should be immediately disinfected with tincture of iodine. This can be purchased at any drug store. The calf should be left with his mother for at least two days. If he does not attempt to suck by the time he is three to four hours old he should be helped. It is important that the calf receive the milk secreted by the mother the first forty-eight hours after birth because this milk, called colostrum, is laxative and cleans out the calf's digestive system. The only condition under which the calf should not be left with his mother during the first two days is where the latter, through being a very heavy producer and perhaps being fed for test, may develop milk fever if suckled too much. If the calf is removed under these conditions he should, nevertheless, receive the colostrum.

55. Teaching calves to drink.—When the calf is removed from his mother he should have a separate pen for at least a month.

The pen should be warm, well lighted, and there should be good ventilation without drafts. Beginning at the third or fourth day the calf should be taught to drink from a pail.

At the start the calf, depending on his size, should receive six to nine pounds (four and one-half quarts) of milk a day in three feedings. During the second week this may be increased by three pounds if the calf is of good size and doing well. He should be fed three times a day for at least the first three weeks.

The milk fed should be sweet, clean, and be at a temperature of 90° to 100° F. It is of prime importance that all utensils used in feeding should be thoroughly cleaned after use. Nothing will upset the calf quicker than carelessness with respect to cleanliness in feeding.

56. Increasing the feed.—After the calf is two weeks old his feeding will differ according to whether he is to be continued on whole milk, or changed to skim milk, or whether, if the latter is not available, some substitute method is to be used. The use of whole milk is an expensive method but it does result in a rate of growth and in a bloom and finish obtained in no other way. One can hardly afford to use this method except for especially valuable animals or where maximum growth and finish are desired for show or sale. The details of raising calves on whole milk are similar to those where skim milk is employed. The use of the latter will be described somewhat at length because it is the method by which the vast majority of calves are grown.

Raising Calves on Skim Milk

57. Changing from whole to skim milk.—The calf should get whole milk for at least two weeks. At this time, if it is good and strong, the change to skim milk may be begun. At least a week or ten days should be taken for the change, which can thus be made at about the rate of a pound a day.

If during the period of change the manure becomes liquid or pasty, a condition commonly referred to as scouring, this is a signal that the food is not being digested properly and no further increase of skim milk should be made until the difficulty disappears.

It may also aid under such conditions to cut down the total amount of milk fed, or even omit one feeding entirely. The best cure for such troubles is to give the digestive system a rest. (62)

No increase in the total milk fed should be made during the period of change. After the latter has been completed the amount fed may be increased as appetite and condition allow. At one month of age a calf will take 12 to 15 pounds of milk a day; at two months, 15 to 18; and at three months and thereafter, 18 to 25 or even more. By the third month the calf is usually consuming considerable grain and hay, and from then on it can get along without increasing the skim milk, provided the supply of it is limited.

58. Feeding hay.—The calf will begin to eat other food besides milk at three to four weeks of age. The best roughage for the calf is second or third cutting alfalfa or the second cutting of clover. This roughage will supply lime and vitamines, other kinds will not. Some calves will eat so much of the legume roughage at the beginning that scouring results. Thus it is safer to start the calf on good mixed hay and change to clover or alfalfa after a few weeks. If legume hay is not available, of course the best other hay that can be secured must be used. The calf should receive all the hay he will eat, for in addition to its food value, the roughage develops the digestive apparatus—one of the essentials for capacity in the mature animal.

59. Feeding grain.—At about the time that the calf begins to eat hay he will also eat a little dry grain. The following mixture has been used by us with much satisfaction:

100 lbs. wheat bran
100 lbs. ground oats
100 lbs. corn meal or hominy
50 lbs. oil meal

The calf should receive all he will eat of this mixture from a feed box nailed to the side of the pen. The grain should never be mixed with the milk or fed in the pail from which the milk is taken. At three or four weeks of age some of the grain mixture may be put in the calf's mouth following the feeding of the milk. He will soon learn to like it and will begin to eat it out of the

feed box. Grain should be put in the latter twice daily but never in larger amounts than will be cleaned up. We prefer to give the calf only as much grain as he will clean up within an hour or two after feeding. Grain remaining in the feed box after it is wet with saliva loses its freshness rapidly, particularly in hot weather, and attracts flies. At any rate, any grain not eaten should be removed before fresh is added. The feed box should be cleaned out frequently, using an iron which will get into the corners. A simpler grain mixture than the one mentioned above might be made up of equal parts of cracked corn and crushed oats.

At two months of age the calf will eat one-half to one pound of grain a day; at four months, two to three pounds; and four to six pounds thereafter.

60. Feeding silage.—At four months the calf may have a little silage. The feeding of milk can be stopped at six months, but it is worth while to continue it longer if there is plenty. Feeding after six months is discussed in Chapter V.

It is important that, beginning at three to four weeks of age, calves receive adequate amounts of good clean water, either by having constant access to it, or by having it placed before them twice daily at other times than at which they are fed their milk. This is, of course, particularly important in warm weather, but it is necessary in winter also. During the past winter the water supply at the Cornell University barns became contaminated with oil, with the result that the calves drank little or refused it entirely. A marked decrease in the consumption of grain and hay was immediately noticed and a loss in weight occurred with the older calves,—conditions that were overcome as soon as good water was obtained.

61. Clean and dry pens.—It is important that the calves should have clean and dry quarters. The temperature of the stable may be rather low but the pens must not be damp. There should be good ventilation but drafts should be avoided. When the barn space will allow, it is preferable that each calf have a separate pen for the first six months. In this way, each animal can receive more individual attention and be fed as an individual.

Where a calf is alone a case of scours will be noticed at once and the feeding modified accordingly. Separate pens keep the calves from sucking each other's ears. A pen four by six feet will be large enough. It should have a feed box for grain at such a height that the calf can reach it without straining and it should have a slat feed rack for hay. The partitions between pens should be three feet high. Where more than one calf must be put in a pen, larger pens will be needed. In this case, it is a good thing to have stanchions with a feed manger wide enough to hold the milk pail. The grain can be fed right after the milk and then the calves can be loosened from the stanchions.

In summer calves are much annoyed by flies and do not do as well on that account. During the times when the flies are especially bad, spraying with a good fly repellant is worth while.

62. Scours.—The most common trouble that will be met with in rearing calves is scours. We have previously referred to it in connection with the change to skim milk. It is most likely to occur during the first two months. When scouring occurs it indicates that the food is not being handled properly. In addition to its resulting from a change of food, the most probable causes are too much food and lack of cleanliness and regularity in feeding. When the trouble occurs the feeder should satisfy himself that his utensils are being cleaned properly and that the skim milk fed is sweet, clean and at the proper temperature. If the trouble does not clear up in a day or two he should next cut down the amount of food temporarily, or even omit a feeding or two entirely. Scouring must not be allowed to continue. Not only will growth be hindered, but the longer the condition exists the more difficult it is to overcome. Do not be afraid to cut down the feed under these conditions. Food which is not digested properly not only is of no use to the animal, but also forms products harmful to the system. Most feeders are apt to err on the side of overfeeding rather than underfeeding, particularly in the early months. It is a good thing to remember in connection with all materials fed that the calf will do better if he does not get quite enough to satisfy his appetite than if so much is given that a part is refused.

63. White scours.—This trouble is very different from the common scours just referred to. It is a contagious form and infection comes a few hours after birth. The germs gain entrance through the umbilical cord. The best remedy for white scours is the preventive one of cleanliness. The stalls used for calving purposes should be kept clean. Particularly they should be thoroughly cleaned after each calf is born. The disinfection of the navel with iodine at birth, as we have previously described, is another preventive measure. (**54**) In white scours the feces are very light colored and have a very bad odor. The affected animal will soon die unless treated, and therefore a veterinarian should be called.

64. The ideal calf.—He should be round-barreled and plump and his belly should be held up snugly. He should have a soft loose hide with glossy hair. He should have a straight back and straight legs. The calf should have an active but not restless disposition and its eyes should be clear and alert. Of course, he should have the proper size for his age and this size should be shown both in weight and in frame.

65. Normal growth.—The following table has been prepared from data reported by Eckles in Missouri Experiment Station Bulletin 36, entitled "The Normal Growth of Dairy Cattle":

Normal Weights of Females During the Growing Period

Age Months	Normal Weight in Pounds			
	Holsteins	Jerseys	Ayrshires	Shorthorns
Birth	90	55	69	73
1	121	76	90	118
2	157	105	128	133
3	200	140	170	174
4	249	174	218	225
5	302	222	254	268
6	349	260	286	316
9	466	376	366	461
12	558	456	456	547
18	686	572	604	668
24	841	716	759	845
30	1021	.....	.....	.....

66. Dehorning calves.—If calves are to be dehorned the best time is before they are three weeks of age. It may be done by the use of a stick of caustic potash which can be obtained at any drug store.

Clip the hair away from the button of the horn. Dip the end of the potash stick in water and rub the horn hard until the skin all round the button is raw and bleeds a little. The important

PREVENTING THE GROWTH OF HORNS
(a) First step, hold the calf securely.

thing is to do the job thoroughly so that all the horn tissue is destroyed. Otherwise a nubby, misshapen horn will grow, spoiling the appearance of the animal's head. Finally the raw skin should be smeared with vaseline. The sores will rapidly heal and require no further attention. Because of the burning properties of the potash stick the end by which it is held should be wrapped in paper. For the same reason the liquid produced in treating the horn must not be allowed to run down into the calf's eyes. Cattle that have been dehorned are more docile and less likely to injure each other or the attendants.

PREVENTING THE GROWTH OF HORNS
(b) Second step, trim away the hair over the button-like lump.

PREVENTING THE GROWTH OF HORNS
(c) Third step, rub the skin over the lump with a dampened stick of caustic potash.

Raising Calves with a Limited Amount of Milk

On many farms there is need for a method of raising calves where only a small amount of milk can be used. Otherwise the farmer cannot raise his own stock and thus breed up his herd. One method of doing this is to substitute a special ration fed as a gruel at the time the change is ordinarily made to skim milk. Another method is to continue the calf on whole milk to two or three months of age and then use dry grain and hay as the only feeds.

67. Amount of whole milk necessary.—Where the latter system is practiced the calf is fed during the first two or three months similarly to the method described for rearing on skim milk except that whole milk is used. The time of cutting out the milk is governed by the thriftiness of the calf. It is usually not best to attempt it before two months of age and for the average calf it is better to wait until the middle of the third month, to give the animal as good a start as possible. The milk should be removed gradually taking about ten days for its completion. With the removal of the milk the grain feeding must be increased. The calf should receive all it will clean up. The same is true of the hay. It is essential that the hay be clover or alfalfa of the best possible quality. Professor C. H. Eckles of the Minnesota Experiment Station has reported a series of trials of raising calves according to this system. The calves were only a little below normal size at six months of age and were entirely up to normal at eight months.

Raising Calves on Calf Meal Gruels

The calf meal gruel method involves the substitution for milk, after the calf is a few weeks of age, of a gruel, consisting principally of a grain mixture combined with water in such a way as to come as close as possible to the chemical composition of milk. There have recently been raised on a calf meal at Cornell University calves comparing favorably at 6 months of age with those of similar age raised on skim milk. From our experience we have no reason to believe that calves so raised in a proper manner suffer

in productive ability thereby. Thus, to those farmers who have only a limited supply of milk to feed their calves we recommend the use of the calf meal method.

68. Proprietary calf meals.—There are a number of proprietary mixtures on the market under the name of calf meals which are designed to be fed as a gruel in place of milk. We have tried out several of these products and in general found them satisfactory, though of course some have given better results than others. Since we have not tried them all and since the formulas of those we have used may have changed, it is not fair to the manufacturers that we select among them here. We can, however, mention certain things which will aid the farmer in choosing among them.

We believe a good calf meal should have 20 to 25 per cent of protein and not over 5 per cent of crude fiber. It should contain no ingredient which experience has taught to be unsuitable for feeding young animals. Our experience indicates that compounds of lime and phosphorus are desirable. The mixture should be finely ground and should not settle too rapidly when placed in water. There seems to be an opinion among some farmers that the more ingredients a calf meal has the better it must be. Unusual ingredients also make an appeal to some who think that the manufacturer has discovered something new which is specially suited for the purpose. To others a high price seems to indicate a specially valuable product. None of these things necessarily indicate a good calf meal.

It is true, however, that the ingredients of a satisfactory calf meal must be more specially selected than those of the dairy ration. A big reason for this is that materials of low fiber content are essential. This also means a more expensive mixture. However, it has been our observation that in general the calf meals on the market are much too high in price in view of the ingredients they contain. The margin between the cost of the ingredients and the finished product is much greater for them than for proprietary dairy feeds. This situation indicates the desirability of a simple formula which can be mixed at home. Here one meets the diffi-

culty that the average feed store does not carry the special ingredients needed.

69. A successful calf meal.—For some years at Cornell University various formulas have been fed to find a satisfactory one for home mixing. The following formula (Cornell Formula 2), devised by Maynard and Norris, has given the best results to date:

250 lbs. red dog flour
250 lbs. corn meal
150 lbs. ground oat groats
150 lbs. oil meal
100 lbs. ground malted barley
100 lbs. soluble blood flour
10 lbs. salt
10 lbs. precipitated bone meal
10 lbs. precipitated calcium carbonate.

Calf Raised on Calf Meal Gruel

Weight at birth 90 pounds. Weight at age of six months, 423 pounds. Average daily gain 1.85 pounds.

In 1921-22 eight calves were reared on the foregoing ration, all of which exceeded an average daily gain of one and one-half pounds from birth to six months of age. In this group were six Holstein heifer calves. They had an average weight of 400 pounds at six months of age. The average food consumption for the six months' period was: 450 pounds whole milk, 300 pounds calf meal, 350 pounds other grain, and about 350 pounds hay. These results show clearly that it is possible to grow calves satisfactorily on a calf meal for they represent better growth than the average for skim milk calves as reported on page 35. These results must not be taken to mean that the use of this formula is preferable to skim milk. Where the latter is available, it constitutes the more economical and satisfactory method.

70. Difficulty with home mixing.—The trouble with the above formula for home mixing is that some of the ingredients would have to be specially ordered and this would mean considerable trouble and expense for the farmer with only a few calves to feed. It is also difficult to obtain the ingredients as finely ground as desired. When these difficulties were appreciated it seemed to us that instead of attempting home mixing it might be preferable for a group of farmers to have the formula mixed by a local miller.

The Grange League Federation Exchange of Ithaca, New York, is now marketing a calf meal under an open formula which is substantially the same as the one previously given. The formula is given in paragraph 123.

71. A simpler formula for home mixing.—Where a simpler formula for home mixing is desired we can recommend the following as a fairly satisfactory one on the basis of our experience:

250 lbs. red dog flour or flour wheat middlings
250 lbs. corn meal
250 lbs. ground barley
150 lbs. oil meal
100 lbs. blood flour
20 lbs. steamed bone meal
10 lbs. salt

Each ingredient of the above should be ground fine enough to pass a twenty-mesh sieve. If not obtainable locally, the bone meal can be obtained from the United Chemical and Organic Products Company, Chicago, Ill.

72. How to feed a calf meal.—Most manufacturers of proprietary calf meals furnish directions as to how to use them. These directions should be read carefully. We will outline the method used at Cornell University.

73. Changing from milk to calf meal.—The calf should receive whole milk for four weeks, at which time its gradual replacement by the calf meal gruel may be begun. In the case of the formulas which we have given, one part should be mixed with five parts by weight of water at about 100° F. Begin by replacing about one-fifth of the milk by gruel. After three or four days replace another fifth and so on until the change is completed. Do not begin the change with any calf while it is scouring. If scouring develops during the change, make no further replacement until the trouble clears up. It may be a good thing to cut down the amount fed for a feeding or two or even to cut out a feeding entirely. If the scouring persists a temporary change back to milk only may be worth while to get the calf back to normal. From our experience we can say that the above procedures will rarely be necessary, but success in using a calf meal comes from feeding it according to the condition of the calf rather than following fixed rules.

The period of change and the following two or three weeks are the crucial period. The substitution of another food at a time when nature intended the calf to have milk can only be done successfully by allowing the calf to become gradually accustomed to handling the new food.

74. Increasing the calf meal gruel.—As soon as the calf has been entirely changed to the calf meal gruel and is accustomed to it, the gruel can be increased with appetite. Do not increase it quite as rapidly as we suggested for skim milk. It is best to reach a figure of 15 pounds a day at four months of age and continue at that amount for the remaining two months. Although maxi-

mum growth will be secured by feeding the gruel until six months of age it is possible to discontinue it at four months by withdrawing it gradually. Of course, this will cut down the cost of raising the calf, inasmuch as the calf meal is more expensive than an ordinary grain ration. The gruel feeding should not be stopped unless the calf is eating the dry grain and hay well and is in thrifty condition.

It is clear that the same precautions as to cleanliness, regularity of feeding, etc., as we have mentioned in connection with raising calves on milk must be observed where a calf meal is used. The same directions we gave for feeding grain and roughage to calves reared on milk also apply. The use of the best possible roughage is even more important for calves reared on calf meal. The latter supplies little of the lime and vitamines liberally furnished by milk, but these essentials will be furnished by leafy roughage, particularly that cured as described in paragraphs 339, 340, 341. The calf raised on gruel may not eat grain as readily as where milk is used because the calf meal itself is really a grain mixture.

75. Calf meal not needed with milk.—Some dairymen use a proprietary calf meal as a dry grain mixture for calves raised on milk. There is no object in using such an expensive feed, and as a supplement to skim milk, a low-protein mixture such as the dry grain mixtures we have listed is preferable. (**59**) Skim milk is a high-protein feed and the grain mixture fed with it should be made up principally of low-protein ingredients.

76. Dried skim milk for calves.—Occasionally a dairyman living in the section where milk-drying plants are located is able to get rather cheaply dried skim milk, which is off quality and which cannot be used in human food. This dried product, when mixed with water has been found very satisfactory for use in place of fresh skim milk for feeding calves. One part of the dried material should be added to nine parts of warm water and fed the same as milk. It is best to add only a small amount of water first and to break up the lumps formed by the dried milk before adding the rest of the water. If this scrap milk can be bought at three or four

cents a pound it is the best feed for calves where whole or skim milk cannot be fed. If the dairyman can get it in limited amounts only he can use it to advantage in one of the calf meal formulas we have listed. If it could be made 20 per cent of the mixture, the blood meal and minerals, except the salt, could be omitted. Thus the dried milk could replace those materials hard to get.

77. Lead poisoning.—A good many calves are lost from time to time through lead poisoning. Veterinarians and chemists have traced many deaths to it, where the owner would have been willing to swear that the calf had no chance to eat anything containing lead. Few dairymen appreciate the variety of ways in which a calf may be poisoned from lead.

78. Most paint contains lead.—This fact is generally understood. Young calves habitually lick everything. A freshly painted wall, a discarded paint container, carelessly left around the barn or thrown on a rubbish heap, in the yard or pasture, furnish the calf his opportunity. Many do not appreciate that calves will eat paint. We know from personal experience that they will drink paint right down if given a chance. When calves get access to a paint bucket, or freshly painted surface they usually swallow enough to produce acute symptoms rapidly followed by death. Consequently the cause is generally located.

79. Slow poisoning from lead.—There is another type of lead poisoning, however, which is harder to locate. It is based on the fact that lead is a cumulative poison. This means that, even though not enough may be taken at any one time to cause characteristic symptoms of poisoning, lead gradually accumulates in the system until there is enough to kill the calf. This is the way in which a lot of unsuspected lead poisoning occurs. Old, dry paint is just as dangerous as fresh, and wherever there is a painted board that the calf can get at, a gradual poisoning may occur. Many like to have fancy quarters for their animals and thus everything is painted. Much lead poisoning occurs under these conditions. Even those who insist that no paint is used around the calf's quarters frequently find an old painted board handy for repairing a manger or partition and use it without realizing that the

calf may lick that board until poisoning results. Most dairymen will, on thinking the matter over, realize that their calves may at times have a chance to lick a painted board or wall. The thing that they must also realize is that, though unobserved, a calf may be getting just a little lead into its system day by day,—an amount too small to cause any noticeable trouble except as it piles up and finally kills the animal.

The symptoms of lead poisoning, particularly in the cumulative variety, are variable. Convulsions and paralysis are frequent. Curative measures sometimes avail if applied sufficiently promptly, particularly in cases of acute poisoning. It is a case for a veterinarian. About the only thing the owner can do is to give a physic in an endeavor to get the poison out of the system.

80. Prevention.—The remedy for lead poisoning is prevention rather than cure. If the dairyman will simply realize that it is natural for a calf to lick anything and everything, and that if there is any paint anywhere, no matter how old or how dry, the calf may gradually get enough to be poisoned, it will not be difficult for him to guard against the losses from this source. It is not necessary to paint the interior of the barn to make it look clean; whitewash will do as well and it is harmless. Or, if a man insists on paint, he can get one that contains no lead.

CHAPTER V

FEEDING YEARLINGS AND TWO-YEAR-OLDS

Having reared the calf to six months of age the problem of its feeding and management becomes easier, much less attention and care being required. However, many dairymen pay too little attention to the young animal from the time it is six months of age until the first calf is dropped.

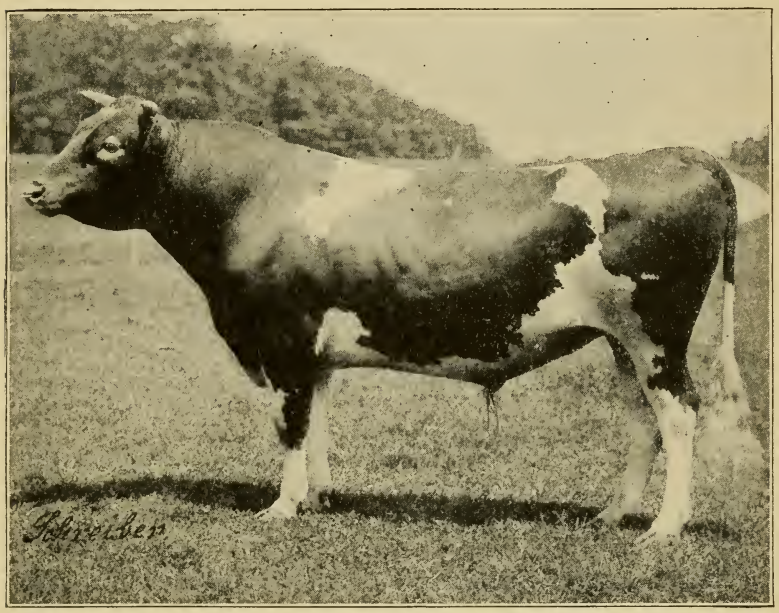
81. Turning out the calf.—The feeding and management of the young heifer after six months of age will differ according to whether she is to be turned out on pasture the first summer. This, of course, depends upon the time of year the calf is born. In general, no calf should be turned out before she is six months of age and under New York State conditions no calf should be turned out at all during the first summer unless six months old before July 15th. After this date the combination of poor pasture, heat and flies will keep the young animal from doing well.

82. Feeding in the barn.—While the calf is in the barn after the six-month period the feeding of skim milk may be continued with profit if it is available. With calves raised on a calf meal it is our custom to discontinue the gruel at this age. When the feeding of either skim milk or gruel is stopped, it should be done gradually, feeding them in decreasing amounts for at least a week.

The young heifer while in the barn should receive all the hay she will eat and this should be legume hay where possible. This kind of hay is especially needed where no milk is being fed, because otherwise, the feed may not contain sufficient lime or vitamines. After six months of age the calf should receive some silage. In fact this feed may be started as early as the fourth month to advantage if the farmer has plenty. Ten to fifteen pounds of silage a day is a fair allowance for the young heifer. Of course, the animal must also receive liberal amounts of grain,—from four to six pounds a day depending on whether the feeding of skim milk is being continued. As a grain mixture we know of nothing better

than that we have recommended for the younger calves in paragraph 59.

83. The calf on pasture.—When the calf can be turned out on pasture the first summer, she can be raised more cheaply and with less labor than where she must be kept in the barn. However, we should keep an eye on each animal to make sure that she is



IMP. KING OF THE MAY 9001

The most noted Guernsey bull. Owned by Langwater Farms, North Easton, Mass.

growing well. If any calf is unthrifty we should try to arrange it so that such an animal can have a little grain to supplement the pasture. In general, by the middle of summer the pastures have become rather poor and all calves should receive some grain. For this purpose use the mixture we have suggested for young calves in paragraph 59. It is fine if the young stock on pasture

can have a cool dark basement or similar place into which they can go to escape the heat and flies. Any place that is dark will cause the flies to leave the animals. When the heifer is brought into the barn from pasture she should receive all the hay of the best quality available she will clean up, also all the silage she will eat if it is available, and four to six pounds of grain a day.

84. Breeding the heifer.—About this time the farmer faces the question as to when the heifer shall be bred. This is a point on which there is a considerable difference of opinion. It is our belief that the heifer should be bred to drop her first calf from twenty-four to thirty months of age. Of course, the breeder must be guided somewhat by the size and state of development of the individual, and he should also remember that Guernseys and Jerseys may be bred somewhat earlier than the slower-maturing Holsteins, Ayrshires and Brown Swiss.

In favor of early breeding it should be remembered that until the heifer becomes a milk producer she yields no income. The condition of pregnancy has a marked stimulating effect on her development and experience indicates that milk-secreting capacity is favored by early breeding. Of course, it is recognized that the production of the foetus temporarily checks growth, but constantly recurring periods of heat may have just as great a retarding effect on her development.

We have recommended the liberal feeding of young stock. This is particularly important for the heifer as soon as she is a few months along with calf. Give her all the legume hay and silage she will clean up, and four to six pounds of grain a day. The mixture to which we have previously referred (**59**) will prove satisfactory here. Another used with good results is as follows:

500 lbs. gluten feed	400 lbs. wheat bran
500 lbs. ground oats	100 lbs. oil meal
500 lbs. hominy feed	

We could sum up our discussion of the feeding and management of heifers by saying: "Feed liberally and breed early." All that we have said in the raising of calves and in the feeding of yearlings and two-year-olds applies to the bulls as well as to the heifers.

CHAPTER VI

FEEDING FOR OFFICIAL RECORDS

The value of an animal is based upon performance. A high production record increases the value both of the cow and her offspring; for high producing cows and bulls with ancestors and progeny of demonstrated high productive capacity are those sought for breeding purposes. The advanced registry systems established by the various breed associations are the means whereby an animal's performance can be officially recorded. This development has played a large part in the advancement of our dairy industry and the feeding for records has an important place in the breeder's business.

85. The advanced registry.—Advanced registry means a further registry in addition to that to which every purebred animal is entitled. To qualify for advanced registry, or register of merit as it is called for some breeds, an animal must attain a certain standard of production under official supervision. This supervision is usually by a representative of the State College of Agriculture who is present during the test period to weigh the milk and determine its fat content. Each breed association has established the standards for that breed. These standards specify the amount of milk or butter fat which must be produced in a given period. The required production increases with age up to maturity. Maturity is defined as five years. Any breeder can obtain from his breed association booklets containing the detailed information as to the requirements for advanced registry. (**151**) For our discussion of feeding it is sufficient to bear in mind that the official records are usually based on seven days, or a year's production. The first is referred to as a short-time record and the second as a long-time record. The method of feeding will be discussed under these two heads. Success in feeding for records is based on three things: an animal of high productive capacity, intelligence and skill in feeding, and the right kind of rations.

86. Fitting a cow for the test.—A cow must have an adequate rest period before calving and must be fed so as to put her in the best possible condition and have a maximum of stored-up energy for milk production. It is believed that most animals will produce a milk higher in butter fat at least for a short period where

GLISTA ERNESTINE 117999 WELL FITTED TO MAKE AN OFFICIAL RECORD
Yearly record 23,341 pounds of milk; 833.73 pounds of butter fat. Owned by Cornell University, Ithaca, N. Y.

they have been well fattened during fitting. Thus fattening is particularly important where short-time records are concerned.

The dry period should be somewhat longer than usual where a cow is to be tested. Two to three months or even longer should be allowed. In the case where heifers are to be tested we should start planning for the test even farther back and not breed quite as early as otherwise in order that they may have a better start,

since the strain of forcing them for high production the first lactation may keep them from growing normally during the period. The heifer must be fed from the start so that she will be as well developed as possible at calving.

87. The fitting ration.—The ration during the fitting period should consist of a good grain mixture together with pasture or hay and silage. Legume hay is the kind to use and the quality should be the best. In feeding for records the dairyman should adopt the attitude that the cow is to have the best feed obtainable without regard to price. He cannot afford to waste the money he spends for official supervision and other extra labor and expense by economizing on the feed.

There must be succulent feed during the fitting period to keep the animal in the best condition. If pasture or silage are not available roots will prove satisfactory if they are to be had. Roots are especially useful during the test period and if the feeder has only a limited supply they must be saved for that period. Beet pulp moistened with three to four times its weight of water, to which a little molasses has been added, will prove useful in the absence of other succulence.

The grain mixture should be light, palatable, laxative and not too high in protein. A good mixture is:

30 lbs. hominy
30 lbs. wheat bran
30 lbs. ground oats
10 lbs. oil meal

Many prefer to increase the oil meal sufficiently to use equal parts of the four feeds. Corn meal can be substituted for hominy except during the week or ten days immediately before calving. At this time corn meal and hominy should be dropped out to lighten the ration. Ground barley can be used in place of the oats or hominy.

88. Feed individually.—An important thing during the test period is to feed the cow the things she likes best. With an animal whose tastes are not known, the best time to find out is during the fitting period and it is well to dry different combinations for this purpose.

The amount of grain to be fed during the fitting period will depend on the animal's size and condition. Usually she should be fed all she will clean up. Mature cows will eat from ten to twenty or more pounds a day. Of course, if the cow is on excellent pasture much less grain is needed.

89. Minerals in the fitting ration.—The fitting period corresponds with the time when the animal's demands for lime and phosphorus are high. She is replenishing her bones depleted during her previous lactation and it is the period when the bone development of the foetus is going on most rapidly. The legume hay will furnish lots of lime and the grain mixture is rich in phosphorus. The question is whether the minerals so supplied constitute the maximum the cow can assimilate or whether a further addition would mean a greater storage in the bones. So far as we know no breeder had made a practice of adding minerals at this time. We should like to see it tried and suggest that two per cent of steamed bone meal be added to the grain mixture.

Perhaps it would be worth while to try to increase the assimilation of lime and phosphorus at this time by adding some green or specially cured feed to the ration, or even a little cod liver oil to furnish the vitamine concerned. This point has not been settled absolutely by experiment. If the cow were on pasture this would take care of itself. In winter this would need to be accomplished by specially curing some alfalfa or other leafy roughage so as to preserve its powers of increasing the assimilation of lime and phosphorus as described in paragraph 13. If cod liver oil is used for this purpose, feed one-half pint per week as a drench or with a syringe. There is no question about the advantage of maximum storage of these minerals. Any increase beyond that made possible by the ordinary fitting ration would probably not affect a short-time test but it might well aid a cow to hold up on a long-distance record, in view of our knowledge that the bones are gradually depleted during the lactation period. At least it would constitute excellent insurance from the standpoint of the animal's health; for an undue depletion of the bones due to a year of forced production might easily have a harmful effect on vigor and later productivity.

The animal should have plenty of good, clean water, not too cold. If she cannot have access to it at all times, she should be watered three or four times a day. The picture of Glista Ernestine, page 50, illustrates a well fitted cow. This picture was taken just a day or two before she calved. She made a 30-pound record.

90. Attention at calving time.—A week or ten days before calving the cow should be placed in the quarters she is to occupy during the test. At this time the grain ration should be reduced. Constipation must be avoided. For this purpose the laxative feeds in the grain ration may be increased if necessary. Often a purgative may need to be given, such as one pound of epsom salts or one quart of linseed oil. Attention here will largely obviate the danger of udder troubles. If the udder becomes caked or swollen it should be treated by rubbing as we have explained in paragraph 16. Keeping the bowels loose and cutting down on the roughage a day or two before calving will do much to prevent trouble at parturition.

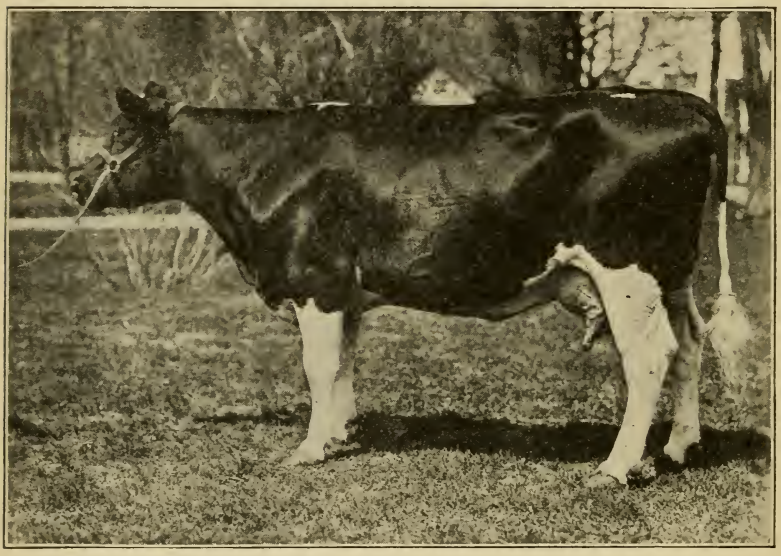
91. Increasing the feed.—For the first few days after calving the cow should receive only a limited amount of food and it should be laxative. After the fourth day if she is coming on all right, the feed can be rapidly increased to that being received before freshening. Milk fever is always a possibility following calving and high producers are especially subject to it. (**15 to 18**)

Feeding for Short-Time Records

Many think of successful feeding for records as being based on a special manipulation of the cow by some secret process. It does seem like a secret process to the beginner but the key to the secret is experience, a keen knowledge of animals and the development of skill. No one can succeed merely by following directions. Each animal must be treated somewhat differently for best results and it is in the proper modification of the methods of feeding and management from day to day according to the behavior of the animal that the skillfulness of the feeder is all-important.

92. Cool weather the best.—Short-time records are almost always made during the cool months because the animal will eat

a much larger amount of concentrates during this period. During the test period the cow is fed and milked four times a day. It will take her some time to get adjusted to this and thus it should be started right after calving, although a considerable time may elapse before the period of maximum production is reached. On the average the time of highest production is three weeks



Agassiz Segis May Echo 41302 (Canadian Herd Book.)
World's Champion in yearly butter fat production. Her yearly record is 30,886 pounds of milk, 1345 pounds of butter fat. Owned by Dominion Experimental Farms, Agassiz, B. C.

after calving. It may be earlier. Watch for it. The cow is carried through until the feeder is satisfied that she has made her maximum record. The production during any consecutive seven days during this period may be taken as the official record. The breeder may report a longer period than seven days if desired. Many 30-and 60-day records have been reported. The record period may start at any milking but not before the morning of the seventh day after calving.

On short-time test cows are fed all they will eat, but this must be done with great care particularly as regards the concentrates. After the cow is back on the same amount of feed received before calving, the grain ration must be increased gradually thereafter. It is best to increase it by one or two pounds on a given day and then watch the results for a day. If the animal does not clean up the increased amount readily a reduction should be made, or at least no further increase should be added until the cow is cleaning up what she is already getting. It is imperative that the animal be not allowed to go off feed. Again the increases must be stopped as soon as they fail to give a response in increased milk production. Proceeding in this careful manner it is quite possible to get the animal to eating 20 to 25 and even more pounds of concentrates daily. Any increase above 20 pounds should be made at a slow rate, say one-fourth to one-half pound daily. This crowding of the cow on rich feeds must be done with extreme care not only for the success of the test but also from the standpoint of the animal's health. Many valuable animals have been spoiled for later production by lack of skill here.

93. The grain mixture.—There are a large variety of grain mixtures that have been used with success as shown by the accounts of how our cows with high records have been fed. However, all these mixtures have many points in common. They are made up of a variety of palatable feeds with a considerable proportion of bulky and laxative ones. The following feeds occur most frequently in such mixtures: wheat bran, linseed oil meal, ground oats, gluten feed, hominy, distillers' grains and cottonseed meal. If one should make up such a ration from the above feeds as would furnish 23 to 25 per cent of protein and weigh about one pound to the quart, he should have a good mixture.

The following mixture has been used with good results:

200 lbs. distillers' dried grains	200 lbs. hominy
200 lbs. wheat bran	100 lbs. linseed oil meal
100 lbs. gluten feed	12 lbs. salt
100 lbs. ground oats	12 lbs. charcoal

Some feeders prefer not to put salt in the mixture but to feed it regularly or have it constantly before the animal. Distillers' grains is one of the best feeds for test cows but is not as available as formerly. A satisfactory mixture without distillers' grains could be made up as follows:

200 lbs. wheat bran
200 lbs. gluten feed
100 lbs. ground oats
200 lbs. hominy
150 lbs. oil meal
150 lbs. cottonseed meal

The salt and charcoal could be added if desired. It is not probable that the addition of lime or phosphorus would have any effect on production during a short-time test. If desired, we would suggest the addition of one per cent of steamed bone meal.

94. Vary the ration for each cow.—Of course, in selecting any ration it must be borne in mind that it may be desirable to vary it according to the tastes of the animal. Frequently, it is a good thing to change the ration entirely for a feed or two and reduce the amount when an animal shows a tendency to go off feed due to over-crowding. The fitting ration we have given will prove satisfactory for this purpose. (87) The sudden change and reduction will help bring the animal's appetite back. Even when there is no tendency to go off feed such a change will frequently be found worth while. Here no reduction in amount is called for. There is usually some feeding period during the day at which the cow eats her ration less readily—generally it is the noon feeding. This is the time for a change.

95. Roots and succulence.—Roots are a necessary feed for the cow on test. A much larger amount of grain can be fed with safety where roots are fed. Beets or mangels are preferred. The "Detroit Red" table beet and the "Norbiton Giant" or the "Golden Tankard" mangel are satisfactory varieties. It is customary to slice the roots and feed the grain on them while the cow is being milked. Use about three pounds of beets for every pound of grain. In the absence of roots, beet pulp soaked in water

may be used in the proportion of two pounds of dry pulp to three pounds of grain. The pulp may also be soaked in molasses diluted with warm water. Use one-half pint of molasses to a feeding. Many use a little molasses in the test ration because it is palatable and laxative. The molasses may cause scouring in which case it must be discontinued. (439)

96. The hay and silage.—For roughage alfalfa hay seems to have the preference. Clover hay will also prove satisfactory, but good results cannot be expected with poor roughage. The cow may receive all the hay she will clean up after she has consumed all the grain it seems wise to feed her. The amount of silage fed should be limited, or may be eliminated entirely, unless the animal shows a special liking for it. Succulence is better provided with beets or beet pulp, as a large consumption of silage means a less consumption of grain. We suggest 15 pounds per day or even less as a limit for the silage.

The stall should be well ventilated, but free from drafts. The temperature should be around 50° F. Regularity in feeding and milking are essential. The latter should be done by the same man throughout the test. When a cow is being forced to her utmost it takes but a little thing to upset her and slow her down. Therefore, she must be carefully and constantly watched that no detail of care which may add to her comfort and content may be neglected. The experienced and skillful feeder realizes these things and he gets the records.

Feeding for Long-Time Records

The general system of feeding for a year's record is similar to that described for the short-time test but the animal cannot be forced as much. Relatively less grain and relatively more roughage are fed. The cow is frequently milked only three times a day instead of four. This, of course, means adjusting the feeding accordingly.

97. The grain mixture.—The same grain mixtures as were recommended for the short-time periods are satisfactory. However, over the year's period the watchful feeder will modify the mixture

frequently as the cow tires of it or of some particular feed. Of course, the animal must have salt regularly either in the grain mixture or separately. We should also be inclined to add to the grain mixture one or two per cent of one of the sources of lime and phosphorus.

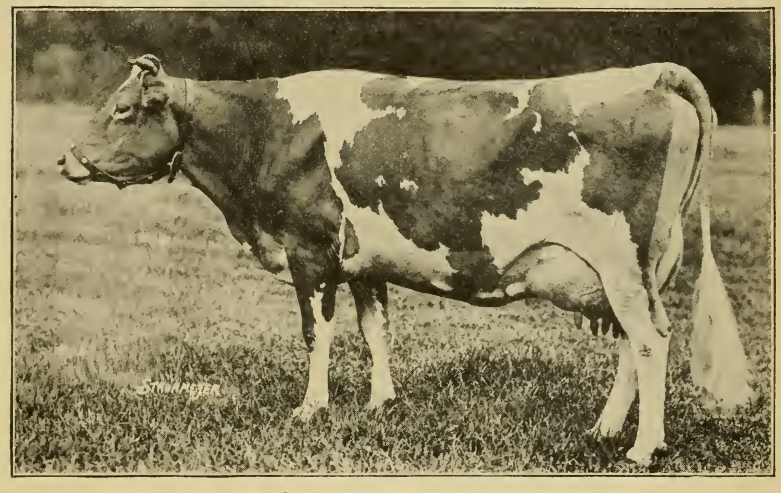
There must be plenty of first quality clover or alfalfa available throughout the year. Due to the scarcity and cost of beets, silage may be the main reliance for succulence and the cow should receive the best to be had. Of course, beets should be used in so far as available. Fed with the grain, they mean a greater consumption with less danger of the cow going off feed. Beet pulp, soaked in water to which molasses is added, may be used in place of roots.

Assuming that the record period is to begin as soon as the cow strikes her gait in a given lactation period she should be gradually changed to the test ration, following calving, as we have suggested in feeding for the short-time test. However, she should not be crowded as much on grain and should receive relatively more roughage. The secret of successful feeding over the long period is to secure maximum consumption without the animal going off feed. This means that at all times the amount of feed must be sufficiently limited to keep the appetite keen. The feeding for a long-time record should really follow closely the suggestions we have given in Chapter II for feeding during the lactation period, paying especial attention to the quality of feed, the condition and attitude of the animal and the other details of individual care we have mentioned in connection with short-time tests.

98. Use of pasture in long-time records.—The pasture season presents a special problem. Many feeders keep the animal in the barn all summer, aside from letting her out for short periods for exercise when the weather is suitable. Others plan that the cow shall secure considerable feed from pasture by turning her out during the cooler parts of the day. In sections of the country where the summers are not hot it is the custom of many to keep the animal continuously on pasture when not too cold or wet. The point is that the animal on test must not be subjected to

cold, rainy weather or to heat and flies. If pasture means these disadvantages it is preferable for her to remain inside. We favor turning the cow out so that she will have the advantage of as much of the succulence of pasture as weather conditions will allow, provided the flies are not bothersome.

If the cow is turned out regularly for sufficient periods during the day to receive a considerable amount of feed from pasture



COUNTESS PRUE 43785

Guernsey world's record in butter fat. Yearly record 18626.9 pounds of milk, 1103.28 pounds of butter fat. Owned by F. L. Howes, Groton, Mass.

it must be remembered that the change from stable to pasture feeding must be a gradual one. The ration fed in the barn should be gradually decreased in amount during the first week on pasture. Even on the best pasture the cow should continue to receive some grain and hay and perhaps some silage also, depending on for how long a period during the day she is turned out. Of course, as the pasture commences to fail the feeding of grain, hay and silage must be increased. This may be the period, however, that it will be advisable to keep the animal in the barn, aside from short periods out for exercise, in which case the full ration of stable feeding should

be resumed. For the cow kept in the barn during the summer or a considerable portion of it, a succession of soilage crops will afford a substitute for pasture and furnish a welcome change from the silage of winter feeding. (386)

99. Comfort and regularity.—The cow must be kept as comfortable as possible at all times. This means moderately warm, dry quarters in winter and cool quarters as possible during summer. Be sure to use a fly spray during the summer. Do not forget to provide plenty of good water at all times. The cow should have some exercise every day, either by being turned out in a yard when the weather is suitable, or having the run of a shed, or through some other means.

Regularity of feeding and milking are essential. The milking should be done by the same man in so far as possible. The most careful and considerate treatment will be repaid many times in the larger production secured.

CHAPTER VII

HOW TO BUY FEEDS

The object in buying feeds is to select those which at the least cost will form a satisfactory ration with the home-grown materials. By a satisfactory ration we mean one that will produce the maximum amount of milk. It must have adequate protein and be highly digestible. It must furnish the proper bulk and variety and be palatable. These factors have been discussed previously. If we overlook them in trying to get a cheap ration, any money saved may be lost many times in lessened production.

100. Digestible part valuable part.—When a feed is taken into the body, a certain part is digested and absorbed while the remainder is excreted in the manure. Of course, only that part which is digested is of use to the animal; thus, in buying feeds we want to get the maximum amount of digestible material for our money. In fact, the only real way to tell what feeds are cheapest is to compare them on the basis of their digestible material. To do this we compute the total digestible nutrients of each feed. By actual trials with animals, the amount of digestible protein, digestible fiber, digestible carbohydrates and digestible fat has been determined for every common feed. If we multiply the digestible fat by 2.25 and add to this product the other digestible nutrients, we obtain the total digestible nutrients. The fat is multiplied by 2.25 because it furnishes 2.25 times as much feed energy as the other nutrients. The total digestible nutrients in 100 pounds of each of the common feeds are shown in Table I in the appendix.

101. Cost of digestible nutrients.—Now, let us illustrate the buying of feeds on the basis of total digestible nutrients. Suppose a feed dealer has the following feeds available at the prices named:

Corn meal	$36.50	Standard middlings	$35.05
Ground oats	38.60	Flour middlings	38.80
Corn gluten feed	49.80	Wheat mixed feed	36.30
Hominy feed	38.05	Cottonseed meal, 43%	58.05
Wheat bran	35.05	Linseed oil meal	59.05

What we really want to know is their cost in terms of total digestible nutrients. Thus, we will calculate the cost of 100 pounds of total digestible nutrients in each feed and rearrange them on that basis. We figure the total digestible nutrients in a ton by multiplying the amount in 100 pounds, as shown in Table I in the appendix, by 20. By dividing the cost per ton by the total digestible nutrients per ton, and multiplying the quotient by 100, we get the cost of 100 pounds of total digestible nutrients.

	Cost per ton	Total dig. nutrients per ton	Cost of 100 lbs. total dig. nutrients
Corn meal	$36.50	1676	$2.18
Hominy feed	38.05	1692	2.25
Flour middlings	38.80	1564	2.48
Standard middlings	35.05	1386	2.53
Wheat mixed feed	36.30	1340	2.71
Ground oats	38.60	1408	2.74
Wheat bran	35.05	1218	2.88
Gluten feed	49.80	1614	3.09
Cottonseed meal, 43%	58.05	1564	3.71
Linseed oil meal	59.05	1558	3.80

102. What to buy.—Now, we are ready to decide what to buy. Though hominy costs $1.55 a ton more than corn meal, it is nearly as cheap in terms of total digestible nutrients and we prefer it because it is bulky and a better general feed for the dairy ration. However, we cannot make our mixture entirely of hominy even though it is the cheapest feed shown, for we must have variety and adequate protein content. The protein content will depend on the roughage. Suppose we have mixed hay containing 50 per cent of clover. We should then select a grain mixture containing around 20 per cent of protein. This will require a considerable amount of one of the high-protein feeds. Here corn gluten feed is the cheapest. However, if we add much gluten we will not be watching out for variety, since we have already selected one corn feed in hominy. Therefore, we had better put in some cottonseed. It costs much more than gluten in terms of total digestible nutrients, but it runs nearly twice as high in protein so we will not need to buy much more than half as much to get the protein needed. Finally, let

us add one other feed for further variety. Wheat bran would be very satisfactory but it is quite expensive. Flour middlings are the cheapest of the remaining feeds but they are rather heavy for the dairy ration. Let us take wheat mixed feed. The next thing is to put together the feeds so as to give the proper protein content. One can set down a trial formula and then compute its protein from Table I in the appendix. How this may be done is shown below:

500 lbs. hominy	500 x 10.6%	=	53.00 lbs. protein
200 lbs. wheat mixed feed	200 x 16.8%	=	33.60 lbs. protein
100 lbs. gluten feed	100 x 25.4%	=	25.40 lbs. protein
200 lbs. cottonseed meal, 43%	200 x 44.1%	=	88.20 lbs. protein
1000 lbs. will contain			200.2 lbs. protein

200.2 ÷ 1000 = 20.02% protein

This trial happened to come out exactly 20 per cent. Had it come out one or two per cent below, the ration would still have been satisfactory. A wider variation than this would have caused us to modify the mixture somewhat.

103. How to buy.—We will assume that a man will make up for use in his herd a mixture similar to the above which will be composed of the four common feeds, wheat bran, hominy, gluten feed, and linseed oil meal. Such a mixture to run 20 per cent total crude protein would be:

	Lbs.	% total protein	Lbs. total protein
Wheat bran	400	16.0	64.0
Hominy	200	10.6	21.2
Gluten feed	200	25.4	50.8
Linseed meal	200	33.9	67.8
	1000 lbs.		203.8
	100 lbs.		20.4

This mixture would be a suitable one to go with red clover hay or with a mixed hay containing more than one-half clover.

Now, in buying feeds for this mixture we will consider the case where a man will buy these feeds separately and mix them himself. The case of the purchase of proprietary feeds and feeds purchased co-operatively is treated in paragraphs 113, 114, 115 and Chapter VIII.

104. Ways in which feed can be bought.—Leaving out of the discussion now the question of buying feed co-operatively, there are several ways that feed can be purchased: the feed can be bought of a local dealer, 100 pounds at a time, on credit; 100 pounds at a time for cash; a ton at a time for credit or for cash; or the number of tons of each kind may be ordered through the dealer in advance for future delivery and cash paid on delivery.

105. Buy for cash.—The place to buy money is at the bank. That is what banks are for. They will keep your money and pay you interest on it or they will sell you some money to use for a time. The thing to do is to establish a line of credit with your banker and learn to use that line of credit properly. What we mean by a "line of credit" is to arrange with the banker with whom you have your checking account to allow you a certain amount of credit on notes signed by you and secured by collateral security such as bonds. Or, the note may be endorsed by your wife and the credit extended to you by your banker upon the deposit with him of a definite statement of the condition of your finances which shows that your business is in such condition that he would be safe in extending to you a certain amount of credit. Then when you need the money you can get it and pay cash for the feed.

106. Expensive to buy in small quantities.—It costs too much to buy a bag of feed at a time. The only way to buy feed is to order it for future delivery at the time when you think the price is right, take it off the car when it comes, pay the dealer cash for it at the wholesale price agreed upon at the time the feed was ordered, plus a small margin to the dealer for doing the business. That margin should not be more than one dollar a ton over the wholesale price to the dealer if you pay cash and take the feed off the car when the dealer calls you up and tells you to come and get it. So long as you do not yourself buy feed in carloads you must expect to pay for the service rendered by the dealer and the amount of profit to which he is entitled is determined by the service he renders. But there is nothing secret about it. You should know through your dairy paper about what the wholesale price of each feed is. Then it is a matter of a business deal between you

and your dealer as to what service he shall render and what you shall pay for that service. Remember all the way through that the thing that really talks is the cash.

107. Order in advance.—If you order in advance the dealer can know how much to buy and if you have the right relations with him he can buy at the right time and price for future delivery. Feed is usually the cheapest between May 1 and October 1 each year, the so-called "grass price" usually obtaining in these months. We will illustrate this in the case of the four feeds chosen above. All prices quoted are on the basis of the Utica, New York, freight rate from western points in carloads, wholesale, for cash, draft attached to bill of lading, which means that the draft must be paid before the car can be unloaded.

108. Time to buy wheat bran.—The following little table shows the highest and lowest prices per ton in each year named for the ten years 1912 to 1922. We have broken the year to run from May 1 to April 30 of the next year because prices usually begin to break in the feed market about April 1.

Year	Lowest price	Highest price
1912–13	April, 1913, $21.15	May, 1912, $27.65
1913–14	May, 1913, 21.15	Feb., 1914, 28.15
1914–15	July, 1914, 23.15	Feb., 1915, 28.35
1915–16	Nov., 1915, 22.85	Apr., 1915, 25.85
1916–17	June, 1916, 22.85	Feb., 1917, 42.85
1917–18	June, 1917, 32.85	Dec., 1917, 46.00
1918–19	July, 1918, 31.20	Jan., 1919, 56.80
1919–20	June, 1919, 41.80	Apr., 1920, 57.00
1920–21	Apr., 1921, 26.40	June, 1920, 64.20
1921–22	Oct., 1921, 21.35	Feb., 1922, 35.45
1922–23	Aug., 1922, 22.55	Mar., 1923, 37.00

A glance at this table shows that bran is cheaper as a rule in the summer months and that a normal summer price is $20 to $23.

109. Hominy.—The hominy table shows that the best price on this feed is likely to come later in the year after the new corn comes on the market, although the low price on this feed varies all over the year. The clearest thing in the table is that $20 to $25 is about the price to pay most years.

Year	Lowest price	Highest price
1912–13	Mar., 1913, $21.25	Sept., 1912, $31.00
1913–14	May, 1913, 24.00	Sept., 1913, 30.70
1914–15	Nov., 1914, 27.97	Sept., 1914, 33.41
1915–16	Nov., 1915, 27.97	Sept., 1915, 33.00
1916–17	May, 1916, 28.50	April, 1917, 56.05
1917–18	Nov., 1917, 54.66	Mar., 1918, 67.25
1918–19	Mar., 1919, 53.83	Aug., 1918, 66.50
1919–20	Dec., 1919, 57.75	Aug., 1919, 78.83
1920–21	Apr., 1920, 28.65	July, 1920, 76.20
1921–22	Apr., 1922, 25.92	June, 1921, 31.90
1922–23	May, 1922, 26.00	Dec., 1922, 37.75

110. Gluten feed.—The lowest price on gluten feed comes quite consistently along in late spring and early summer. If you buy at this time at a price between $30 and $35 you are fairly safe that it will not go higher. It is not at all likely that high-protein feeds will go under $30 for some years.

Year	Lowest price	Highest price
1912–13	April, 1913, $24.05	Jan., 1913, $29.85
1913–14	May, 1913, 24.05	Jan., 1914, 30.80
1914–15	Apr., 1915, 27.11	Feb., 1915, 31.61
1915–16	Nov., 1915, 26.03	Jan., 1916, 31.36
1916–17	May, 1916, 27.06	Apr., 1917, 45.11
1917–18	June, 1917, 43.76	Apr., 1918, 58.71
1918–19	June, 1918, 48.71	Jan., 1919, 62.99
1919–20	May, 1919, 61.74	Feb., 1920, 73.95
1920–21	Apr., 1921, 35.90	June, 1920, 80.20
1921–22	Nov., 1921, 33.05	Dec., 1921, 41.23
1922–23	July, 1922, 34.75	Jan., 1923, 49.05

111. Oil meal.—In most years oil meal appears to be cheapest along in the spring and early summer. The low price on oil meal appears to vary around $35 to $40.

Year	Lowest price	Highest price
1912–13	Apr., 1912, $29.50	May, 1912, $39.00
1913–14	May, 1913, 27.50	Aug., 1913, 35.50
1914–15	Oct., 1914, 31.50	Feb., 1915, 42.00
1915–16	Apr., 1916, 33.00	Dec., 1915, 41.50
1916–17	May, 1916, 31.50	Dec., 1916, 49.50
1917–18	June, 1917, 49.50	Dec., 1917, 63.50
1918–19	May, 1918, 60.50	Jan., 1919, 79.50
1919–20	April, 1920, 71.50	Aug., 1919, 94.50
1920–21	Apr., 1921, 35.90	July, 1920, 70.20
1921–22	May, 1921, 35.85	Mar., 1922, 58.75
1922–23	Aug., 1922, 42.10	Dec., 1922, 56.60

112. Saving money.—A study of these tables will show what we have tried to bring out at the beginning of this chapter. Money

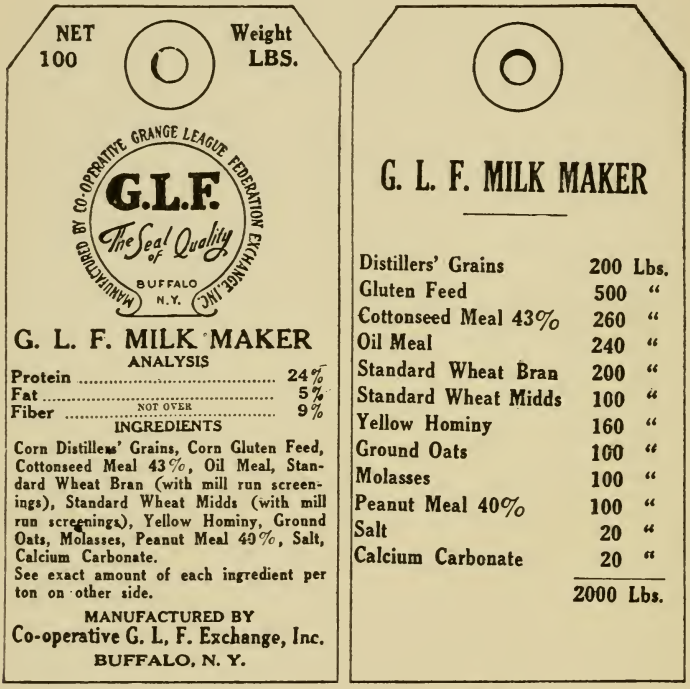
will be saved by buying for cash for future delivery. Your feed dealer will help in finding out the proper time to buy. But do not leave it all to him. Know feeds and prices and form your own judgment as to when and how to buy.

113. Proprietary feeds.—Thus far we have been thinking of the farmer who mixes his own ration. We know that a large number of farmers use proprietary feeds. It has been our observation that the average dairyman can mix his own grain ration more cheaply if he will take the trouble to do it. In so doing, he has the opportunity of making it up to fit his home-grown feeds, and he is surer of what he is getting than he is if he tries to choose from the large number of proprietary feeds on the market which do not have public formulas.

According to law a proprietary feed must be sold under a guaranteed analysis, and in most states the ingredients must be stated. However, this tells the farmer nothing as to how much of a given ingredient is present. In a proprietary feed listing six or eight or more ingredients those the farmer wants most may or may not be present in any considerable amount. This is why we say that such a feed does not enable the farmer to get what he wants as well as though he mixes his own ration. Fortunately manufacturers are commencing to recognize this and there are now on the market certain proprietary feeds with "open formulas"—that is, the amount of each ingredient is stated. We believe that these are the kind of proprietary feeds that should be bought when looking for a ready-mixed feed. (**123, 124, 125**)

114. Feeds with secret formulas.—If a proprietary feed of unknown formula must be bought, the farmer should study the tag on the bag before buying. Note the guarantee to see whether the protein content is what is desired and that the fiber content is not above 12 per cent. Study the list of ingredients. Certain proprietary feeds contain materials which are so low grade that the cow can make no use of them for milk production. Many feeds contain ingredients which are about equal in value to hay and the farmer cannot afford to buy such unless they are charged into the feed at a price no higher than it would cost him to buy or raise hay

at home. Unfortunately when the farmer does not know how much of this low-grade material is in the feed he cannot tell whether he is paying a fair price for it or not. Thus, in buying a feed of unknown formula it is safest to purchase one containing high-grade ingredients only.



THE G.L.F. SEAL OF QUALITY

The open formula of G.L.F. Milkmaker. The tag on every bag tells the story.

Of course there are good proprietary feeds of unknown formulas. There are many such feeds that have enjoyed a good market for years and they must give satisfaction or farmers would not continue to buy them. Unfortunately there are also many proprietary feeds of poor quality and some that are practically worthless.

It is therefore difficult except on the basis of an open formula to tell a farmer how to select and use a proprietary feed.

115. Feeds with public formulas.—What we mean by a feed with a public formula is a feed sold with a tag attached to each bag with the formula by which the feed is mixed printed on the tag. From this the buyer can tell not only from what ingredients the feed is made but he knows exactly how much of each ingredient is used. This will enable one to compute the value of the ready-mixed feed and compare it with what he can do in home mixing when he buys the separate ingredients. We believe that all farmers should insist on having public formulas printed on the tags of all the mixed feeds they buy. In Chapter VIII we will show how this can be and has been worked out successfully. An example of a feed with public formula is G.L.F. Milkmaker. The formula given on page 68 is printed on the tag accompanying every bag of G.L.F. Milkmaker.

CHAPTER VIII

THE CO-OPERATIVE PURCHASE AND DISTRIBUTION OF FEED

In order to get feed from where it is grown or manufactured to our barns, a series of operations must take place which, as far as making the feed available for use is concerned, are as essential as the production of the feed itself. These operations include financing, assembling quantities of feed at points of origin, grading it, sacking it, transporting it, and finally distributing it locally. Of late farmers have had a feeling that they themselves could perform some of these operations and a large number of co-operative corporations have been organized.

116. Advantages of a corporation.—All corporations are legal entities. They derive the authority for their existence from the state. The advantages of a corporation as an instrument to conduct business are several: first, through it individuals may pool their capital; second, it is a permanent institution; third, it limits personal liability through assuming a personal liability of its own; and finally, it provides a means whereby the small capitalist or the small producer may invest his capital and secure skilled management of it. In short, the corporation is a useful way of concentrating money and management for great undertakings that could never be handled by individuals because of their great size. At the same time it provides a means whereby individuals may participate in enterprises without endangering their personal fortunes.

117. Character of co-operative corporations.—In the ordinary business corporation money rules; men vote in the management of the corporation in proportion to the shares of stock that they own. In the case of the co-operative corporation, it is a generally recognized principle that each member has one vote regardless of his share of ownership in the corporation.

In the ordinary form of business, corporation profits that accrue are distributed in the form of stock dividends. In the co-operative

form the usual plan is to distribute profits on the basis of patronage. Farmers have organized co-operative corporations to buy and distribute feed quite generally during the past few years and with a few exceptions—probably no more than would occur in connection with the organization and operation of a like number of business corporations—these companies have been successful.

To begin with, the character of the corporation is such that it is always operated in the interest of its members. Service rather than money-making is the primary aim of the corporation itself. This means that it is used to get feed marketed as cheaply as possible, instead of trying to see how much can be made off the various marketing operations. Again, since the men who own it are the men who use the feed, greater attention is given to quality and to making available those feeds which it is to their best interest to use.

118. Service costs.—Despite these marked advantages in favor of co-operative buying, members of co-operative corporations everywhere should remember that marketing operations cost money, whether performed by their own co-operative, an ordinary business corporation, or a private individual; and that the lack of good business management, sufficient working capital, or the necessary volume of business may so handicap the co-operative that it becomes the most expensive method of buying and distributing feed.

119. Examples of successful co-operative corporations.—Successful co-operative feed-buying corporations operating over large territories are the Eastern States Farmers Exchange, with headquarters at Springfield, Mass.; the Michigan Farm Bureau at Lansing, Mich.; the Pennsylvania Farmers' Co-operative Federation at Philadelphia, Pa.; the Co-operative Grange League Federation Exchange, Inc., with headquarters at Ithaca, New York. Operating locally are hundreds of smaller concerns; in fact, in New York State alone there are reported to be around seventy-five local co-operatives owning and operating warehouses. Two co-operatives, the G.L.F. Exchange, as it is popularly known, and the Adirondack Farmers Company, will be described in some detail.

The first is an example of a farmer-owned corporation engaged in the manufacture and wholesale distribution of feed; the other operates as a local buying and distributing agency. Both have been successful to date and each has supplemented the other.

120. The Co-operative Grange League Federation Exchange, Inc.—This is, as its name implies, a co-operative corporation developed by the New York State Grange, the Dairymen's League Co-operative Association, Inc., and the New York State Farm Bureau Federation. The history of the organization of the Exchange is about as follows:

For a number of years prior to 1918 the New York State Grange had attempted through various agencies to purchase farm supplies for its members. In 1918, after some unfortunate experiences, its executive committee authorized the organization of a co-operative stock corporation, the stock to be subscribed by Grange members and the corporation to be used to purchase farm supplies for the members of local granges.

The authorized capitalization was $100,000. For some reason or other, only about $35,000 worth of stock was subscribed. This corporation, known as the New York Grange Exchange, began operation, and during 1919 and the early part of 1920 did a fair volume of business.

At this time, due to war conditions, prices were rising very rapidly and many feed manufacturers and local dealers were taking advantage of the situation to make a good deal of money. This condition was noticed by farmers who became restive and who began to demand through their organizations—the Grange, the Dairymen's League, and the State Farm Bureau Federation—that something be done to put them in a stronger position. Not only were those engaged in marketing feed making undue profits, but great quantities of inferior feed, seed and fertilizer were being distributed.

121. The New York State Agricultural Conference Board.—The executive committees of the leading farm organizations in New York State belong to a body known as the Agricultural Conference Board which serves as a clearing house for all agri-

cultural matters. At meetings of the Agricultural Conference Board during the spring of 1920 the need of some sort of a farmer-owned co-operative buying corporation was discussed frequently. Careful thought was given to the whole matter and considerable investigation was done by special committees of the Board, with the result that it was finally unanimously agreed by all members of the Board to unite in the organization of a purchasing corpora-

THE BOARD OF DIRECTORS AND MANAGER OF THE CO-OPERATIVE G.L.F. EXCHANGE

Typical farmers who operate the Exchange for the benefit of themselves and other farmers.

tion of sufficient size to insure an adequate volume of business and to make possible the employment of the most skilled management available. It was also agreed that this new corporation should purchase the assets of the Grange Exchange and begin operations with the business of that corporation.

A million-dollar co-operative stock corporation was finally agreed upon, to be known as the Co-operative Grange League Federation Exchange, Inc. The board of directors was made up of nine members, three from each of the supporting organizations. The certificate of incorporation was filed in June, 1920, and the

stock in shares of $5 each offered to the members of the supporting organizations during the same month. As a result of a quick and comprehensive campaign about two-thirds of the stock was subscribed and the Exchange began business about July 1, 1920.

122. The feed and grain department.—This department of the Exchange was at the very beginning located at Buffalo, New York, where a fairly large mill was built and equipped. This department early began the manufacture of public formula, ready-mixed rations for G.L.F. members. The demand for these rations soon outgrew the Buffalo plant and it became necessary for the Exchange to secure additional manufacturing facilities.

In the meantime, coincident with the development of the G.L.F., New England farmers were developing the Eastern States Farmers Exchange, Michigan farmers the Michigan Farm Bureau, and Pennsylvania farmers the Pennsylvania Farmers' Co-operative Federation. These organizations all had the same problems, among them the manufacture of the best possible dairy and poultry rations.

123. Feeds with public formulas.—The managers of these farmers' co-operative corporations early in 1922 got in touch with the feeding experts of the eleven eastern agricultural colleges and invited them to meet and agree upon the best possible formulas for dairy rations and other mixed rations. This meeting was held in Springfield during the summer of 1920.

Probably the greatest single success of the feed department of the G.L.F. has come through the manufacture and distribution of the G.L.F. dairy feeds, particularly of G.L.F. Milkmaker. The formulas of the G.L.F. dairy feeds follow:

G.L.F. Milkmaker

	Pounds
Distillers' grains	200
Gluten feed	500
Cottonseed meal 43%	260
Oil meal O. P.	240
Std. wheat bran	200
Std. wheat middlings	100
Yellow hominy	160
Ground oats	100
Cane molasses	100
Peanut meal 40%	100
Salt	20
Calcium carbonate	20
	2000
Digestible nutrients	1506

Guarantee:
Protein, 24%; Fat, 5%; Fiber, 9%.

G.L.F. Exchange Dairy

	Pounds
Distillers' grains	100
Std. wheat bran	360
Yellow hominy	260
Ground oats	200
Gluten feed	440
Peanut meal 40%	140
Cottonseed meal 43%	160
Oil meal O. P.	100
Cane molasses	200
Salt	20
Calcium carbonate	20
	2000
Digestible nutrients	1452

Guarantee:
Protein, 20%; Fat, 4½%; Fiber, 9%.

G.L.F. Sixteen Per Cent

	Pounds
Yellow hominy	530
Ground oats	280
Std. wheat bran	300
Std. wheat middlings	300
Gluten feed	400
Oil meal	50
Cottonseed meal 43%	100
Salt	20
Calcium carbonate	20
	2000
Digestible nutrients	1476

Guarantee:
Protein, 16%; Fat, 4½%; Fiber, 9%.

G.L.F. Young and Dry Stock Feed

	Pounds
Corn meal	480
Ground oats	480
Wheat bran	500
Oil meal	200
Molasses	200
Alfalfa meal	100
Calcium carbonate	20
Salt	20
	2000
Digestible nutrients	1369

Guarantee:
Protein, 13%; Fat, 3½%; Fiber, 9%.

G.L.F. Calf Meal

	Pounds
Oil meal	300
Barley, malted	200
Red Dog	440
Oat flour	300
Blood flour	200
Yellow corn meal	500
Salt	20
Prec. calcium carbonate	20
Prec. bone meal	20
	2000
Digestible nutrients	1560

Guarantee:
Protein, 22%; Fat, 4%; Fiber, 3½%.

These feeds can all be used as suggested for similar mixtures in earlier chapters.

124. A complete feed service.—In addition to the above dairy feeds, the G.L.F. Exchange manufactures G.L.F. Horse Feed, G.L.F. Hog Feed, G.L.F. Laying Mash, G.L.F. Coarse Scratch Grains, G.L.F. Growing Mash, G.L.F. Fattening Mash, G.L.F. Chick Scratch Grains, and G.L.F. Intermediate Scratch Grains. These feeds all have public formulas. We will not take the space to give the formulas of any but the dairy feeds. There is in the G.L.F., feed service a feed for every farm animal.

In addition, the G.L.F. carries the following stock of standard ingredients for home mixing:

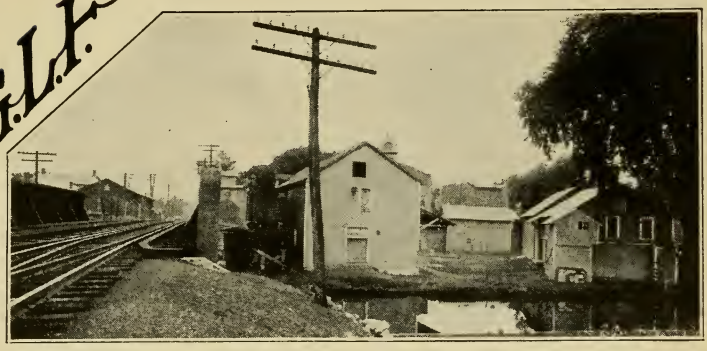
Choice recleaned yellow corn
Yellow sifted cracked corn
Fancy yellow corn meal
Yellow corn feed meal
Corn and oats half and half ground
Recleaned white oats
40-pound white clipped oats
Crushed oats
Ground oats
Fancy feed wheat
46-pound barley
Corn gluten feed
Choice white hominy
Standard bran
Standard middlings
Choice flour middlings
Wheat mix feed
Cottonseed meal 43%
Choice alfalfa meal
O. P. oil meal 30% protein

125. Manufacturing the feeds.—The American Milling Company, Peoria, Illinois, one of the largest and most modern feed-mixing plants in the country, watched the development of farmer-owned co-operative corporations like the G.L.F., and its president and directors became convinced that the movement was sound and likely to endure. Mr. H. G. Atwood, its president, therefore entered into negotiations with the managers of the Co-operative G.L.F. Exchange, the Eastern States Farmers Exchange, the Pennsylvania Farmers' Co-operative Federation and the Michigan Farm Bureau, and finally contracted to manufacture for them *under their supervision* the feeds recommended by the agricultural colleges.

As a result of all the co-operatives contracting with the American Milling Company for the manufacture of their feeds, a tremendous purchasing power was built up. This immediately placed them in an enviable position as regards purchases and low manufacturing costs. The feed department of the G.L.F. Exchange—and what was true of it was equally true of the other co-operatives—found itself in a position to furnish its members with high quality ready-mixed rations of known ingredients and with public formulas at lower costs than the most optimistic of its members had ever anticipated.

126. A successful feed pool.—During the fall of 1922 it appeared to the management of the G.L.F. and Eastern States Farmers Exchange that feed prices would be likely to go higher. Both organizations accordingly got in touch with their members

G.L.F.



A Farmer Owned and Managed Farm Supply Store

At Fort Edward, Washington County, New York, the community got together, organized and capitalized a community purchasing corporation. They bought out a local merchant. Now they have their own store through which the community buys Public Formula G.L.F. Feeds, known origin G.L.F. Seeds, and dependable quality G.L.F. Fertilizers and Binder Twine. They have paid dividends on their capital stock and have accumulated a small reserve. Good business management, G.L.F. service and the loyal support of shareholders have made this co-operative association a success.

Are You Using G.L.F. Service?

At many other points in the State, farmers are providing themselves with warehouse facilities. They have organized co-operative corporations, or arranged with their local dealers to handle G.L.F. goods for them. At other places they have elected a community agent to assemble carload orders, the purchasers taking the goods from the car when it arrives. If your community has not yet arranged to get G.L.F. Feeds, Seeds, Fertilizers, Coal and Binder Twine, write direct for full details.

The public formula G.L.F. dairy feeds now being mixed for you by the G.L.F., are the best that money can buy, and quality considered, are the cheapest on the market.

You get more milk and have a better cow left.

The Co-operative
Grange League Federation
Syracuse, N. Y.

Public Formula Feeds

"The Truth in Feeds"

and suggested that they place orders for feed without price, the feed to be purchased by the corporations at the best possible figure and delivered to them as needed. The members responded readily and orders were placed for a very large tonnage as needed.

As a result of this operation, the G.L.F. purchased and delivered to its membership in the fall and winter of 1922-23, its leading ready-mixed dairy ration, G.L.F. Milkmaker, a feed carrying 24 per cent protein, at a price of $41 per ton, Utica rate basis. Before the feeding season was over this same feed went to $51 per ton.

The feed pool, as it came to be known, because of the collective placing of orders, has become very popular; and it is likely that almost too much has come to be expected from this form of feed purchasing. On the other hand, as shown in a previous chapter, feeds are usually lowest in the summer months and it therefore follows that one year with another the owners of co-operative corporations like the G.L.F. may profitably use their organizations to purchase large quantities of feed at what appear to be low prices, with the idea of taking these feeds as needed throughout the winter months.

Because it was well capitalized in the beginning, because it was able to secure skilled management, and because it enjoyed from the outset a fairly satisfactory volume of business, the feed department of the G.L.F. has been a successful venture upon the part of New York State farmers. However, they can at best only use it to perform the functions of a manufacturer and wholesaler. When it comes to the problem of receiving and distributing feed locally new agencies must play a part.

127. Local distribution.—After studying the problem, the management of the G.L.F. Exchange has adopted the policy of asking its shareholders in a community to determine the type of agency which they desire to use to purchase and distribute G.L.F. feeds for them. In some instances farmers have developed local co-operative associations; in others they have made arrangements with established dealers whereby these dealers agree to work with them in purchasing feed at favorable times, and in giving price recognition to cash payments, and to feed that is drawn direct

from the car on arrival instead of being taken from a warehouse; and in still other communities, farmers themselves have operated as individuals and as groups in bringing in and distributing among themselves carloads of feed.

128. The Adirondack Farmers Co-operative Exchange, Inc. —One of the most successful of the co-operative associations, and one which typifies, according to the best experience to date, sound organization and operation, is the Adirondack Farmers Co-operative Exchange, Inc., located at Fort Edward, New York.

Like the G.L.F. Exchange, this is a co-operative stock corporation. Since co-operative associations receiving and distributing feed usually need to own property and maintain stocks of goods, experience has developed the fact that the co-operative stock form of corporation which has paid-in capital is a better business instrument for farmers to use than the non-stock form.

In practice the Adirondack Farmers Exchange uses the G.L.F. Exchange to purchase grain for it in the primary markets and to manufacture its dairy rations. This is proper, since the same farmers are stockholders in or owners of both companies.

In the operation of the G.L.F. Exchange and the Adirondack Farmers Exchange, it has been demonstrated beyond a doubt that the most important factors, next to the absolutely essential skilled management, are volume of business and adequate working capital. These factors are so important that men who are authorities on the question are very doubtful of the success of a co-operative corporation which cannot be adequately capitalized, which cannot be assured of an adequate business, and which cannot secure a trained manager. Unquestionably to make the greatest success possible all three of these factors must be combined. Groups of farmers who are not reasonably sure of combining them had best not develop local co-operative associations. They might better depend upon the services of established dealers who will work with them and who will give their business to the larger farmer-owned co-operative organizations like the G.L.F., or depend upon their own efforts in pooling and bringing in carlot shipments to be distributed out of the car.

Adirondack Farmers Co-operative Exchange, Inc.
Balance Sheet as at November 30, 1922

ASSETS

CURRENT ASSETS				
Cash:				
In Sandy Hill National Bank	$1,385.70			
In Safe	285.10	$ 1,670.80		
Accounts Receivable	10,225.94			
Less Reserve for Bad Debts	102.26	10,123.68		
INVENTORIES				
Supplies	267.66			
Sacks and Bags	207.53			
Gasoline	67.20			
Feed, Seed and Twine	20,404.90	20,947.29		
Total Current Assets,			$32,741.77	
CAPITAL ASSETS				
Building and Land		19,802.62		
Motor Delivery Equipment	2,334.60			
Less Reserve for Depreciation	466.06	1,868.54		
Horse and Wagon	306.67			
Less Reserve for Depreciation	45.99	260.68		
Machinery and Equipment	2,264.66			
Less Reserve for Depreciation	333.99	1,930.67		
Office Equipment	1,523.07			
Less Reserve for Depreciation	219.02	1,304.05		
Stock Subscription Account		2,610.00		
Total Fixed Assets,			27,776.56	
DEFERRED ASSETS				
Unexpired Insurance and Deposits			628.11	
Total Assets,				$61,146.08

LIABILITIES

CURRENT LIABILITIES				
Accounts Payable	$ 454.36			
Notes Payable S. H. Bank	14,500.00			
Trade Acceptances Payable	4,060.57			
Total Current Liabilities,		$19,014.93		
CAPITAL AND RESERVES				
Capital Stock	35,000.00			
Reserve for Contingencies	4,605.45			
Net Earnings Six Months Ended Nov. 30, 1922	2,525.70	42,131.15		$61,146.08

I have examined the Books and Accounting Records of the Adirondack Farmers Co-operative Exchange, Inc., for the six months ending November 30, 1922, and hereby certify that the attached Balance Sheet and Statement of Earnings reflect in my opinion the true financial position of this Exchange as at November 30, 1922, and their operations for that period.

ROBERT E. DAME,
Special Accountant for Local Co-operatives.

Careful bookkeeping is as essential to the successful operation of a co-operative as to any other business. Books should permit the drawing off of such a statement as this at frequent intervals.

Whatever method may be worked out locally, farmers should realize that in the purchase of all farm supplies, "Volume Saves." Taken collectively the feed and grain purchases of dairy farmers are enormous. Co-operative corporations such as have been described make it possible for dairy farmers to pool their feed grain purchases in the hands of their own companies. The development is so logical and the objects to be gained so important that it seems hardly conceivable that the co-operative movement will fail.

Part II
THE COW
Better Dairy Farming Through Better Cows

CHAPTER IX
THE IDEAL COW

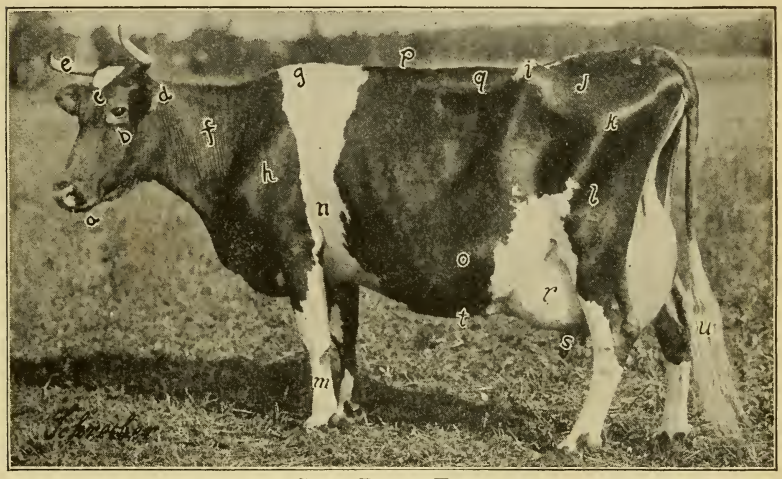
The main objects of better dairy farming are to produce better cows that will sell for more money and to produce milk at less cost. Better cows can be produced only by improvement in breeding. A breeder can best form his ideal by seeing good animals, noting the work of judges at the best fairs and by studying the relation between form in animals and their production. Not all, however, can attend national shows and state fairs, therefore, for many of us, our ideals must be formed more or less at home by means of pictures, studies of production and descriptions. In forming the mind's picture of the ideal cow, we must always remember what is necessary in a cow.

129. The purpose of a cow.—A cow exists to turn forage and grain into milk, butter and other milk products. Therefore, to handle large amounts of coarse, cheap roughage and grain, size is a tremendous factor. A cow is the hardest working animal on the farm. Strength of constitution is equal in importance to size. The standard weights for the dairy breeds are, for Jersey cows, 800 to 1000 pounds; for Ayrshires, not less than 1000 pounds; for Guernseys, 1050 pounds; for Holsteins, well above 1200 pounds for mature cows. These weights are all minimum and in his ideal cow, the breeder should always strive to have larger cows than these at maturity.

130. Capacity.—The value of a cow is in direct relation to her capacity to produce milk. Above that needed to pay for her maintenance and the reproduction of her kind, she must always

pay her way and yield a profit. Besides, she must pay during her life what it costs to bring her up to producing age. Therefore, in forming one's ideal for a cow in any breed, the foremost things to keep in mind are size, strength of constitution and capacity to utilize food above maintenance.

The picture of Imported Hayes Rosie 15476 illustrates an ideal type of dairy cow. She happens to be a Guernsey but she em-



GOOD DAIRY TYPE

Imp. Hayes Rosie 15476. Yearly record 14,630.08 pounds of milk, 714.31 pounds of butter fat. Owned by Langwater Farms, North Easton, Mass. a, muzzle; b, eye; c, forehead; d, ear; e, horn; f, neck; g, withers; h, shoulder; n, chest; p, back; q, loin; i, hip; o, barrel; j, rump; k, thurl; l, thigh; u, switch; r, udder; s, teat; t, milk vein; m, shank.

bodies the things which should be emphasized as ideal in a mature cow of any breed.

THE FRONT QUARTERS

131. The head and face.—The head of an ideal cow should be fine and lean and long, with no meatiness, but it must not be too long and must have the right balance to give the right appearance to the animal. The face should be smooth with some of the larger veins showing and not so long and thin as to indicate weakness.

The forehead should be broad between the eyes and slightly dished. The muzzle is particularly important and should be large with good sized nostrils. Size of muzzle is a good indication of feeding capacity and size of nostril is a good indication of breathing capacity.

132. Eye and ears indicate temperament.—The cow's eye is indicative of her temperament. It should be large and placid, but together with the carriage of the head and size and placing of the ears, it should give evidence of quality, alertness and the possession of enough nervous energy to carry the animal through a heavy lactation. The ears should be set well upon the head and the tips should not rise any above the poll. The ears should stand up well and be inclined forward when the cow is alert. The texture of the ears should be rather fine and it is thought by some experts that the color of the secretion in the inside of the ear indicates something of the capacity of the cow to produce butter fat. The yellower and more abundant the secretion, the more butter fat the cow is supposed to yield. The hair on the head, ears and face should be fine. The horns, if present, should be of good quality, not too scaly and rather tapering. For the best interests of the cow and her owner, the horns should be removed from all cows in grade herds and possibly also in purebred herds. (66) This can most easily be done during the first three weeks of a cow's life. The neck should be lean and long with little dewlap. The fineness and quality of a dairy cow are shown up quite largely in the appearance of the head and neck. The attachment of the head to the neck should be neat with a clean throat. The neck should set smoothly into the shoulders.

133. The vital organs.—Forequarters are important. They house the vital organs that really run the machine. They should be light but roomy. The heart girth should be large and the floor of the chest broad and wide between the legs. There must be room for capacious lungs. This means that the ribs must be well sprung, the withers should be rather sharp and the shoulders not so prominent as to give a coarse appearance to the animal. The shoulders can give some idea of angularity to the animal, but must never appear rough or coarse.

The Middle

134. Size and capacity.—The capacity of the dairy cow to utilize feed and to give milk is indicated in the size of barrel and udder. Our ideal Holstein cow ought to give 100 pounds of milk in a day. This means that she has to have a barrel that will hold several bushels because she must eat a bushel of silage, several pounds of hay, some beets, some beet pulp and molasses, large quantities of water and about a bushel of dry grain. High producing cows of the other breeds must have barrels in proportion to their size. When we visualize this ration we see the necessity of a large barrel with well-sprung ribs, giving plenty of room. The flank in front should be deep indicating good heart girth. The deep flank in the rear indicates depth of barrel and good length of rib. The flanks should be thin in flesh as indicating good dairy type.

135. The abdomen and back.—To carry this barrel, the abdomen must be held well up and the muscle walls strong and fine. The back must be straight. No breed type allows any sway-backed animal to represent the ideal of that breed. The top line must be straight right through from withers to tail head with perhaps a slight rise above the pelvis, the ribs well rounded out from the back with no slabsidedness. There is a feeling among breeders of dairy cattle that high production is linked up with a good nervous development. A strong back with plenty of room for the spinal canal will allow full nervous development of the rear quarters. A straight top line means a strong back.

The Rear Quarters

The organs of reproduction are in the rear part of the barrel, so that width and depth here are necessary for the growth and development of the unborn calf. The loins must be broad and level and there must be no depression in front of the hips, indicating weakness here.

136. Hips and rump.—The hind quarters of the cow are particularly important. Here the machinery must work smoothly and properly. Wide, level hips give room for a wide udder below and room for the uterus to grow above. The rump must be strong and

level, with the thurls high and wide apart. The whole nutrition of the dairy cow is directed to the udder to make milk. A large quantity of milk cannot be manufactured in a small udder and a large udder will not develop unless there is room for it. The backbone must be carried on a level clear up to the tail head and no sloping in the rump can be allowed. The pin bones should be wide apart in order that the calf may be delivered without difficulty. Some men say that cows with a sloping rump will give just as much milk as cows with level rump. We cannot allow sloping rumps even if this were so because in each breed we must have uniformity of type and straight backs and level rumps must be held to. We must not neglect uniformity in type even to gain in production. There is much in the beauty of animals and beauty can be maintained without loss in production if we will establish an ideal and breed to it. Beauty and production are both possible.

The tail should be long and fine with a good switch. The boniness of the tail helps to indicate the openness of structure. Good dairy cows when mature are open and rangy in conformation.

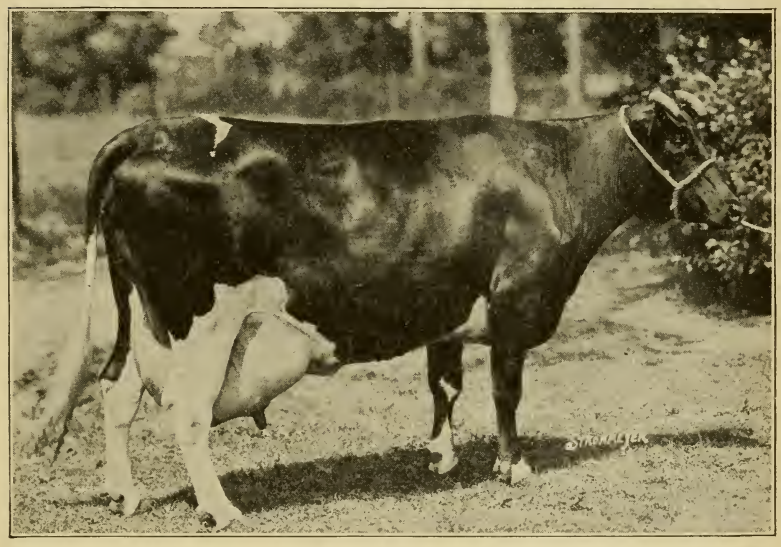
137. Dairy type, not beef.—The thighs must be long and thin and widely separated. There must be no evidence of meatiness as in the beef cow. In the dairy cow we need room between the thighs for the udder. In the beef cow we need thickness of the thighs in order to get a large amount of meat. Right here is one of the great differences between the beef and the dairy type. The udder is hung between the thighs and a big udder must have room. The hind legs should be straight and carried well apart for the same reasons. The legs must be clean with good bone.

The Udder and Milk Veins

We now come to the most important parts of our ideal cow, the udder and milk veins. First, we must learn just what the udder is and what it does. With the exception of what we get in the way of income from the offspring, the whole product of the dairy cow comes through the udder. This milk is derived from the blood in two glands, one on each side, which go to make up the udder. Therefore we see what a wonderful thing the udder of an

ideal cow is. The whole function of the mature cow is to consume large quantities of feed and turn that feed into forms which can be taken up by the blood. This is the digestion and assimilation of the feed. When the proper amounts and kinds of nutrients are absorbed into the blood these nutrients are then carried to the udder and manufactured into milk.

138. Size of udder.—Therefore, first of all the udder must be large enough to do the work that it is called upon to do. And when



DeKol Plus Segis Dixie 25787 (Canadian Herd Book)
One of the world's highest record cows. Yearly record in June, 1923, 32,632.8 pounds of milk, 1151.48 pounds of butter fat. She is on test and will probably finish with the world's record in butter fat production in July, 1923.

this work is to secrete 60 to 100 pounds of milk a day containing all the nutrients found in milk, the job cannot be done unless the udder is large enough to do it.

The udder shall be long and extend high up between the thighs and be carried well along under the belly. The bottom or floor of the udder must be flat or level. It must also be wide. There must

be no open space in front of the udder, but it should extend forward so that the underline of the cow's body made by the abdomen and udder will be comparatively straight. The muscular development must be such that the udder is well supported and not pendulous. In some of the earlier imported cows the udder was really a bag hanging down between the thighs. This is not the kind of udder now wanted on the ideal cow in any of the dairy breeds. We want the udder to start high up behind and fill in all the space between the thighs and extend way forward. The udder must not be cut up between the right and left halves and between the fore and rear quarters. Probably the greatest general defect in the form of the udder in all breeds is the lack of development of the fore quarters. In selecting a bull, his dam, maternal granddam and the dam of his sire should be seen to determine what the chances are for him to transmit the proper form and size of udder. In selecting within our own herds, the inheritance to be expected from the females is known and should be considered in deciding on which heifers to keep for breeders.

139. Quality of udder tissue.—The quality of the udder is highly important. There are two extremes in udder quality, the meaty udder, and the highly elastic udder. The meaty udder as a rule will not yield much milk, no matter how large it is. The tissue in a meaty udder is not truly secreting tissue. This emphasizes the importance of milking out a cow when buying her in order to thoroughly examine the tissue of the udder. Of course, we have all kinds of variation between the large meaty udder with a small amount of true secreting tissue and the very fine large udder made up of true, elastic, secreting tissue that milks out when the milk is drawn.

140. The manufacture of the milk.—The udder of a cow does not hold much milk. When we milk out a cow, most of the milk is secreted from the blood during the process of milking. Of course, there is some space in the udder that fills up with milk between milkings, but most of the space is filled up with secreting cells in which the materials from which milk is made are deposited between milkings and the tissue of the udder made ready for the

next milking. In this process of getting ready for the next milking between milkings, the cells of the tissues in the udder are distended. When the milk is drawn off from an udder made up largely of truly secreting tissue, the cells are not so distended at the end of the milking process and the udder is soft, elastic and mellow and very easily manipulated. After the milk is drawn from a good udder, there should be no hard spots in it. One should be able to manipulate the whole udder thoroughly.

The skin of the udder should be rather thin, mellow and abundant, so that even when the udder is fully distended it will not be too tight. The hair should be soft and silky and short, with no evidence of coarseness.

141. Teat placement.—The teats should be only four in number. Extra teats do not mean a better cow. These four teats should be well placed and of such a size and length that the milk can be easily drawn. The udder should be snugly held against the body so that it will not hang down too much. If the udder is pendulous, as the cow grows older it is likely to break down and be dragged in the mud, which will cause the teats to become sore and make her hard to milk. In our breeding operations, we should be very careful to keep firmly in mind the ideal form and quality of udder in the selection of breeding animals.

142. Capacity of milk veins.—The milk veins carry the blood away from the udder. Since the amount of milk depends on the amount of blood circulating through the udder, the milk veins are an indication of the capacity of the circulation of the cow. They should be long and tortuous, from one-half inch to one inch in diameter on a mature cow. On the very best milkers they are usually crooked and extend at least half way forward to the front legs. It is usually a good sign if the veins branch and enter the body through more than one milk wall or hole in the abdominal wall. It is also a usual thing on the best milkers to be able to see the network of veining on the outside of the udder itself. We never see a large mature milk producer without seeing the milk vein system very well developed on each side. The walls of the milk veins should be elastic.

General Conformation

In general conformation the skeleton structure must be open instead of close and tight. The bones should be fine and strong and large enough to support the animal properly. The bones of an animal may be large and yet fine. We must have large frames in order to get capacity, but largeness of frame and good-sized bones must not be confused with coarseness. The bony structure while indicating size and openness must also have quality.

143. Dairy quality.—There is such a thing as dairy quality as indicated by the appearance of the whole animal. She must appear to be alert and in the best of health. This is indicated by a fine, mellow skin not too thickly covered with fine hair of silky texture. The skin and hair must be of such quality that more or less of the surface veining of the body will show through as it does in a well groomed race horse. The whole animal must show a bloom which when once recognized will not be forgotten and will be sought for by proper methods of breeding and feeding. Abundant oily secretions in the ears, at the end of the tail and on the skin in general are an evidence of quality. This waxy secretion is yellow in color.

144. The wedge shape.—The form of the entire body of our ideal cow will show three distinct wedge shapes. The form of one wedge is seen from the side by the top and bottom lines ending at a point a little in front of the cow. This wedge is accentuated by a deep barrel and deep, full udder. The second wedge is the wedge formed with the point at the withers and the side lines running from the withers to the hip bones. This wedge is seen by looking down on the cow. The finer the withers and the wider the hips and rump, the broader this wedge will be. The third wedge is seen from the front with the point at the withers. The sides of this wedge are made by the general lines formed by the sides of the chest and barrel. The better the chest development and the larger the barrel the more clearly defined this wedge will be. This idea of the ideal wedge shape is merely checking in the ideal general form the points that have been described in detail. In breeding for capacity we must get it in the chest and barrel.

145. Dairy temperament.—We say that the ideal cow must have the right dairy temperament. This does not mean excitability. We can see something in the race horse or even in the fine quality draft horse which makes us know whether he will work or not. That same quality must stick out on the ideal cow. She must show evidence of great nervous force that will carry her through a long lactation and force her at all times to be thoroughly alive, consume large quantities of food and turn every ounce of that food into milk with just barely enough taken out to maintain her. We must strive for this, breed, and select for it. It will be shown in carriage of head and body, balance and poise on properly placed legs, silkiness and quality in skin and hair, and appearance of eye. Together with this suggestion of abundant life and milk-producing power in form and quality, must be associated the docility, quiet and content and lack of temper that is always associated with maternity. Maternity is, after all, the greatest force and factor behind high milk production.

CHAPTER X

PUREBREDS OR GRADES?

We have told what to look for in an ideal cow of any breed. Now shall we be content to have only grades in our herds or shall we have purebreds?

The title of this book is "Better Dairy Farming." Its purpose is to stimulate those who may read it to greater efforts to make more money and to have a business in which they can take more pride. Better money returns will mean a greater comfort in living. All these things will surely come about faster with purebreds than with grades.

146. Pure bred sire first.—There can be no argument in the mind of an enlightened man as to the necessity of using pure bred sires. Intelligent farmers are beyond that. We say without fear of contradiction that no farmer can afford to use anything but pure bred sires if he is growing any young stock at all or is selling any offspring. The offspring of grade sires will not bring enough in the market today to pay for its production. The whole study must be along the lines of how to select the pure bred sire and how much to pay for him.

Now, comes the question of whether we shall be content to use only grade females and improve the offspring from them when mated to pure bred males or shall we go in for pure bred females also? Our answer is to go in for as many pure bred females as possible as soon as your pocket book will allow it.

147. Purebreds produce more than grades.—We will quote two sets of figures to support our argument to induce you to do this. Mr. LeRoy Hoffer of Pennsylvania reports on this point in the "Holstein-Friesian World" as follows:

"The dairy extension department of the Pennsylvania State College made a study of the records of ten cow-testing associations in seven counties in this state, comparing the production of the pure bred Holstein cows and grade Holstein cows in these associations.

"The total number of cows completing a year's work in the associations having the proper age specification numbered 1013 cows. Every record in this comparison represents the production of twelve months, including the dry period. The classification made consisted of comparing two, three, four, five and over five-year-old grade Holstein cows with two, three, four, five and over five-year-old pure bred Holstein cows.

Production of Purebred Holsteins versus Grades in Ten Cow-Testing Associations in Pennsylvania

Purebreds				Grades			
No. Cows	Age	Lbs. Milk	Lbs. Butter fat	No. Cows	Age	Lbs. Milk	Lbs. Butter fat
36	2 yr.	7771	276.8	80	2 yr.	6164	235.0
76	3 yr.	8378	287.4	111	3 yr.	6480	234.6
42	4 yr.	8017	273.2	140	4 yr.	6977	256.6
50	5 yr.	9581	320.6	120	5 yr.	7271	258.1
102	over 5 yr.	8420	311.4	256	over 5 yr.	7223	282.7
306	all ages	8467	299.1	707	all ages	7124	260.4

"The difference in favor of purebreds was 1343 pounds of milk and 38.7 pounds of butter fat."

148. Banks recognize purebred breeders.—In the "Guernsey Breeders' Journal" for February, 1922, we see how the banks of Wisconsin look at this question in the following quotation from D. H. Otis, Director, Banker-Farmer Exchange, Madison, Wis.

"Banks depend for their success upon the success of the communities in which they are located. In the rural districts and to a very large extent in the cities, the success of the community is dependent upon the success of the farmer. The farmer's success depends largely upon the development of the livestock industry. The higher the grade of livestock, or the nearer the livestock comes to being purebred, the larger the farm profits. This is well illustrated with dairy cattle in the following table:

	No. of farms	No. of cows per farm	Total income per cow	Profits per farm
I Grade cows only	70	18	$ 95	$ 819
II Grades and purebreds	42	19	124	1151
III Purebreds only	8	20	189	2157

"The farms having purebreds only show a profit of $1006 per year over those having part grades and part purebreds, and $1338 per farm over those having only grades. This is a good showing for improved blood in dairy cattle and indicates that where one is equipped and sufficiently experienced to handle them, judicious investments in high quality dairy cattle will not only pay the interest on the investment, but much more. Banks can well afford to loan money to farmers who want to use it to invest in high grade or pure bred dairy cattle.

"At the Wisconsin State Fair and at the National Dairy Show last October there was an exhibit of a pure bred Guernsey bull and ten of his daughters. These daughters produced an average of 119 pounds of butter fat in excess of their dams. Such a bull is an asset to any community even though his purchase price runs up to several thousand dollars. When properly handled he will make good returns on the investment. Banks can well afford to encourage and stake the purchase of tested sires. It will mean much to the prosperity of the community."

149. Surplus purebreds sell better.—In addition to the greater amount of milk that will be produced by purebred animals is the added fact that the surplus animals to be sold from the pure bred herd are worth much more than surplus grades. Therefore, each breeder should strive to replace his grades with purebreds just as fast as possible. It is not advisable to sell the grade herd off all at once but to purchase one or two foundation pure bred cows and gradually replace the grades with their offspring and perhaps further purchase.

150. The choice of breed.—The "best" breed will not be argued here. It is assumed that the reader has made his choice of breed already. We only hope that he may pick up some points that may be helpful to him in the improvement of the animals in the breed that he has already chosen. The breed that a man likes and which produces the products that are in demand at the best prices in his community is the breed for him to raise. This much may be said, however,—very few men have tried to stimulate a high class market for high grade products in close touch with their

farms. (**285**) It is not hard to produce such a product and create a market that will yield a cent or two a quart margin over the average price in the community if one will produce a clean product and stimulate his demand. It is this margin won on clean products that will mean profit and comfort.

151. Breed associations will help.—All the national breed associations, formed for the purpose of registering pure bred

MINERVA BEETS 85791

The only five times champion at the National Dairy Show. Owned by R. E. Haeger, Algonquin, Ill.

animals, are anxious to help farmers who have grade stock to get started with purebreds. It is well to get in touch with these national associations at the start. The addresses of the national associations of the leading dairy breeds are:

The Holstein-Friesian Association of America, Brattleboro, Vermont.

The American Guernsey Cattle Club, Peterboro, New Hampshire.

The American Jersey Cattle Club, 324 West 23rd St., New York, N. Y.

The Ayrshire Breeders' Association, Brandon, Vermont.

The Milking Shorthorn Society, Independence, Iowa.

The Brown Swiss Cattle Breeders' Association of America, Beloit, Wisconsin.

Write to the breed association of the breed you are most interested in and get their literature as to the best type, the most popular families and things of this kind. It will take only a two-cent stamp and five minutes' time. The result will be well worth while and helpful because it is important to know the right type of the breed and to get the right ideal in mind.

152. State associations and state representatives.—Many of these associations have a state secretary in your state who will be only too glad to help you find what you want to get started with and to help you in your sales when you have animals to sell. We have known of very successful state secretaries who have made good in helping the farmers who own the animals of the breed they represent.

153. Local associations.—Perhaps most important of all is your local county association. After all, it is the combined efforts of the many local units that make any great group a success. Therefore, we should all be members of our local county breeders' associations. Some of these county associations are doing a wonderful business. Columbia County, Pennsylvania, is doing well with Guernseys. Waukesha County, Wisconsin, is noted for its Guernseys and Holsteins. Buyers come to the clean, well-known counties. Your county can be such a county through you and your neighbors. (191)

154. Breed magazines.—Every breeder of grades or purebreds should be a subscriber to his own breed magazine. This will help him immensely in keeping up with what is going on in his breed world and in the dairy world in general. We will not take the space here to list the breed magazines. The names and addresses can be obtained from the breed associations listed above when you are ready.

It is a great thing to be associated in a national group of earnest men all working for the same ideal. No better fellows live in the world than dairymen who are breeding pure bred stock. The local, state and national pure bred dairy cattle breeders' associations are groups in which it is an honor to be counted. Membership is easy. The ownership of a pure bred sire and some pure bred females marks you as a member and from that day your road will be easier, happier and leading to an ideal.

CHAPTER XI

THE LEADING DAIRY BREEDS

We will now discuss briefly the leading breeds of dairy cattle and something of the ideal already reached in each will be illustrated.

The Holstein-Friesians

This breed is the most popular breed of cattle for market milk and is the largest breed in size and in numbers in the main dairy states. In this breed it is well understood that size is a desirable feature. Spring Brook Bess Burke 2d, 131387, page 14, illustrates in a wonderful way size and capacity in this breed. Her yearly record is 24,918.1 pounds of milk containing 1032.75 pounds of butter fat. She held the record as the largest dairy cow in the world for a time at a weight of 2225 pounds. In 1921 her granddaughter, Wisconsin Fobes 5th, 370303 took her world's record away from her when she attained a weight of 2240 pounds. This is the record weight as it stands today.

Glista Ernestine, 117999, page 50, shows remarkably fine development in mature form. Her yearly record is 23,341.0 pounds of milk containing 833.73 pounds of butter fat. She reached a weight of about 1900 pounds. In 1922, July 3, Glista Ernestine dropped her eleventh calf. Glista Ernestine is a world's record cow in that she has made a seven-day record of over 24 pounds of butter fat in each of seven different lactations. No other cow has done this. Twenty-four pounds of butter fat is equivalent to 30 pounds of butter, 80 per cent fat. Cows producing over 24 pounds of fat in seven days are called "thirty-pound cows." Glista Ernestine has produced an average of 100 pounds of milk a day for 100 consecutive days in two different lactations. In one lactation she kept her 100-pound gait for 119 consecutive days.

155. The best record Holsteins.—In order that our readers may form an estimate of the ideal production among Holsteins, we give the following records: Segis Pietertje Prospect, 221846, page 3,

has the largest yearly milk production, 37,381.4 pounds of milk in one year, an average of 102.4 pounds per day. Agassiz Segis May Echo, 41302 (Canadian Herd Book), page 54, is the holder of the world's record in butter fat production for all ages and breeds. She produced in 365 days, 30,886 pounds of milk containing 1345 pounds of butter fat. DeKol Plus Segis Dixie, 25787 (Canadian Herd Book), shown on page 87, will probably finish a record in 1923 that will be the world's record in fat production for all ages and herds. Her record (June, 1923) is 32,632.8 pounds milk, 1151.48 pounds butter fat.

156. The production of grade Holsteins.—The publication of these world's records may seem to be out of place in this book when we expect that most of our readers will not have world-record cows. They are printed with the idea that each one of us must have his ideal and we cannot form the right ambition and ideal unless we have something concrete to go by.

It should be the ambition of every dairyman owning Holstein cattle to get the average production of his herd to 10,000 pounds of milk per year. Better breeding, better bulls, careful selection, careful buying and better feeding will do it in time. These wonderful world's records show that three times this may be accomplished.

157. The best Holstein type.—The Holstein-Friesian Association of America, through its "true-type" Committee, W. S. Moscrip, W. W. Stevens, R. E. Haeger, H. H. Kildee, T. E. Elder, W. H. Standish, A. C. Oosterhuis, Axel Hansen and Fred Pabst, has done a most excellent piece of work in standardizing the type of Holstein-Friesian cattle by means of painting and sculpture. We show pictures on pages 100 and 101 of the ideal type of bull and cow as visualized by a skillful artist under the direction of this committee.

The pictures of Minerva Beets, 85791, page 95, the only cow five times champion at the National Dairy Show, of Segis Pietertje Prospect, Agassiz Segis May Echo, of Spring Brook Bess Burke 2d, and of Glista Ernestine give us an idea of the possibilities in this great breed of cattle as living representatives of the type that also leads in production.

The best way to summarize the ideal Holstein type of cow is to give the following on Holstein type from W. S. Moscrip, one of the leading judges of the Holstein breed, as published in the "Holstein-Friesian World."

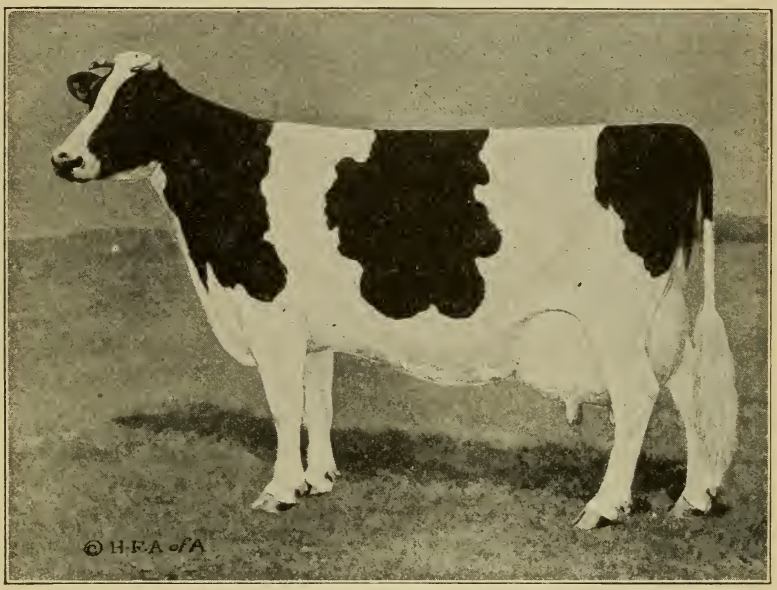
158. W. S. Moscrip on Holstein type.—"My understanding of the expression so often used, or applied to an animal as 'typey'

True Type Holstein-Friesian Bull

is that it is as nearly as possible an ideal representative of its breed, having all the essential characteristics of that breed.

"In starting out to select your foundation animals, or in choosing from your herd already established, to obtain the highest possible success, you must so train yourself that you can readily recognize an animal of superior type The Holstein breed has made wonderful progress during the past few years, but it is absolutely imperative that all who are interested in the advancement of our breed should make every effort humanly possible for the attainment of the greatest possible perfection in the conformation of our animals.

159. Conformation important.—"You must select animals with great, deep, well-sprung middles. Avoid the kind that have the appearance, when viewed from the rear, of an underfed sunfish. In the middle are the digestive organs that manufacture into milk the feed we give our animals, and they must be large in order to have the necessary room to handle a great amount of bulky



True Type Holstein-Friesian Cow

feeds. Remember, our Holstein type is not exemplified by the cow that will exist on the smallest possible amount of feed, but is the cow that will consume and turn into milk the greatest possible amount of feed beyond what is needed for bodily maintenance. Consequently, we must have the tremendous capacity that is found in the animal of our ideal type.

160. Constitution.—"Now, you must select the ones that have the strength and constitution to carry on their tremendous labor. Remember that a heavy producing cow is the hardest working animal on any farm. She must be deep through the chest,

and have wide spring of forerib. This chest cavity contains the heart and lungs, and in order to properly do their work they must have ample room. An undesirable type sometimes found has the appearance of having been drawn in behind the shoulders with a belt.

161. The forequarters.—"They should be fine—free from any coarseness. The vertebrae should be very open from the shoulders along the back and free from flesh. This will not be so pronounced in animals in good flesh that are dry and soon to freshen; nor in heifers that are below the milking age. A great change very frequently takes place in the structure of the shoulders during the first lactation period. In these animals you must learn that the broad shoulders will, as it is put, 'milk off.'

"The neck must be clean-cut and fine, neatly attached to the body and free from any coarseness or superfluous flesh.

"The head should appear as clean and fine as if chiseled by a master sculptor, the veins standing out prominently on the face, and the entire head free from any meatiness. The eyes must be expressive of great intelligence, and large and bright and full—the term is 'broad between the eyes.' The nostrils must be wide—very wide and full; a large, broad mouth; a clean, powerful jaw. The entire head must be clean-cut, showing intelligence and temperament.

162. The milk system.—"The udder of our ideal type is one whose attachment to the body is both long and broad, the udder coming up well behind, and joining the body smoothly in front. The floor, or bottom, should be level; the teats of medium size, placed well apart and squarely upon the udder. It is desirable that the udder be covered with a network of prominent veins. When milked out the udder should be soft and pliable and free from any indication of meatiness. In our ideal Holstein cow you will find that milk veins which are long and crooked and branching, and which enter numerous wells, are much to be preferred to shorter, heavier veins. In superior animals, we often find a very well defined middle vein.

"The hide should be soft, pliable, and covered with soft, fine hair.

163. General appearance.—"An animal of the type described above will have a stylish appearance, an alert carriage, an intelligent look, which will impress you with the fact that she is wide awake, ready to take advantage of every opportunity of converting feed into milk.

"I want to take this opportunity to impress on your minds that in order to become successful breeders of high class dairy animals you must be able to see and acknowledge defects in your own animals and to see and acknowledge the superiority of the other fellow's—if they are superior. Study superior types as often as opportunity offers. Show your animals as often as you can. Keep trying to make each succeeding generation better than the one before. No higher calling than yours, as breeders of dairy cattle, exists. No one—no matter what his calling or profession—can do more for the advancement of our country than can you, by pro-

Oak DeKol Ollie Homestead 85529
Grand Champion at National Dairy Show in 1916. Owned by Iowana Farms, Davenport, Iowa.

ducing better dairy animals than have been produced before. It can be done. Study the score card and keep trying."

164. Holstein bulls.—With regard to "true-type" bulls, Mr. Moscrip expresses himself in the "Breeder's Gazette" as follows:

"In passing on bulls the judge notes the impressive, masculine head and neck; strength of back and loin; long, level rump; great constitution and capacity, and, in fact, all the qualities that have made the Holstein-Friesian breed the leader it is today. All these are wrapped up in this one animal. Surely he will prove an inspiration to all who carefully study his structure, and apply the lesson to the selection and mating of their animals."

165. Living example of type.—The proper type of Holstein bull is illustrated by Oak DeKol Ollie Homestead, 85529, page 103, owned by Iowana Farms, Davenport, Iowa, and grand champion at the National Dairy Show in 1916.

This picture of a great show bull defines better than words what is wanted in a mature Holstein sire. The air of masculinity, the dairy temperament, the lack of beefiness, and the quality are all shown in a fine way. The straight back line, the deep front and rear flanks, the great heart girth are all there. And with plenty of size, there is no sluggishness or lack of alertness.

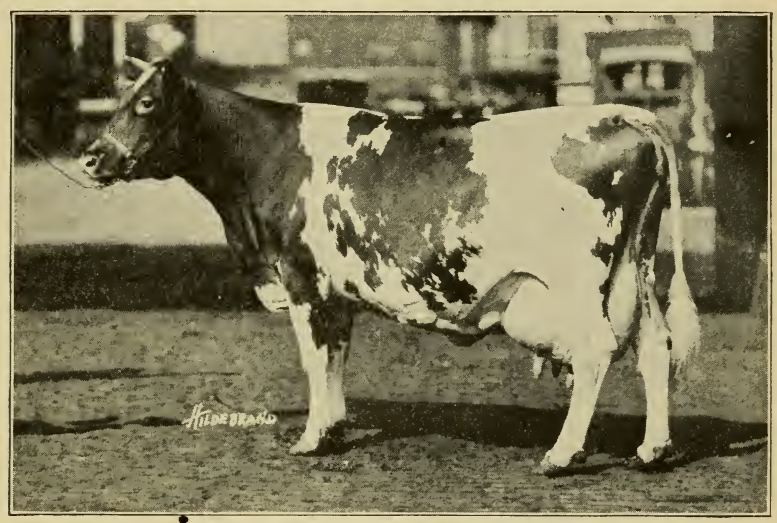
The Guernseys

The Guernsey breed of cows is much loved by many breeders of cattle in the United States. The most noted characteristic of the Guernsey breed is the color that this breed gives to its milk and milk products. No other breed can equal the Guernsey in quality of milk, so far as appearance is concerned.

166. Their production.—The great producers of the breed, of course, do not equal the great producers of the Holstein breed in pounds of milk per year. But they are not so far behind in pounds of butter fat. The best year's record of the Guernsey breed in pounds of milk is 24,008.0 made by Murne Cowan 19597. This cow also holds the second highest record in pounds of butter fat per year. Her best yearly record is 1098.19 pounds of butter fat. The best year's record of butter fat production is 1103.28 pounds, made by Countess Prue 43785, page 59.

A good high record in Guernseys would be 10,000 pounds of milk and 500 pounds of butter fat. The average of 4043 records in the mature class, five years old and over, is 10,485 pounds of milk and 519 pounds of butter fat. The average percentage of fat in Guernsey milk is almost exactly 5.0, the average of 13,474 registry records being 4.988 per cent butter fat.

167. Size and type in Guernseys.—In size, Guernsey cows should be well above 1000 pounds, and in the Guernsey breed, as



Mildred II of Les Godaines 55120

Grand Champion at the National Dairy Show in 1920. Yearly record 11,546.9 pounds of milk, 575.06 pounds of butter fat. Owned by Jones & McKerrow, Waukesha, Wisconsin.

in other breeds, size counts and it should be the endeavor of every Guernsey breeder to get 1200-pound cows as the average size of his herd. Guernseys perhaps lack a little in uniformity of type and may be criticized as being a little thick over the withers and apt to drop a little in the back line. The ideal of the best breeders, however, is for a straight back line in Guernseys as with other breeds. The best milking Guernseys are spare in form with beautiful mellow hides, covered with silky hair. The color of the Guernsey

varies from a light fawn to a reddish fawn, splashed with white. The muzzle of the Guernsey should be white and the switch should be white. The Guernsey breed is troubled a little with dark noses. Probably it is not worth while to discard breeding females with dark noses, but a bull calf with a dark nose should not be used in a pure bred herd. Of course, if dark noses are allowed to continue in the females, they probably can never be bred out of the breed, but it seems not worth while to discard promising females because of this faddish characteristic.

168. Examples of Guernsey type.—As a good example of the Guernsey type, a picture of Mildred II of Les Godaines, 55120, is shown on page 105. This cow was grand champion at the National Dairy Show in 1920. She is owned by Jones & McKerrow of Waukesha, Wisconsin. A beautiful udder, fine milk veins, large size and quality are well illustrated in this cow. Langwater Cleopatra, 47043, page 188, attained great fame in 1922 by bringing the record price for the Guernsey breed at $19,500, when she was sold to R. L. Benson, Princeton, New Jersey. These cows all show that size and quality count.

169. Guernsey bulls.—Probably no bull in the Guernsey breed has had as great an effect on the breed as Imported King of the May, 9001, page 47. He has had more influence than any other bull in the introduction of the popular May Rose blood. May we discover many other bulls like him.

Ladysmith's Cherub, 30670, page 107, owned by D. D. Tenney, Crystal Bay, Minnesota, was the grand champion Guernsey bull at the National Dairy Show in 1918.

Of course, all breeders of Guernsey cattle cannot hope to own as good bulls as these, but their pictures are shown to illustrate the ideal type to which we must aim in breeding Guernsey cattle.

170. Guernsey milk.—One of the characteristics of Guernsey milk is to hold its customers. The Guernsey breed is the dairy breed above all others which can well be chosen in case one has opportunity to develop a fancy toward any milk and dairy products. The milk of no other dairy breed is more palatable or more highly colored than the milk of the Guernsey breed. When a customer

gets accustomed to Guernsey milk, that customer is not likely to be lost if the Guernsey milk is put up in bottles and proper sanitary measures taken all through to insure a clean product. More breeders of dairy cattle should try to establish high quality products and attract people to such products. It is a mistake to suppose that only rich people will buy high class milk and pay a

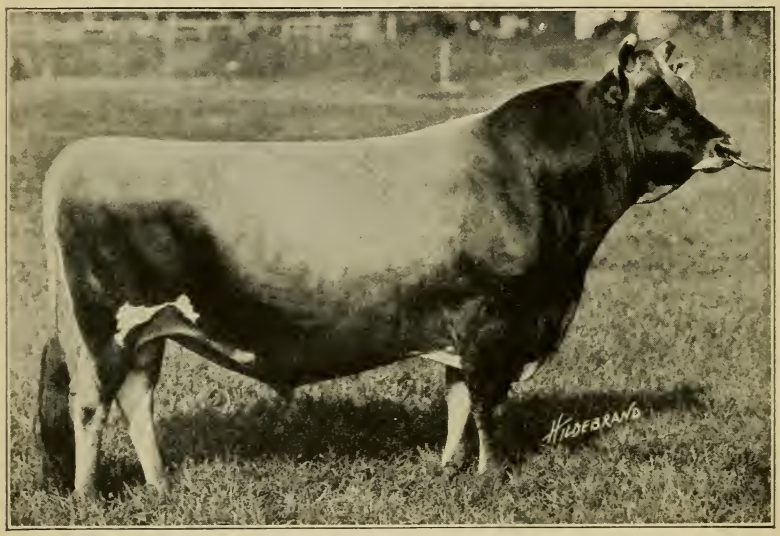
Ladysmith's Cherub 30670
Grand Champion at the National Dairy Show 1918. Owned by D. D. Tenney, Crystal Bay, Minn.

premium for color and quality and butter fat. This is not true. A high color and fine quality of milk will sell and hold customers in any city.

The Jerseys

The standard in size for the Jersey cow is not quite so large as the standard for Guernseys. A Jersey cow must weigh in mature form 800 to 1000 pounds. The Jersey breed is one of the breeds first imported into this country and has been bred very

extensively so that large numbers of Jersey cows are scattered all over. The Jerseys have been crowded out by the Holsteins in the market milk section, because the butter fat test of Jersey milk is the highest of that of any breed. The average butter fat from 13,840 records is 5.36 per cent butter fat. As will be remembered, the average butter fat for the Guernsey breed was 4.988 per cent



Fauvic's Prince 107961
A good type of Jersey bull. Owned by A. V. Barnes, New Canaan, Conn.

or practically 5 per cent. Therefore, because of the very high butter fat content of the milk, it will be seen that Jersey milk could not compete in the fluid milk market with Holstein milk at the ordinary differential price paid for butter fat.

Jerseys are economical producers of butter fat. The advocates of the Jersey breed have always stood up for their breed as being the most economical producers of butter fat. Figures will not be attempted to prove this one way or another. It is sufficient to say that Jerseys are at least the equal of other breeds in economical production of butter fat. Therefore, we find them in the largest

numbers in those parts of the country where butter fat is the form in which milk is sold.

Like the Guernseys, the Jerseys offer a breed for use in those places where a fancy market may be developed for high class milk. The Jerseys produce milk of the same richness and flavor and butter

Fauvic's Star 313018

World Champion milk producer of the Jersey breed. Yearly record, 20,616 pounds of milk, 1006 pounds of butter fat. Owned by A. V. Barnes, New Canaan, Conn.

fat as do the Guernseys, and it has nearly as much color, so that Jersey milk is a wonderful milk for market milk and, of course, Jersey butter is very fine in quality where it is handled in the right way so as to bring out the natural flavor.

171. Jersey type.—Due to the long and careful breeding and selection on the Island of Jersey and also in this country, the Jersey type is fairly well fixed. And Jersey breeders like to say that the Jersey type is the standard by which all dairy breeds are judged. Fanciers of other breeds probably would not admit this,

but it is true that the Jersey breed does typify the characteristics of the real dairy cow, perhaps better than any other breed. As an example of one of the good cows of the breed, the picture of Fauvic's Star, 313018, is shown on page 109. This cow is owned by A. V. Barnes, New Canaan, Connecticut. She is the champion milk producer of the Jersey breed with a yearly record of 20,616 pounds of milk and 1006 pounds of butter fat.

Darling's Jolly Lassie, 435948, page 205, has the world's record in butter fat for Jerseys and the world's record over all breeds as a junior four-year-old. Her record is 16,425 pounds of milk and 1141.3 pounds of butter fat. The following quotation from the American Jersey Cattle Club is of interest here:

"Pickard Brothers, of Marion, Oregon, bred and tested Lassie. Ovid Pickard takes full charge and does all of the labor in connection with the Jersey herd, while his brother, Elzie, takes full charge of the farming end. Many articles have been written on the accomplishments of cows owned by wealthy breeders, and it has been generally believed that the cow owned by the practical dairy farmer in very moderate circumstances could not hope to compete against the cow that is favored with de luxe surroundings. The achievements of the Pickard herd, however, show that there is one factor in the making of official records which the wealthy owner finds it very difficult to compete with, and that is the amount of care and sacrifice which the practical hard-working dairy farmer will give to the animals he loves and which furnish his livelihood. It is very difficult, indeed, to find a paid herdsman who will place the health and comfort of his charges above his own. This is the secret of the Pickard Brothers' success; Ovid Pickard loves his cattle and he has found that it has been a paying proposition to sacrifice and to make his cattle return his affection."

172. Jersey bulls.—One of the Jersey bulls which shows good dairy type and that also have been able to back up his form with performance is Fauvic's Prince, 107961, page 108, owned by A. V. Barnes, New Canaan, Connecticut. Fauvic's Prince has seventeen daughters that have made records averaging 10,097 pounds of milk and 560 pounds of butter fat with their first calves. Fern's Wex-

ford Noble, page 119, owned by P. H. B. Frelinghuysen of Morristown, New Jersey, was the grand champion Jersey bull at the 1922 National Dairy Show.

The Ayrshires

The Ayrshire is many times called the aristocrat of the dairy breeds. Probably no group of cows in a show ring will produce a more handsome or uniform appearance than a group of Ayrshires. The lines on the Ayrshire cows are straight and strong. There is rarely any question about the back line in an Ayrshire or about the ideal type of udder. Ayrshires in show condition are usually a little more fleshy than the other dairy breeds and perhaps there is a little more difference in condition of flesh between the Ayrshire cow in perfect show condition and the Ayrshire cow in good productive condition.

173. Ayrshire type.—Style receives considerable attention in the Ayrshire cow bred for show purposes and judges pay some attention even to the way a cow moves around the show ring, when he is judging Ayrshires.

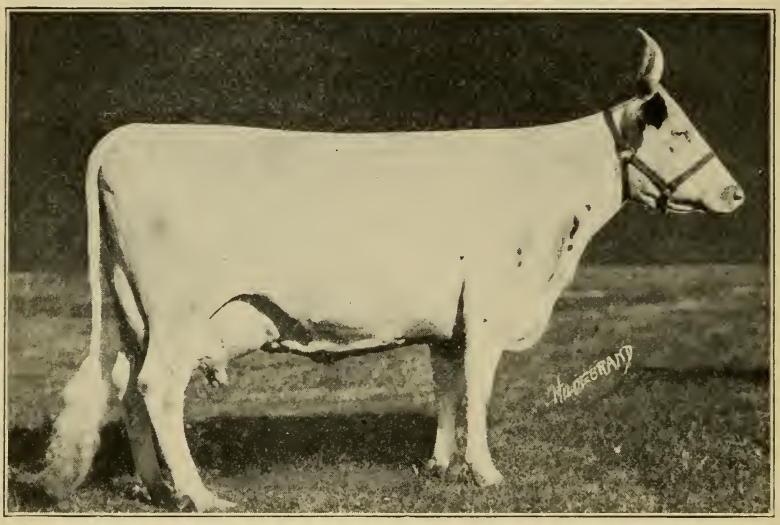
To illustrate the type of good producing Ayrshires, a picture of Garclaugh May Mischief, 27944, page 112, is shown. She is the highest record cow in milk production in the Ayrshire breed, namely, 25,329 pounds of milk containing 894.91 pounds of butter fat. However, this high milk record does not entitle her to the highest place in pounds of butter fat. Lily of Willowmoor, 22269, page 184, holds the butter fat record with 955.56 pounds of butter fat from 22,596 pounds of milk. No Ayrshire cow has yet made 1000 pounds of butter fat, but this breed is not very far from the other breeds in this respect.

These two cows whose pictures are given illustrate the wonderful dairy type and beauty of mature Ayrshire cows.

174. Ayrshire milk.—The milk of Ayrshire cows does not test quite as high as the milk of the Guernsey and Jersey breeds, but the average happens to be almost exactly 4 per cent. For example, the average test of the seventy leading cows and heifers of the breed is 4.03 per cent of butter fat. This percentage of butter fat

in the milk is just at the popular percentage in the minds of most people who buy a high grade market milk. Market milk, to sell well, must contain at least 4 per cent butter fat and the milk of the Ayrshire breed just nicely fits in with this popular demand.

Further, there has been a good deal said concerning the right percentage of butter fat in milk for children, and the enthusiasts for Ayrshires point to this percentage of fat in Ayrshire milk in



Garclaugh May Mischief 27944

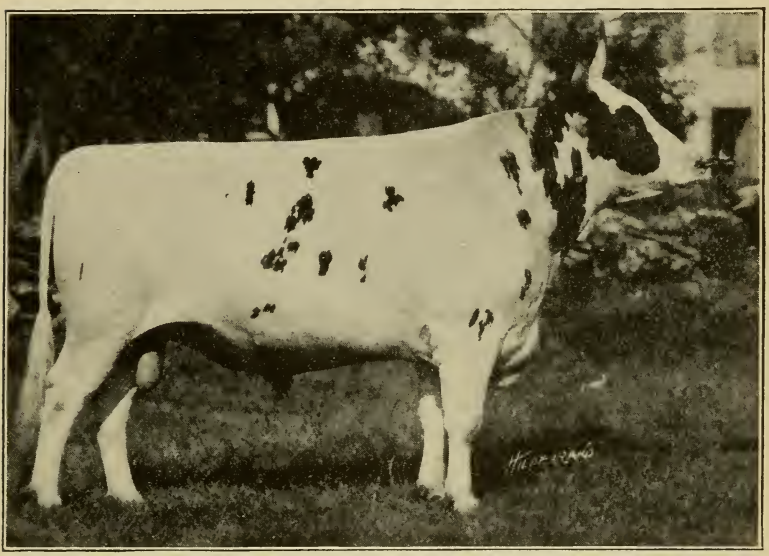
Record Ayrshire cow for milk. Yearly record, 25,329 pounds of milk, 894.91 pounds of butter fat. Owned by Penshurst Farm, Narberth, Pa.

claiming that Ayrshire milk is the finest milk for the babies and children. In a good many places this belief is taking root and here is another opportunity for those who love Ayrshire cattle to make a special effort in the marketing of milk for babies and children.

Ayrshire cows are good producers, strong and lively. A further point much emphasized by Ayrshire breeders is the ability of the Ayrshire cow to graze. She seems to be somewhat lighter and perhaps more active than cows of the other breeds and will range

over rough pastures and perhaps pick up more than cows of the other breeds.

175. Ayrshire bulls.—A glance at the picture of the Ayrshire bull, Morton Mains Lord Barrylyndon, 25000, shown below in connection with this discussion of the Ayrshire breed shows what wonderfully fine animals they are and how beautiful is their ap-



Morton Mains Lord Barrylyndon 25000
A leading Ayrshire show bull. Owned by Alta Crest Farms, Spencer, Mass.

pearance. This bull has been a leading show bull and is owned by Alta Crest Farms, Spencer, Massachusetts. Perhaps it may be said that the Ayrshires exhibit greater uniformity than the cattle of any other dairy breed. They are not quite so open or rangy in form, but the greater producers the individuals are, the more open conformation they must have and the lesser tendency to lay on fat. In fact, as in any other breed of cattle, as we approach great production of milk and butter fat, we must more nearly approach the ideal dairy type and form.

The Brown Swiss

This breed of dairy cattle is now demanding more of our attention, particularly in Wisconsin, where their popularity is growing. While not so numerous in the United States as the other dairy breeds, they are making a fine place for themselves.

176. The Brown Swiss type.—The ideal of the Brown Swiss breeder is found in cows that are small-boned for their size with quality indicated by a fine, silky coat and rich, elastic skin. The eyes are full and mild, indicating, together with the general appearance and carriage of the animal, an unusually docile disposition. The large, round ears, lined with long, silky hair, add to the appearance.

The body is large and well rounded and the appearance of the whole animal shows a strong healthy individual, with easy feeding qualities, indicating that they are easy keepers and strong breeders. The Brown Swiss breed is remarkably uniform. The Brown Swiss as a rule are long-lived animals and have hardiness as a strong characteristic.

177. The milk.—The milk of the Brown Swiss breed is about 4 per cent butter fat, which would show them to be a good breed for the production of market milk.

178. Their records.—Hawthorn Dairy Maid, 6753, page 129 owned by Hawthorn Farms, Lake County, Illinois, has the highest record in both milk and fat in the Brown Swiss breed, with a record of 22,622.6 pounds of milk and 927.23 pounds of butter fat.

The best types of the Brown Swiss are illustrated in Nellie's Stasis, 6721, page 128, owned by L. S. Marshall and Sons, Leslie, Michigan, grand champion bull at the National Dairy Show in 1922, and in Hawthorn Dairy Maid.

The Milking Shorthorns

The dairy world has had its eyes directed toward an entirely new quarter in 1923. The Australian Milking Shorthorn cow, Melba 15th of Darbalara, page 149, owned by the Scottish-Australian Investment Company of Gundagai, New South Wales, finished her wonderful year with a record of 29,423 pounds of

milk and 1,316 pounds of butter fat. This places her second in world's production of butter fat. Her record is exceeded only by that of Agassiz Segis May Echo, with 1345 pounds. This record clearly centers attention on the Milking Shorthorn as a contender for dairy honors among strictly dairy cattle.

179. Milking Shorthorn type.—It is rather plain from their writings that breeders of Milking Shorthorns do not wish to be classed as breeders of dairy cattle strictly speaking. They believe that their cattle are really dual-purpose and that the ideal type of Milking Shorthorn must not go to the extreme dairy type because of the necessary beefing qualities of the breed.

Instead of trying to put the qualities and points to be attained in the ideal of the Milking Shorthorn into our own words, we will quote from the statement of the breed association on judging Milking Shorthorns:

"Milking Shorthorns are produced to perform a dual function, viz.: the production of beef and the production of milk and butter fat. A good judge knows that there are close relationships existing between form and function. To produce beef and milk, an animal must be a good feeder, indicated by a wide muzzle and roominess in the region of the digestive organs. The good beef animal must have a strong, straight and wide back, with strong loin and well-sprung ribs. The milk animal shows her ability to produce by having a good udder well held up between the thighs and carried well forward beneath to the belly. The teats should be uniform in size and evenly placed well apart. Milk veins should be large and extend well forward toward the front legs.

"It is not possible to attain the extreme dairy type and retain the necessary beefing qualities of the Milking Shorthorn. There are characteristics common to both beef and dairy animals and these the Milking Shorthorn should have. Shorthorn character should be noticeable in the shape and type of head and horn. The eye should be clear, indicating health, and the horn ought to be short and slightly curving forward. The neck (on the cow) should be graceful but not slight; shoulders well laid in, smooth and not too thick at the top. The chest should be deep and wide, indicating

sufficient room for heart and lung development. A straight wide back indicates room for development of meat when the cow is dry and a good udder indicates capacity to produce milk.

"The bull will naturally show indications of masculinity and is stronger in the head, neck and forequarters. An erect head gracefully carried on a strong neck showing a well pronounced crest is desirable. The shoulders are prominent but smoothly laid in. The top and bottom lines should be straight and the thighs and whole conformation less thick than in the case of the beef bull.

"The Milking Shorthorn bull has a more open loin, slightly longer body and greater length of rump than the beef bull, but he must present a larger chest and middle, indicating health and feeding capacity."

180. Good Milking Shorthorn individuals.—As representative of the best of the type of Milking Shorthorn cows in America, we show the picture of Bare Fashion, 634770, page 139, owned by H. E. Tener of New York. She has a record of 17,027.9 pounds of milk, 581.47 pounds of fat. Illington Beauty, 1070790, owned by Sherwood Farms, Far Hills, New Jersey, is the highest milk producer among the Milking Shorthorns in America. Her record is 18,257.3 pounds of milk and 677.11 pounds of butter fat. The best Milking Shorthorn fat producer in America is Snowdrop, 647217, also owned by Sherwood Farms. Her record is 15,550.8 pounds of milk and 692.22 pounds of butter fat. A good type of Milking Shorthorn bull is illustrated in Count Tickford, 738427, page 146, the grand champion bull at the International Live Stock Show in 1922. He is owned by F. W. Sullivan, Battle Creek, Michigan.

Part III
THE BULL
Better Dairy Farming Through Better Breeding

CHAPTER XII
THE IDEAL BULL

We assume in urging certain principles upon our breeders by use of which they may make more money in better dairy farming, that they are all interested in improving their own herds by breeding and raising better cows of their own breeds and the feeding out of the young stock to proper maturity.

181. A pure bred bull on every farm.—If a man is to improve his herd through breeding, then the bull is the all-important factor. First of all, the bull must be a purebred. There is nó argument for using a grade bull. Not even the money argument can be used any longer because pure bred bulls can be purchased for very small sums as calves. Hugh Van Pelt, a veteran breeder of Jerseys, says in the "Dairy Farmer" of August 1, 1922, that we are registering only about 75,000 pure bred bull calves each year and 175,000 are being slaughtered. We need four million pure bred sires to have a pure bred sire on every farm where cows are milked. If every pure bred bull were saved it would take 20 years to get a pure bred bull on every farm.

182. Strive for improvement.—Due to the continued pounding of leaders in the dairy business and extension workers on the idea that pure bred sires must be from dams with advanced registry records, if we are going to have improvement, perhaps farmers have got the idea that they can get along just as well with scrub and grade sires as they could with pure bred sires from dams that have not been tested for advanced registry. Also breeders having herds of pure bred cattle have at times taken the point of view that

it was very bad business policy for them to sell bulls from their herds at low prices. They have knocked the calves in the head rather than let them go out for small sums.

183. Purebreds create interest.—Now our ideas and the idea of Mr. Van Pelt is that a farmer should certainly have a pure bred bull at the head of his herd and without question the thing for him to do is to have the best one that he can get and if he cannot make up his mind to put real money into a bull, then let him get the best one he can for the price that he can pay. If he cannot pay more than $10, then get a pure bred bull from an untested dam as a newborn calf for this price and be sure that the calf is registered and feed him out to take the place of his scrub or grade bull. Certainly it is true that if the calf is a good individual coming from a good individual pure bred cow and from a good individual pure bred bull, this calf will improve the herd better than a grade bull. A farmer that gets interested in having a pure bred bull will never go back to the use of a scrub or grade bull and the fact that he has a pure bred registered male at the head of his herd will soon interest him to have one or two pure bred females to mate to this bull and then his interest is soon awakened to such an extent that he is ambitious to have a pure bred herd. From then on, the improvement in his herd will be rapid.

Many breeders even when operating on an extensive scale cannot test all of their animals and there are many small breeders who can not afford to test at all, even though their herds may be all pure bred. Yet the animals that are not tested in the larger herds and the animals that are not tested in the small herds may be of very strong blood lines and the bulls from untested dams in these herds may be as prepotent and as powerful in bringing about increased production as bulls from tested dams.

184. Bull all-important.—Therefore, each breeder of grade cattle should secure the help of his agricultural college or that of a neighbor who is a purebred breeder, to find some breeder that has bulls from untested dams that he will sell cheaply. Then he should buy one of these bulls for his use until such time as he can afford to get the bull he wants from a tested dam.

No misunderstanding should arise from the above argument. The bull is more than one-half the herd. Farmers should learn this first of all. In the herd of 20 cows the bull influences every one of the 20 offspring. Each one of the 20 cows can only influence one offspring in any one year. Therefore, since the hereditary contribution of the bull is on the average one-half of each of the

FERN'S WEXFORD NOBLE 172066
Grand Champion Jersey bull, at the National Dairy Show, 1922. Owned by Twin Oaks Farm, Morristown, N. J.

offspring produced each year, the influence of the bull on the productivity of the herd and on the uniformity of the herd is as great or greater than the influence of all the cows put together. This seems hard to believe, but the hereditary contribution of the cows is very divergent because there are 20 of them, but the hereditary contribution of the bull is the same in the case of every heifer produced from him.

185. Buy the best you can.—Therefore, we see the tremendous reason for having the best bull that we can possibly afford.

We say that we cannot afford to pay two or three hundred dollars for a pure bred bull. Yet, when a horse in a team dies, we do not hesitate a minute about borrowing the money to replace that horse because we have to have the horse to do the work. We can get the breeding work done with a scrub bull, but we do not realize the importance of having a good bull. Wonderfully good bulls can be purchased today in all of the dairy breeds as calves for two to three hundred dollars each. Therefore, let us drive this thought home to every reader. If you do not have a good pure bred bull, do not breed another cow until you get one.

CHAPTER XIII

BUYING A PURE BRED BULL

186. The value of pedigree.—In buying a pure bred bull to head either a grade or a pure bred herd the first thing to look at is the bull and then look over his pedigree. No matter how good the pedigree may be, a poor individual should not be bought.

However, the pedigree is so important that a bull will not be likely to bring about much improvement in production unless he comes from a line of high-producing ancestors, so that we must conclude that after all is said, the pedigree is as important as the individuality and we must study both equally well to judge our animal.

187. How to read a pedigree.—The best way to show how to read a pedigree and to judge the value of the breeding of the animal, and to judge his ability is to show a pedigree and pick out the ancestors which give us a basis to form our judgment. On page 123 is given the pedigree of Carnation King Setske Segis, 361477. He was sold at the third co-operative national sale held in connection with the annual meeting of the Holstein-Friesian Association of America in June, 1922. He was purchased by the Pereley Dairy Company of Crescent, Missouri, for $1500. What was there in his pedigree in connection with his own individuality which gave him this value?

The immediate ancestors of an animal used for breeding are more important than those farther back. The real value of an animal for breeding and improvement can be judged, (1) from his dam and her record; (2) the sire and his record; (3) from the dam of the sire and her record; (4) from the sire of the sire and his record; (5) from the dam of the dam and her record; (6) from the sire of the dam and his record; and (7) from the more remote ancestors and their breeding and records. In short, we must study intensively the records of the first two generations back of the animal under consideration and then learn the family lines and

the records in the back generations which give him his breeding power.

188. The records on the dam's side.—This pedigree shows that this bull is out of a dam with a record of 33 pounds of butter in seven days at five years of age and another record of 28 pounds at 4 years. In the Holstein-Friesian breed a "thirty-pound cow" is a cow with a record of thirty pounds of 80 per cent butter or 24 pounds of butter fat in seven days. Thirty-pound cows are considered good producing cows. The dam comes from a good line of breeding with a sire who not only has many advanced registry daughters but who was evidently an outstanding individual, as evidenced in his show yard winnings in Oregon and Washington fairs. Her dam, the maternal grandam of the bull under consideration, had a record of 28 pounds and was a full sister of Belle Josephine Ormsby, with a yearly record of 1127 pounds of butter.

189. The records on the sire's side.—The sire of this bull was Carnation King Sylvia, the only bull to sell for $106,000. He gets his value from his dam, May Echo Sylvia, whose seven-day record of 41.01 pounds of butter and 1005.8 pounds of milk is a wonderful record. She also has five thirty-pound records. She was the first cow to produce 150 pounds of milk in one day.

Carnation King Sylvia gets further value from the fact that his dam, May Echo Sylvia, is also his great grandam on his sire's side because she is the dam of Avon Pontiac Echo, the sire of King Echo Sylvia Johanna. In this way it is seen that he is "line bred" from May Echo Sylvia. Also the dam of his sire has a record of 37 pounds. Taken altogether it is seen that the records on both sides of the pedigree are very fine.

It was said of Carnation King Setske Segis at the sale that he was "an excellent individual from a cow that is making a large milk record." This pedigree and brief description will make it plain how one should go about reading a pedigree.

190. The value of advertising.—When one is buying a bull to head his herd he should buy some advertising with him. We have chosen this pedigree of Carnation King Setske Segis to illustrate another point. Mr. A. C. Oosterhuis, member of the "true type"

CARNATION KING SETSKE SEGIS 361477

Born November 20, 1921

Owned by Pereley Dairy Co., Crescent, Mo.

Carnation King Sylvia 231045

1 A. R. O. daugnter
Carnation Sylvia Pietertje
Butter 2¼y 23.48
Milk 417.40
The records of his 7 nearest dams average
Butter 7 da 33.13
Milk 646.84
He is line bred on both sides to the greatest family in the world. His dam, the world wonder milk producer, May Echo Sylvia, is also his great grandam on his sire's side. His 37-lb. sire is from the only three times 30-lb. cow to have a three times 30-lb. daughter. His dam holds all world milk records from 7 days to 90 days, and was the first cow to produce 150 lbs. of milk in a single day.

King Echo Sylvia Johanna 203054

5 A. R. O. daughters
King Segis D K Korndyke Duch. 2d
Butter 3½y 29.05
Milk 476.40

Echo Sylvia Rose 3½y 21.58
Milk 402.60
Sylvia Johanna Parma 2y17.58
Milk 404.50
Echo Sylvia Queen 2½y 17.13

Avon Pontiac Echo 203055

36 A. R. O. dau. 18 over 20 lbs.
3 over 30 lbs.
7 Semi-official daughters
Raymondale Abb. D K 4y 1167.00

Belle Model Johanna 2d 113357

Butter 37.34

4 A. R. O. dau. 3 over 20 lbs.
2 over 36 lbs.

May Echo Sylvia 223725

Butter 41.01
Milk 1005.80
(World record)

Five times 30-lb. cow

Inka Sylvia Beets Posch 122780

36 A. R. O. dau. 4 over 30 lbs.
May Echo Sylvia 7y 41.01
20 others over 20 lbs.
12 Semi-official daughters

May Echo Verbelle 223724

Butter 10½ y 29.80
4 A. R. O. dau. 1 with 41 lbs.
1 with 33 lbs.

Segis Lyons Hengerveld 69558

14 A. R. O. daughters
Forward Segis Pontiac 21.95

Milk 464.90
Forward Seg. Cor. 4½y 19.01

Forward Prince Segis 125061

25 A. R. O. dau. 13 over 20 lbs.
Carnation Setske Seg. 5y 33.18
Carnation Sky. Segis 4y 30.89
Milk 745.30

6 Semi-official daughters
Lady Mollie Segis 3½y 834.60

Carnation Setske Segis 376194

Butter 5y 33.18
Milk 573.70

Inka Princess Mutual De Kol 65425

Butter 7½y 33.25

3 A. R. O. dau. 2 over 20 lbs.
1 Semi. with 1087 lbs.

From a full sister to Belle Josephine Ormsby
Butter 10y 31.58
Milk 543.40

Belle Setske Josephine 2d 167903

Butter 5y 28.19
Milk 506.80
3 A. R. O. dau. 2 over 20 lbs.
Carnation Setske Segis 5y 33.18
Milk 573.70
Lady Ollie Fayne 3y 22.02

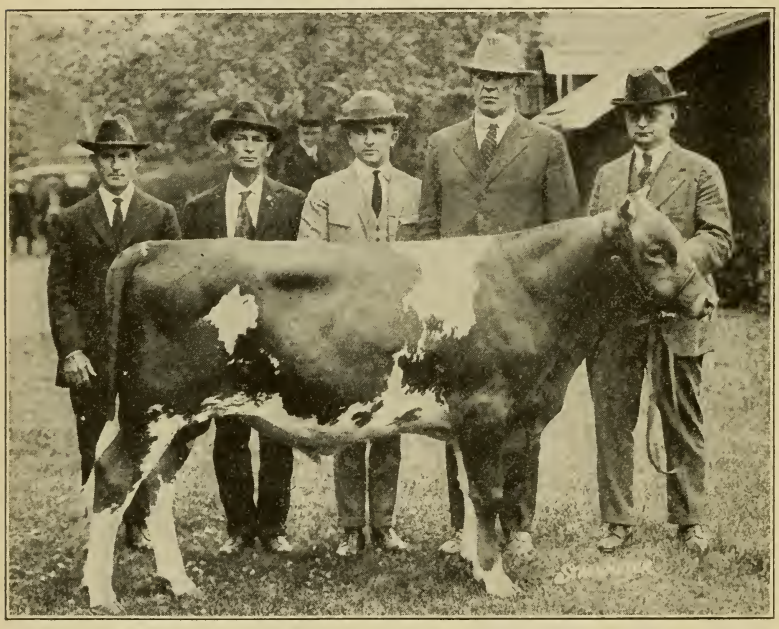
Sir Skylark Ormsby Hengerveld 39138

6 Semi-official daughters
Belle Josephine Orm. 8y1127.27
38 A. R. O. dau. 25 over 20 lbs.
5 over 30 lbs.

Belle Setske Josephine 56593

Butter 2½y 12.48
Milk 258.60
3 A. R. O. dau. 1 over 30 lbs.
One 1127-lb. Semi-official

committee of the Holstein-Friesian breed, was asked by one of the authors, how to buy a bull calf. He said that one of the most important things for a beginner to do was to choose a bull from a well known line of breeding that was sure to receive a large amount of advertising. Then whatever good may result from the use of the bull will share in the benefit of the general advertising of the



LANGWATER FEARLESS 77111
Owned by Columbia County Breeders' Association, Columbia County, Penn. Purchased 1922, for $7500.00.

family by all the owners of members of the family. It is hard to sell good individuals from unknown lines or families in any breed. The offspring of this bull calf will sell easier because they will be of May Echo Sylvia and Carnation King Sylvia breeding.

191. Buying a community bull.—Good breeding can be brought about through the community bull. One of the best examples of the interest that some farmers take is shown by the purchase of

Langwater Fearless, 77111, page 124, for $7500 by 25 of the foremost breeders of Columbia County, Pennsylvania. The money was raised by the sale of shares at $25.00 each. Each share carries with it the right to one service during the period of five years. Each breeder has made himself responsible for the number of shares he expects to require. A breeder having 25 shares will get five services a year for the period of five years. This represents the high extreme to which community breeding may go. Of course a group of men in a neighborhood could go into this sort of thing on any scale.

192. The pedigree of Langwater Fearless.—On page 126 is shown the pedigree of this young bull. It was said that he was the most valuable young Guernsey bull in the world at the time of the Langwater dispersal sale in June, 1922. In connection with the idea of advertising as expressed in another paragraph the whole community gained from the purchase of this bull and all the Guernsey cattle in Columbia County of May Rose and Langwater breeding will be distinctly benefited from the fact that a young bull of exceptionally popular blood lines is coming into their part of the country. These men have done more than to buy a bull. They have put their community on the map and have stimulated better breeding and better care of animals in that whole part of Pennsylvania.

193. His ancestors.—A study of the pedigree will show that he is a son of Langwater Phyllis, 70607, who is a granddaughter of Imp. King of the May, 9001. She has a record of 13,288.4 pounds of milk and 746.23 pounds of butter fat at two years of age. His sire was Langwater Warrior, 26509, who is a son of Imp. King of the May, 9001. Imp. King of the May, 9001, was the greatest sire of his day. The dam of Langwater Warrior was Langwater Lily, 26606, who in turn was the dam of Langwater Levity, 70293, that made 12,785.9 pounds of milk and 662.15 pounds of butter fat as a three-year-old.

This shows the value of this young bull because of the line breeding to Imp. King of the May, 9001, and the very fine breeding and records of his nearby ancestors.

LANGWATER FEARLESS 77111

Born July 26, 1921

Owned by Columbia Co. Accredited Herd Guernsey Assn., Penn.

Langwater Warrior 26509 A.R.
Sold for $15,000.00
Sire of
14 A. R. Daughters 1 A. R. Son
Langwater Queen of the East 13221.5 lb. M., 646.82 lb. B. F. Sold for $11,000.
Langwater Memoir 13949.00 lb. M., 639.19 lb. B. F. Sold for $13,000.
Langwater Forever 12668.40 lb. M., 602.67 lb. B. F. Sold for $6900.
Cramond Patricia 12271.7 lb. M., 594.62 lb. B. F.
Brookmead's Dorothea 12721.6 lb. M., 605.56 lb. B. F.
Lone Pine Charity 13175.2 lb. M., 599.92 lb. B. F. Warrior's Lustre of Fernbrook 12257.2 lb. M., 582.16 lb. B. F. Sold for $1100. Langwater Helpmate 77759, sold for $15,000. Langwater Eastern King 63072, sold for $9600. Brooklandwood Warrior 45696, sold for $6000. Cramond Chieftain 60857, sold for $5500.

Imp. King of the May 9001
32 A. R. Daughters including 5 Class Leaders. 24 A. R. Sons.
Langwater Hope 19882.0 lb. M., 1003.17 lb. B. F.
Langwater Lustre 17307.2 lb. M., 806.10 lb. B. F.
Langwater Heroine 805.64 lb. B. F.

Imp. May Rose King 8336
Queen of the Roses 17753.10 lb. M., 852.86 lb. B. F. Florham Daisy 14876.60 lb. M., 747.08 lb. B. F.

Imp. Itchen Daisy III 15630
13636.80 lb. M., 714.10 lb. B. F. 3 A. R. Daughters, 3 A. R. Sons.
Langwater Dairymaid 16949.-2 lb. M., 812.66 lb. B. F.

Imp. Langwater Lily 26606
10290.10 lb. M., 548.66 lb. B. F.
Dam of
Langwater Levity 12785.90 lb. M., 662.15 lb. B. F.
Langwater Amazon 11548.40 lb. M., 631.99 lb. B. F.

Imp. Golden Secret 12599
15 A. R. Daughters, 15 A. R. Sons. Nella Jay, 3rd 17047.20 lb. M., 809.38 lb. B. F.

Imp. Itchen Lily V 23540
Dam of Langwater Hope 19882.0 lb. M., 1003.17 lb. B. F.

Langwater Monarch 20899
4 A. R. Daughters, 1 A. R. Son. Langwater Desire A. R. 4877. 17086.2 lb. M., 817.36 lb. B. F.

Langwater Fashion 23660
Sire of 8 A. R. Daughters, 3 A. R. Sons. Langwater Yvette 12203.2 lb. M., 679.66 lb. B. F. Langwater Glory 13182.5 lb. M., 647.16 lb. B. F. Langwater Crystal 12359.2 lb. M., 603.53 lb. B. F. Langwater French Lady 12614.5 lb. M., 590.10 lb. B. F.

Langwater Pauline 33566
10918.80 lb. M., 595.27 lb. B. F. Dam of 2 A. R. Sons.

Langwater Phyllis 70607
13288.40 lb. M., 746.23 lb. B. F. Cl. G. 3rd. pl. in Cl. G. Leaders. Sold for $10,500.

Imp. King of the May 9001
A. R. 32 A. R. Daughters including
Langwater Cleopatra 15364.7 lb. M., 792.51 lb. B. F. Sold for $19,500.

Langwater Faithful 39949
10489.00 lb. M., 492.67 lb. B. F.
Dam of
Langwater Phyllis 13288.40 lb. M., 746.23 lb. B. F. Sold for $10,500.

Langwater Faith 31568
Dam of Langwater Faithful A. R. 3409. 10489.00 lb. M., 492.67 lb. B. F.

CORIUM RAIDER'S DURAND

Born August 8, 1922

Owned by Larsen Canning Co., Green Bay, Wisconsin

Border Raider's Governor No. 61872
6th prize bull, 18 mos. and under 2 yrs., National Dairy Show, 1921.

Imp. Border Raider No. 22243
20 A. R. daughters including:
Raider's May Star of Waddington. Fat 823.29 lb.
Raider's Rosetta of Waddington. Fat 748.82 lb.
Raider's May Wirt. Fat 599.95 lb.
Raider's Violet of Waddington. Fat 532.16 lb.

Imp. Itchen Red Raider No. 27343
5 A. R. daughters including:
Golden Cross Alice of Linda Vista
Fat 532.63 lb.
Golden Cross Elois of Linda Vista
Fat 518.85 lb.
Raider's Belle of Linda Vista
Fat 459.88 lb.

Itchen Verbena 5501 E G H B
Milk 13673.75 lb. Fat 693.25 lb.
2 A. R. sons

Imp. Nelly of Clovelly No. 65614
Milk 11533.7 lb. Fat 629.50 lb.

Governor of the Chene R G A S 1297 P S
119 A. R. daughters including:
Imp. Loulou's Maid
Fat 730.81 lb.
Imp. Nettie of the Hubits
Fat 718.97 lb.
Imp. Bon Espoir XII
Fat 713.31 lb.

Nelly II of La Croisee R G A S 6061 P S
Milk 13157.0 lb. Fat 724.84 lb.
2 A. R. daughters

Imp. Adeline of St. Croix No. 54122
Milk 6994.5 lb. Fat 336.77 lb. in Class G.
Re-entry.
Milk 13656.2 lb. Fat 646.33 lb. in Class A.
On retest and promising to make about 750 lb. Fat.

Imp. Flora's Sequel II of Vimiera No. 28603
18 A. R. daughters including:
Imp. Snowdrop III of Havilland. Fat 707.08 lb. Imp. Hon. Lady Jeff of the Chene. Fat 706.5 lb. Imp. Adeline of St. Croix. Fat 646.33 lb. Imp. Pansy III of Havilland. Fat 610.99 lb. Imp. Kiluna's Welcome. Fat 562.77 lb. Imp. Queen Mary of Sunnyside. Fat 515.48 lb.

Imp. Clara's Sequel No. 29414
50 A. R. daughters including:
Brownie of Linwood
Fat 831.07 lb.
Imp. Primrose of the Vrangue III. Fat 682.46 lb.

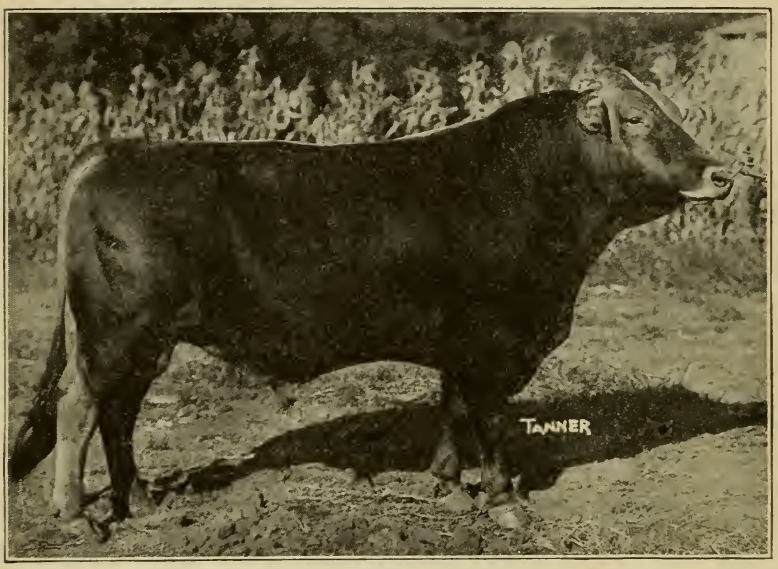
Imp. Flora of Vimiera No. 45954
Grand Champion, Eastern Show Circuit, 1913-14.

Favourite of Le Douit Farm R G A S 9145 P S
Milk 11113.00 lb. Fat 558.75 lb.
Class AA
3 A. R. daughters

Imp. Raymond's Emperor No. 15380
4 A. R. daughters
Imp. Favourite of Le Douit Farm. Fat 558.75 lb.
Imp. Nina's Iowa Dairy Girl
Fat 490.78 lb.
Imp. Aurora of Sarnia
Fat 398.82 lb.

Master's Beauty R G A S 3474 F S
Commended London Show, November 12, 1908.

194. Buying a bull for $500.—We believe that farmers can aspire to paying $500 for a bull when they have ten pure bred females. What does the pedigree of a $500 bull look like? At the Wisconsin State Sale of Guernseys the bull calf, Corium Raider's Durand was sold for $540. His pedigree is given on page 127. The breeding brings together the blood of Imp. Border



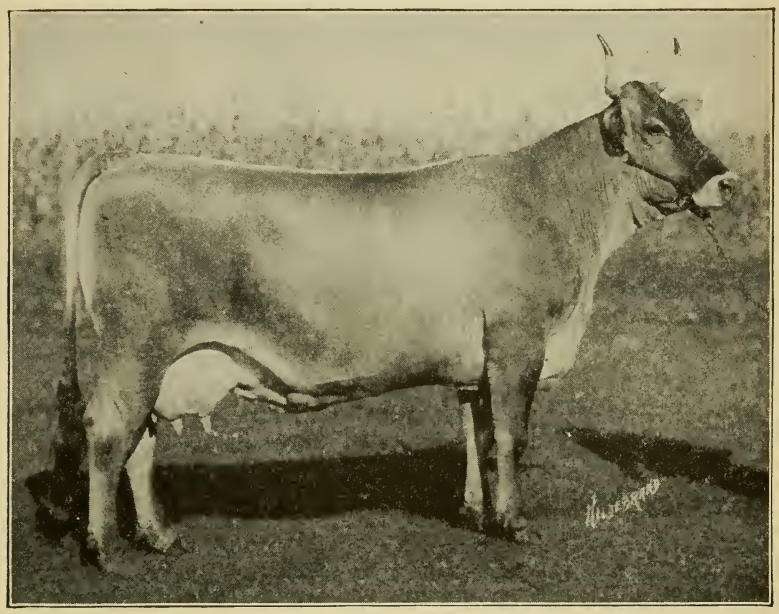
Nellie's Stasis 6721

Grand Champion Brown Swiss bull at the National Dairy Show in 1922. Owned by L. S. Marshall and Sons, Leslie, Mich.

Raider, Governor of the Chene, and Imp. Clara's Sequel, all of which have been popular bulls with many advanced registry daughters. The records of the nearest dams are high. This pedigree will illustrate what to look for in hunting out a bull.

195. Buying a bull for a grade herd.—In buying a bull to head a grade herd perhaps it will be well to look for a bull from less popular blood lines, but production should not be lost sight of. The thing to do is to buy the best one can afford. Take plenty of time and consult as many persons as possible so as to learn

where bulls are for sale in order to get a choice. Sometimes bulls will be farmed out by breeders who wish to see how they may develop or how their dams may test before selling. In this way the service of a son of a great sire from an untested dam may be secured for a time for his keep.



Hawthorn Dairy Maid 6753

Champion Brown Swiss cow in both milk and butter fat. Yearly record, 22,622.6 pounds of milk, 927.23 pounds of butter fat. Owned by Hawthorn Farms, Lake County, Ill.

196. Type and individuality.—A dairy bull should be long, deep and rather angular. Especially should he have marked constitutional vigor. The chest should be particularly deep and the front legs should be far enough apart to give good width of chest with the ribs well sprung. He should have no heaviness or coarseness in the withers and shoulders, beyond that which goes with his sex character. A bull, of course, does not have as fine withers

as a cow. The neck will be heavier than that of the dairy cow and should show some arch. The throat will be fuller and the head somewhat heavier with thicker and shorter horns. The face and eyes and muzzle should exhibit many of the same characteristics as found in the dairy cow.

A bull does not have the same wedge shape that is found in the dairy cow, but he must have the same straight back. The hips will not be as prominent nor the rump quite so wide. He must have a strong back and there must be no droop in the rump or sag in the loin. A bull must show no tendency to lay on flesh. This is very important. The hind-quarters should be lean and muscular and the thighs not fleshy but well separated. Good depth of flank in front of the thighs is a fine thing to see.

197. Size.—Large size is to be preferred if it is associated with quality and not with exceedingly large bone and coarseness. Size and weight should not be secured through fleshiness.

A dairy bull should show an active, nervous disposition with little evidence of sluggishness. Sluggishness in a young bull is likely to indicate that he will take little exercise and will be slow in service as he gets older.

Many of the readers of this book will probably be forced to choose their bulls while the animals are young which makes the problem doubly hard. Therefore, in the young calves, look for indications of constitution, capacity and quality. Long, level, wide rumps and comparatively thin thighs must be insisted upon.

198. See the dam.—Wherever possible, the dam of the bull should be seen, and, of course, the pedigree should be studied and if money is available a bull should be purchased with as high a record on the part of the dam, maternal grandam and dam of the sire as can be found. The records of the dams close up in the pedigree are the ones likely to have the most influence and certainly as much as possible should be found out about the individuality of the first four animals in the pedigree, as it is possible to find out. Particularly, should one find out about the conformation of the udders of the nearest dams; whether their fore-udders were well developed; whether the quality of the udder is right and placing

of the teats and things of that sort are right in the dam, and the placing of the rudimentary teats on the bull calf himself.

The importance of the bull in the herd must always be emphasized. He is by far the most important and valuable animal on the dairy farm, and better dairying will come about on farms more quickly through the use of good dairy sires than in any other way.

CHAPTER XIV

FEEDING, DEVELOPING AND EXERCISING THE HERD BULL

Much has been written about the feeding, care and management of the dairy cow, but writers as a rule do not pay much attention to the herd bull. He is rarely appreciated until he will not get the cows in calf or until he has a daughter or two which turn out exceptionally well. When this happens then he will be looked after more carefully. Often it is then too late.

199. Bull one-half the herd.—This is an old saying, probably overworked, but it is one of the truths that we should really try to learn and appreciate. He may be even more than half the herd if he is found to be valuable and then is used on some of his own daughters in inbreeding or used on relatives in line breeding. Anyhow, it is certainly true that a bull contributes in the long run one-half the makeup of a herd as his daughters come into the herd. For example, if one herd is made up of 20 daughters of one bull, that bull will have furnished one-half of the blood found in that herd, whereas it has taken 20 dams to make up the other half. Therefore, the contribution of any single dam has been only one-twentieth of the blood of the present herd. Whether she were a poor or good individual, she would have influenced only one out of the 20, whereas the bull, good or poor, would have influenced each and every one of the 20.

200. Bull the source of fastest improvement.—Therefore, we easily see that the bull is always the source of the quickest improvement. Again, the bull will have a great influence in making the herd uniform, because his daughters should be more uniform than their dams. For these reasons let us pay attention to the selection and care and management of our bulls.

201. Feeding the young bull.—For the first six months the feeding and care of the bull calves will not be materially different from the treatment of the heifer calves. (**Chapter IV**) The main

thing is to keep them growing. A little fat will do no harm. We are taught that there is no such thing as acquired characteristics that can be transmitted, but we believe that environment and feeding and care will have something to do with the offspring. An underfed, undersized bull will not have as large, well-developed daughters as a bull will have if he has been well grown and has attained a desirable size and stretch for his breed. Therefore, let us grow out our young bulls properly. The best treatment is raising them on nurse cows. A good nurse cow will raise two good calves if she is well fed and for valuable animals this method cannot be beaten. The next best way to raise the calf is on skim milk, hay and grain.

202. Management as yearling.—The bull calves must be separated from the heifers at six months of age because they will annoy the heifers then and some young heifers are very precocious and might breed soon after this age. Therefore, it is better to be safe.

From six months on the young bull may have silage and hay and grain enough to keep him growing well. One hundred pounds each of corn meal, wheat bran and ground oats, and fifty pounds of oil meal make an excellent grain mixture for bulls.

A young bull well grown can be used at ten months for a cow or heifer or two, but it is better to delay using him if possible until he is twelve months old. Then to get good growth he should be used sparingly until he is two years old. We want size. Therefore, let us do nothing to retard growth.

203. Management of older bulls.—It is best to ring a bull at one year old. He is dangerous to handle as soon as he gets any size on him and it is better to be safe than sorry. Bulls that have gotten their growth should be fed sparingly on silage. Feed them good hay, preferably legume hay, and grain. Limit the silage to fifteen to twenty pounds per day. The grain should be regulated by the service. Bulls serving two or three cows a week need grain.

Bulls can probably handle as high as two hundred cows per year if properly fed and managed, if the cows are distributed. The trouble is that in most herds the calves are all wanted at a

particular season, which makes it impossible to distribute the service to the best advantage for the bull. In no case should a bull serve more than two cows in the same day and then these services should be as many hours apart as possible. One service to one cow is enough. Two services cannot possibly help

EXERCISING THE BULL

Special tread power built by Lyon Iron Works, Greene, N. Y., as used at Tarbell Farms, Smithville Flats, N. Y., with bull Eminent Secret.

in settling a cow and two services at one time are very hard on the bull.

204. Exercise.—All-important is exercise. There are many ways, not any one of which is very satisfactory. The bull may have a half-acre paddock in which to run but if alone he will not do much, particularly when along in years. Two bulls together will do much better. Any number can be turned together if they are dehorned. Some breeders think dehorning a bull will decrease

his power to bring about improvement. This cannot be so. All bulls should be dehorned for safety and convenience in handling.

A long wire, to which he may be hitched so that he can walk back and forth, may help. An empty beer keg in his pen will give him something to butt around. Probably, the best way is to drive him or to use him in a tread power. Certainly a bull will breed better if he is kept down in weight and is exercised regularly. It is an axiom that all animals will be improved in their breeding powers, if regularly worked or exercised.

205. Housing.—Except in severe weather the bull needs nothing more than an open shed that will protect him from the wind. A bull pen off from his paddock with the door open at all times will keep him in better physical condition than if penned or tied in the barn.

The objection to this is that he will look unkempt and shaggy. It is better for him and we can forgive him his looks if he will give us good daughters and sons. Judge the looks of a proven sire in his daughters and sons, and not through his own appearance, particularly if he is a little thin but good and lively. Much time is lost through the use of impotent bulls.

206. Have the bull examined.—If your cows are not getting with calf easily it may be that the bull is impotent. If there is any serious delay, or cows have to be served more than once, it is certainly good practice to have the semen of the bull examined to see if the spermatozoa are alive and motile. The trouble may all be in the bull even if he does appear to be lively and serves the cows promptly.

Lastly, do not overlook the importance of the bull. He is entitled to more care than just the care of one individual in the herd. His care is all-important because improvement cannot go on without him.

Part IV
DAIRY FARM PRACTICE

CHAPTER XV
GOOD BREEDING PRACTICES

There are two ways to build up a herd. One is by purchase of all the cows and then keeping the numbers good by continued buying. The other is by the use of a pure bred bull and the raising of daughters to replace the cows that must be discarded. It seems to us that this latter practice is the only good one for the solid, successful farmer. To be sure, a man is pitting himself against odds in selecting bulls to maintain the productivity of his herd. But it is the most fascinating thing in the world to select animals and mate them and watch for the development and improvement in the offspring.

207. The bull the main factor.—At the risk of some repetition we are going to bring in here again the importance of the sire. To bring about improvement the sire must be better than the females to which he is bred. Therefore, the finer and the higher the average of the females, the better must be the bull. How are you going to know the value of the bull and to know that he is better than the females in the herd? The answer must be given in two ways. First, we can know that he is better than the females if he has produced stock that have better records and are better individuals than the females in the herd. The second way is to judge from the uniformity of his ancestors through the study of the pedigree.

208. The value of a proven sire.—The above illustrates the wonderful thing that is represented by a proven sire. If a bull has daughters with records, either official records or cow testing association records, then we can actually compare the records of these daughters with the records of the females in our herd and

know beforehand what he will do. Proven sires are expensive and hard to find but occasionally they can be found and of course are the best. The pedigree form below shows how valuable such a sire is. This pedigree form is quoted from F. R. Marshall in "Breeding Farm Animals," published by the Sanders Publishing Company, Chicago, Ill.

Pedigree Form Showing Relative Importance of Ancestors

			Record as a sire 1
			Individuality 1
			Ancestry 1
		Record as a sire 4	
		Individuality 2	
			Record as a producer 1
Record for uniformly siring good stock 12			Individuality 1
Individuality 12			Ancestry 1
			Record as a sire 1
			Individuality 1
		Record as a producer of good stock 3	Ancestry 1
		Individuality 3	
			Record as a producer 1
			Individuality 1
			Ancestry 1
			Record as a sire 1
			Individuality 1
			Ancestry 1
		Record as a sire 4	
		Individuality 2	
			Record as a producer 1
Record as a producer of good stock 10			Individuality 1
Individuality 14			Ancestry 1
			Record as a sire 1
			Individuality 1
			Ancestry 1
		Record as a producer of good stock 3	
		Individuality 3	
			Record as a producer 1
			Individuality 1
			Ancestry 1
Similarity in type of sire and dam 4			
52		24	24=100

209. Judging the bull from his ancestors.—This suggestion of Marshall's is very helpful in selecting the young bull that is

to be saved for a sire from one's own herd, or in buying a sire from another herd. The value of the individuality, of the animal is as important in the sire as his record, and in the dam of the sire the value of the individuality is greater than the record. Marshall gives a great deal of weight in this suggested scheme to the record of production of good stock.

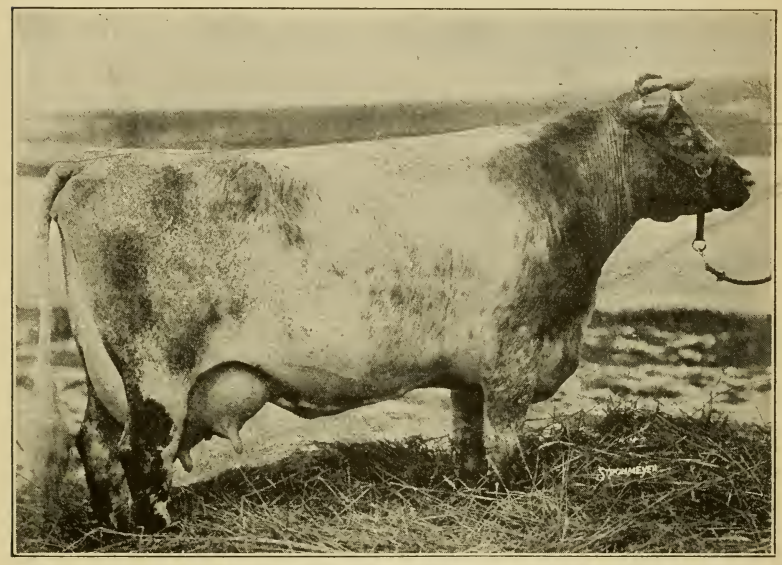
210. A balanced pedigree.—This illustration of a pedigree shows the value of balance. The sire and dam contribute equally and also their similarity of type must be given some consideration. The four grandparents contribute only one-half as much influence as the sire and dam, but if by their individuality, records of production of good offspring, and records of production of milk in the dams, they can show uniform high character, then the individual is almost sure to be an animal that can be depended on. Strive to get such a balanced pedigree.

The influence of a single animal in the generation of the great-grandparents is not important in the sense that we would pay very high for an animal on the strength of individual performance in that generation. However, the more good ones found back in the generation of the great-grandparents, the better balanced the pedigree.

211. Heredity and environment.—What a cow is going to contribute to her calf is all contained in a single little egg produced in her ovaries at the time she is in heat. It is all there. All that the bull is to transmit to this calf is in the sperm cell which fertilizes that egg. The contribution of the thousands of individuals for generations back is all carried along into the new calf when this tiny egg and sperm cell unite. It is hard to believe that all the calf can ever be is thus passed on to him in this way from his dam and sire, but it is so. This is heredity. Environment, or feeding and care, can only develop what is inherited. We cannot create by feeding. We can only develop. Of course, heredity is not of value if it is not properly developed, but the important thing is that no care or management can amount to a thing if the material is not supplied by heredity ready for proper feeding and development. Let us learn this and then there will surely come

home to us the necessity of learning to select the proper sire first of all and then the best dams we can afford on which to breed him.

212. The selection of the females.—In selecting both bulls and cows, size should be the first thing to have in mind. Individuality is important. Then try to have the herd uniform and have an ideal in selecting the herd. In buying females, know



BARE FASHION 634770

Yearly record 17,027.9 pounds of milk, 581.47 pounds of butter fat. Owned by H. E. Tener, Washingtonville, N. Y.

the records if possible. The time has come when we should always have in mind that we are buying foundation cows. Therefore, buy from accredited herds and from members of cow testing associations.

There is a thrill in buying the first pure bred female. Enjoy it to the utmost by paying a good price and get a good one. Do not make the mistake of buying a pure bred female that is not the equal of the best grade you have. If you do, she will be a dis-

appointment. Above all in this first pure bred female get a good one because she truly is the foundation cow.

213. Mating.—In mating animals a single service is all that is necessary. Nothing is accomplished by a second service. There are thousands and thousands of sperm cells in the semen coming from a single service and only one is needed to fertilize the egg. Therefore, protect the bull by not overworking him. Try to distribute the breeding so that at no time will it be necessary to use the bull twice in the same day.

Heavy, old bulls can safely be used on young heifers if a breeding crate is used. Directions for building one can be obtained by writing to your agricultural college.

214. Inbreeding.—Much has been said on this subject, but more good has come from inbreeding than any single instrument in the hands of the breeder. Inbreeding is the breeding together of related individuals. It may be as close as the breeding of a sire to his daughters or of breeding together full brothers and sisters. Judicious inbreeding can always be depended on to help in bringing about uniformity and increased production, if it is combined with careful selection always toward the ideal of greater size, better type, and better production. The only thing to remember is that bad points will be emphasized just as strongly as good ones.

215. Line breeding.—Line breeding is the use of inbreeding among related animals within a family without having the relationship too close. Line breeding is illustrated in the pedigree of Langwater Fearless, page 126. Imp. King of the May is the grandsire on the sire's side and the great-great-grandsire on the dam's side. Thus, Langwater Fearless is said to be line bred to Imp. King of the May on both sides. This line breeding of course makes him an inbred bull also, but not closely inbred. Such line breeding has been the instrument which has fixed type and made families famous.

216. Breeding efficiency.—One of the strongest factors in the success of any herd is breeding efficiency. For the greatest milk production we must have our cows produce a calf once a year. A simple record of the time each cow is bred and the number of

times she has to be bred should be kept. If she has to be bred more than once she should be looked after carefully. If several cows in the herd have to be bred more than once the bull should be examined. A good veterinarian should be a consultant of the stock owner and a systematic record kept of the breeding efficiency of the herd. Forms are not important so long as it is possible from a simple record to know just where each cow stands. The following is a gestation table which will make it possible to work out and know just when each cow is due to come in.

Gestation Table for Dairy Cows

Date of service	Due to calve	Date of service	Due to calve	Date of service	Due to calve	Date of service	Due to calve	Date of service	Due to calve	Date of service	Due to calve
Jan.	Oct.	Mar.	Dec.	May	Feb.	July	Apr.	Sept.	June	Nov.	Aug.
1	10	1	8	1	7	1	9	1	10	1	10
3	12	3	10	3	9	3.	11	3	12	3	12
5	14	5	12	5	11	5	13	5	14	5	14
7	16	7	14	7	13	7	15	7	16	7	16
9	18	9	16	9	15	9	17	9	18	9	18
11	20	11	18	11	17	11	19	11	20	11	20
13	22	13	20	13	19	13	21	13	22	13	22
15	24	15	22	15	21	15	23	15	24	15	24
17	26	17	24	17	23	17	25	17	26	17	26
19	28	19	26	19	25	19	27	19	28	19	28
21	30	21	28	21	27	21	29	21	30	21	30
	Nov.	23	30		Mar.		May		July		Sept.
23	1		Jan.	23	1	23	1	23	2	23	1
25	3	25	1	25	3	25	3	25	4	25	3
27	5	27	3	27	5	27	5	27	6	27	5
29	7	29	5	29	7	29	7	29	8	29	7
31	9	31	7	31	9	31	9	.....	.....	.....	.....
Feb.		Apr.		June		Aug.		Oct.		Dec.	
1	10	1	8	1	10	1	10	1	10	1	9
3	12	3	10	3	12	3	12	3	12	3	11
5	14	5	12	5	14	5	14	5	14	5	13
7	16	7	14	7	16	7	16	7	16	7	15
9	18	9	16	9	18	9	18	9	18	9	17
11	20	11	18	11	20	11	20	11	20	11	19
13	22	13	20	13	22	13	22	13	22	13	21
15	24	15	22	15	24	15	24	15	24	15	23
17	26	17	24	17	26	17	26	17	26	17	25
19	28	19	26	19	28	19	28	19	28	19	27
21	30	21	28	21	30	21	30	21	30	21	29
	Dec.	23	30		Apr.		June		Aug.		Oct.
23	2		Feb.	23	1	23	1	23	1	23	1
25	4	25	1	25	3	25	3	25	3	25	3
27	6	27	3	27	5	27	5	27	5	27	5
29	8	29	5	29	7	29	7	29	7	29	7
.....	.....	.....	.....	.....	.....	31	9	31	9	31	9

217. Records of production.—It is easy to distinguish from their conformation between the cows that will produce 365 pounds of fat in a year from those that will produce only 200 pounds, but it is not possible to pick out those that will produce 500 pounds in a year from those that will produce 360. Therefore, consistent records of production are necessary as an aid to selection. We believe in cow testing associations because they help in many ways. The milk of every cow should be weighed at every milking. It will help in selection and it will help in feeding. We know of no good breeding practice that will be as stimulating as weighing and recording the production of individual cows every milking.

Advanced registry testing with purebreds is to be advised just as soon as one can possibly get to it. It is expensive but will pay for itself as soon as one is established.

218. Milking three times a day.—When one is established and has gotten his herd going well, it is worth while and will pay to milk three times a day all cows that produce over 40 pounds per day for Holsteins or 30 pounds per day for cows testing over four per cent butter fat. (42)

219. General effect of good breeding.—The best crop on the farm is the boys and girls. Mr. George M. Rommel, former chief of the Bureau of Animal Industry, says, "Why cloud a boy's dreams with poor stock? Give the youngsters well bred pigs, calves, sheep and chickens." This will be giving the children the proper environment to develop to its best the heredity that is in them and they are entitled to that environment.

220. Outside help.—The breed associations, whose addresses are on pages 95 and 96, maintain extension departments through which record forms can be obtained at cost. This is the best place to get them. These forms are for keeping breeding records and production records in the best manner for that particular breed.

Every breeder should subscribe for his breed paper and at least one good farm paper. He should be a member of his farm bureau and a member of his county breed association and his state breed association. All these things help. We must all help out in our community life and in the welfare of the state.

Community breeding is being worked out in a large way with Langwater Fearless in Columbia County, Pennsylvania. It is reported (May, 1923) that 30 selected cows are safe in calf to him and it is hoped to have 400 selected cows in calf to him in the next five years. (**191**)

Professor H. H. Wing of Cornell University says: "When we have pure bred chickens, pure bred sheep, pure bred hogs, pure bred horses and pure bred cattle, then we will have pure bred men and women and that is what we all want."

CHAPTER XVI

THE CONTROL OF TUBERCULOSIS

221. General herd sanitation.—The profitable dairy herd must be made up of sound, healthy cattle. The diseased animal is not an efficient producer and such an animal is frequently a menace to the herd through the spread of the disease to others. The first essential for a healthy herd is the practice of sanitation—that is, keeping disease away from the herd in so far as possible, and preventing its spread when it does get in, by the use of whatever measures the nature of the specific disease may require. The successful dairyman must practice disease prevention. The cure of disease falls primarily in the realm of the veterinarian and his services should be sought wherever the value of the animal justifies it. The good dairyman should know how to recognize the symptoms of the common ailments, since many of them will respond to simple remedies which he can apply. Others require the services of a veterinarian. Even the simplest troubles may develop to the point where a veterinarian must be called if the animal is to be cured. Thus a knowledge of symptoms will help one to decide when a veterinarian should be called.

As regards general sanitation, the following will help keep the herd healthy: plenty of good, clean, palatable feed; light, well-ventilated, dry quarters; clean stables, stalls and mangers, and plenty of fresh, clean water.

222. The tuberculosis problem.—Everyone is familiar with the strenuous campaign that is being waged against bovine tuberculosis. This disease has spread from herd to herd and from animal to animal until its annual toll has reached enormous figures. Not only is the disease a serious menace to the dairy industry, but also it is taking its toll of human lives by its transmission to babies through infected milk. It is high time that tuberculosis is stamped out. That success here is possible has been shown by the results of the nation-wide plan for cleaning up the disease started five

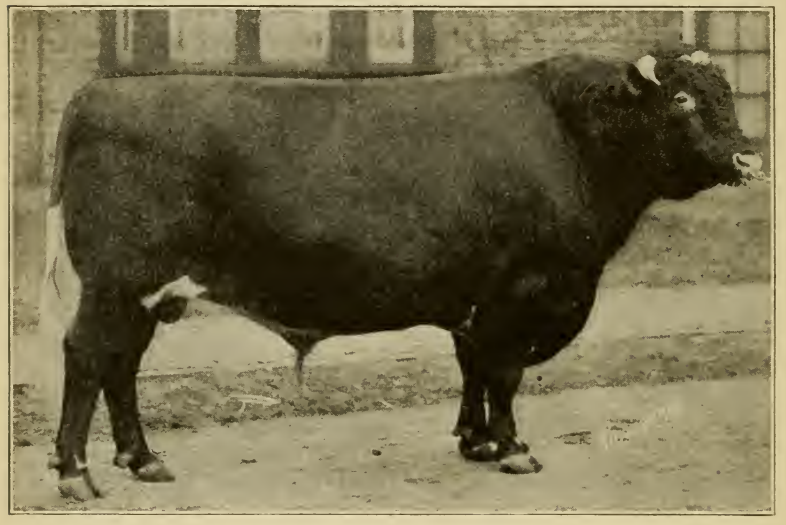
years ago. Its complete eradication can only come through united action. To get this action every dairyman must understand why sound and profitable dairying demands that his herd be free from tuberculosis.

223. The losses.—The disease takes a regular toll by death from herds where it has become established. Long before death it lowers the usefulness of the animal and makes her an unprofitable producer. Once tuberculosis gets into the herd it spreads from animal to animal. The calves become infected through the milk and the pigs also fall victims if fed dairy by-products. Tuberculosis destroys the reputation of the herd, making it difficult to sell either the animals or the milk. An animal showing physical signs of tuberculosis has practically no market either for milk production or breeding. More and more buyers are demanding animals shown by test to be free from the disease. With the realization of the possibility of the spread of the infection to children through the milk, the consumer is commencing to demand milk from tuberculosis-free herds and public health officials are giving this subject increasing attention.

224. Nature and symptoms.—Tuberculosis in cattle is similar to the disease in man. It is caused by a germ which gradually eats away the tissues of the body. The process may go on for four or five years before the presence of the disease can be recognized by any physical or external symptoms. The germ gets into the body in the air breathed in or may be taken in with the feed. When breathed in, it goes directly to the lungs which we frequently think of as the principal seat of the disease, and from the lungs gets into the blood. When taken in with the feed it gets into the blood through the digestive tract. Once the germ gets into the blood, any part of the body may be attacked. Thus, we have tuberculosis of the joints, of the udder, etc., as well as of the lungs.

225. How the disease starts.—The germs float around on the dust in the air and may live in the cracks of the mangers and in other places around the barn for months. These germs must come from some animal which is giving them off. They are given off in

the manure, in material coughed up and in the milk from a tubercular udder. The disease of the udder is not very common but when it does occur it is a sure method of passing the disease on to the calves, swine and humans receiving the milk therefrom, unless it is pasteurized. The milk may also contain the germs from infected manure getting into it. There are periods when the germs are being given off by a diseased animal and periods when they



Count Tickford 738427

Grand Champion bull at the International Live Stock Show, 1922. Owned by F. W. Sullivan, Battle Creek, Mich.

are not, but one cannot recognize these different periods; thus a tuberculous animal must be considered as a constant menace to the rest of the herd. Infection is spread from cow to cow through a common watering trough, through germs in the air breathed or coughed up by an infected animal, and through the manger. If a sound animal eats from a manger recently used by a diseased one, infection is sure. The use of mangers without partitions makes the spread of the disease more certain. Watering the cows by running

the water down through a common manger is an almost certain way of passing on the disease to animals drinking the water after an infected one.

The disease may be brought into a herd by the purchase of infected animals. The feeding of unpasteurized skim milk and whey from creameries and cheese factories to calves and pigs frequently brings in the disease. If these products are properly pasteurized they are safe to feed. A healthy herd may become infected through mingling with diseased animals at the fairs or by occupying premises previously occupied by infected animals and not disinfected. Similarly, infection may result from shipment in contaminated cars.

226. Physical symptoms not marked.—It has been mentioned that a cow may have the disease for years before physical symptoms are evident. In the advanced stage there may be coughing and sometimes there is lameness due to the joints being affected. The cow generally has a dull eye, a rough coat, a drooping head and shows loss of weight. But these symptoms are not satisfactory for detecting the disease. By the time they have become evident the animal may have spread the disease throughout the herd, as well as having been a liability for some time as regards production.

227. The tuberculin test.—Fortunately we have in the tuberculin test a method which will detect tuberculosis in its earliest stages. The method is not perfect but it certainly has proved so valuable that a man is foolish to disregard it.

228. Control and eradication.—The first step for the interested dairyman is to find out whether he has any diseased animals in his herd. This is done through the tuberculin test. An animal which is shown to have the disease by this test is called a reactor. Where reactors are found they must be removed from the herd. Next the barn must be thoroughly disinfected to get rid of germs present. Finally the herd must be so handled as to prevent future contamination. This is an outline of the method of getting rid of tuberculosis. The details will be brought out by a discussion of the accredited herd plan.

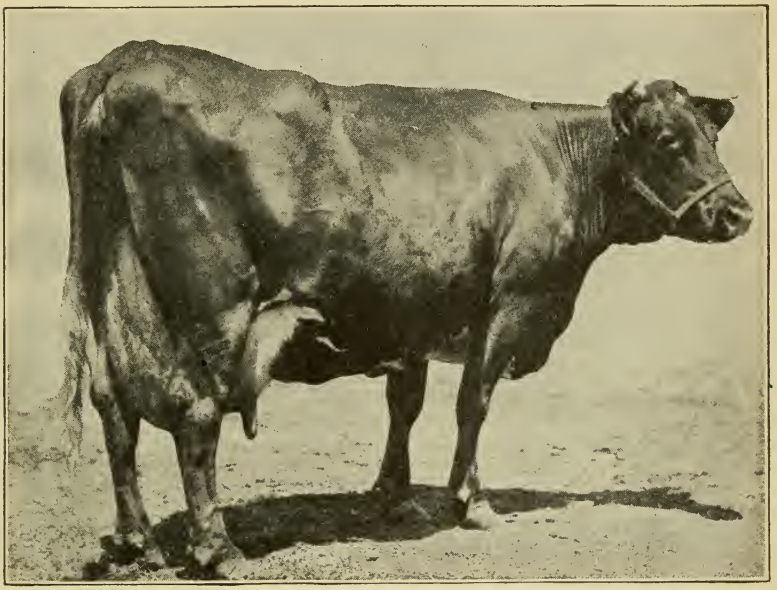
229. The accredited herd plan.—This is a plan adopted in 1917 to be used as a nation-wide program for the stamping out of tuberculosis. It provides for co-operation between the United States Government and the various states both as to financial support for carrying out the program and as to its supervision. To accredit a herd as free from tuberculosis means to certify officially that the owner has complied with certain specific rules laid down in the plan. These rules specify that an accredited herd is one that has been tuberculin tested under the supervision of the Bureau of Animal Industry or of a state official, and found to have no animals showing the disease upon two annual or three semi-annual tests and upon physical examination. It is further provided that where reactors are found they must be removed either by slaughter or segregation and that two more tests showing no further reactors are required. A thorough disinfection of the barn is also required. All milk and other dairy products fed to calves must come from tuberculin tested cows or else be pasteurized. No cattle can be added to the herd unless they have passed certain specified tests. Compliance with the above rules entitles the owner to an official certificate—"Tuberculosis-free Herd"—good for one year and renewable at the end of that time if all the animals again pass the test.

N. C. State College LIBRARY

230. Payment for losses.—The feature of this plan which makes many owners hesitate to adopt it is the probable loss due to the removal of reactors. It is possible to retain them by keeping them entirely separate from the rest of the herd and this may be done to advantage with animals in the early stages of the disease and of special value for breeding purposes. However, many problems of management arise here and all reactors should be headed toward slaughter. Most owners want the reactors killed at once and out of the way. To compensate for these losses, the Federal Government pays a certain indemnity for each animal slaughtered. Most of the states also pay a further indemnity, with the result that unless the animals are especially valuable the owner may actually lose little. The possible loss varies greatly in different states according to the amount of indemnity provided. However,

no man who is making dairying a business can afford to hesitate on this account, for over a period of ten years he will be money ahead by cleaning up his herd even if his reactors are largely a dead loss.

231. Area work.—We cannot go into details as to the actual working of the accredited herd plan because it varies in different



MELBA 15TH OF DARBALARA

World's Champion Milking Shorthorn Cow. Yearly record 29,423 pounds of milk, 1316 pounds of butter fat. Owned by Scottish-Australian Investment Company, Gundagia, New South Wales, Australia.

states. Generally it is preferred to clean up by intensive campaigns in small areas, such as counties or townships aiming at testing every herd in the area, rather than by disconnected work all over the state. The area system stimulates local interest and a clean herd in a clean area has a better chance of remaining clean than where surrounded by infected animals.

232. Owners must help.—The value of the area system is, however, being overemphasized. It must be borne in mind that the accredited herd plan is only a method of helping the owner clean up and of giving him recognition when he has done it. No plan, no matter how good or how well directed, will succeed unless the owner has the desire and the ability to carry it out. Desire which is stimulated by indemnities is not the kind that will result in clean herds. Under the present accredited herd plan, which places insufficient emphasis on the attitude and ability of the owner, money is being paid to owners who never will clean up their herds and keep them clean. This is a big objection to the area plan. No area will remain clean except by the intelligent and constant effort of every owner. The area plan may ignore owners sufficiently interested and intelligent to make a clean-up successful, because they are not in areas being worked, and waste time and money on other owners, who have no qualifications except being in the path of the projected clean-up. The idea of the accredited herd plan is fine but its absolute dependence for success upon the individual owner should be realized by everyone, not only in cleaning up his own herd, but also in supporting the working out of the plan in his state and locality.

233. The Tompkins County plan.—This is a modification of the accredited herd plan being tried out in Tompkins County, New York. One bad feature of the accredited herd plan is that the testing must be done by a state or federal veterinarian or no federal indemnity is received. Thus, the local veterinarian whose services the dairyman prefers and who is entitled to do the work, provided he is properly qualified, is discriminated against. To overcome this objectionable feature there has been organized the Tompkins County Accredited Herd Co-operative Association, Inc., which has entered into an agreement with state and federal authorities whereby the testing may be done by properly accredited local veterinarians without loss of federal indemnity. This plan localizes the responsibility of conduct and supervision. The working out of this plan should be watched with interest and if successful should commend itself to other localities. Further details of the

plan can be obtained by writing the Bureau of Animal Industry, Department of Farms and Markets, Albany, New York.

234. Should every owner test?—We have stressed the desirability of eliminating tuberculosis and have stated in general terms that a clean herd is an essential of profitable dairying. Now that we have discussed the losses due to disease, described the working of the accredited herd plan for cleaning up and indicated the cost involved, let us face the question as to whether every owner should plan to apply the tuberculin test and test his herd at once. This is difficult to answer because conditions differ in different states and areas and because each owner has his own special problems, but we believe we will help our readers most if we answer this question as definitely as we can. The owner of pure bred cattle should by all means plan to test at once. Profit in the pure bred business must rest in part on sales. No reliable public sales will take other than tested animals. In fact, so many pure bred owners are striving for clean herds that there is little market for untested animals even at private sales. Animals cannot be shipped out of the state unless tested. Thus, the purebred owner must test or go out of business.

235. Testing the grade herd.—Where there is an opportunity for a special market for milk from a clean herd it will be profitable to test whether the animals are purebreds or grades. Where grades are being raised for sale it is profitable to test. There are conditions, however, where it may not be profitable to test a grade herd now. Let us take an extreme case. Take a herd in an area which has a high percentage of the disease and where indemnities are low and slow in coming. To test the herd means to lose a large part of it with no nearby place from which to buy tested cattle and little money to buy them. Assuming that the milk is so disposed of as to be pasteurized before being consumed, it is not a menace to health, except possibly to the young members of a farm family. The local veterinarian can be called upon to locate an animal producing milk safe for the children. This can also be done for the calves, or pasteurized skim milk can be used. There are many owners of grade herds in these badly infected areas.

Their herds should, in general, be left until later when the area can be cleaned up as a unit and when clean cattle are more available.

What we have said above in no way denies the principle that everyone must be behind the clean herd program. The program must be carried out as rapidly as public money is available and owners can stand their share of the losses. Because of the tendency of the disease to spread, and the losses in production incurred with diseased animals, it certainly is true that the men who have the will to do it should test their herds at once and get on a clean basis.

236. How to proceed.—There are many other questions that will arise in the mind of one desiring to clean up his herd. He will want to know just how he should go about it, how soon the work can be begun and how much it will cost. The answers to these questions will differ according to the state and other conditions. The owner desirous of cleaning up his herd, but in doubt how to proceed, should consult his Farm Bureau Agent or State College of Agriculture for information.

We can offer a few suggestions which may tend to keep the disease from spreading in a herd while the owner is waiting for the actual clean-up. In the first place, the chance of further infection from without should be shut off by adding no animals to the herd, unless they are tuberculin tested, and by avoiding the use of skim milk from a creamery for feeding calves unless it is properly pasteurized. The chances of the further spread of the disease within the herd may be lessened by a separate manger for each animal and individual drinking cups, and by seeing that every cow has her own regular stall and avoiding the shifting of animals around. These same precautions, coupled with the elimination of any animals showing physical symptoms, are worth while for every owner to follow even if he is not planning to have his herd tested in the immediate future. But no one can hope to get rid of tuberculosis except by the test method, and every dairyman should look forward to having his herd cleaned up by the accredited herd plan. It will pay him in the long run, even if the first cost be high. The quicker it is done the smaller will be the losses.

237. Keeping the herd clean —The principal things that an owner must do to keep his herd clean under the federal plan have been mentioned. We want to emphasize here the importance of following the regulations closely. The utmost care and vigilance are necessary to prevent reinfection particularly in areas where the disease is widespread. The greatest care should be exercised in buying in animals. They should not be bought simply on the basis of passing one tuberculin test but they should come either from accredited herds or one should be sure that the test is reliable. Showing at fairs should be limited to those where adequate sanitary regulations safeguard against infection. The man who has a tuberculosis-free herd will win back the losses he suffered in cleaning up only if he keeps it clean. A clean herd is an asset that will increase in value from year to year. More and more, buyers will demand that the animals they purchase shall come from accredited herds and the selling price of such animals will increase.

238. Clean areas ideal.—Every owner of a clean herd should be behind the accredited herd campaign and should urge his neighbors to clean up. A clean area means less chance of reinfection and buyers are going to purchase in areas free from the disease in preference to buying from clean herds surrounded by the disease. The nation-wide campaign has progressed to the point where certain areas are recognized as fairly free from tuberculosis and others as widely infected. The latter areas will shortly find little market for their cattle unless they clean up. Thus, every owner of a clean herd should strongly support a campaign for cleaning up his community and state.

CHAPTER XVII

ABORTION AND OTHER DISEASES INTERFERING WITH BREEDING

It is estimated that abortion and related diseases are causing more losses to dairy farming than is tuberculosis. The importance of stopping these losses is, therefore, evident. Unfortunately, the knowledge of how to do this is very incomplete at the present time and we must state at the outset that no plan can be offered which may be counted on to clean up abortion troubles in the way that tuberculosis may be cleaned up. There are, however, certain preventive measures that any breeder may use which will decrease his losses, and it is these measures which we will take up.

239. Definition of terms.—There is much confusion in the use of terms in discussing breeding troubles and it is necessary to state at the outset just what we mean by certain terms. Abortion is the premature birth of a dead calf. The premature birth of a live animal or the birth of a weak or dead calf at term are not abortions strictly speaking, but they are related troubles which may have a similar cause. Retained afterbirth commonly goes along with these other troubles and sterility is a frequent result of them.

240. Causes of breeding troubles.—Occasionally accidents may cause premature birth but this is not a very common cause. Everyone agrees that abortion is generally due to an infection, but whether this infection is due solely to a specific organism, B. abortus, or whether a variety of infections may cause an inflammation of the uterus and result in a premature birth are points which are in debate. Lack of mineral matter in the ration has been given as a cause of breeding troubles. In fact, many have been led to believe through garbled reports of experimental work and through statements of unscrupulous persons having mineral mixtures to sell that feeding the proper minerals will prevent and cure abortion. This is untrue. No infectious disease can be cured

or entirely prevented by feeding, but the question of feeding cannot be ignored in this connection.

241. How the diseases are spread.—It seems clear that infection may gain entrance both through the feed and through the genital organs and perhaps by other means. It is not known what is the most common way. Experience indicates that an entire herd may become infected by a bull having infected organs; on the other hand, many infections have occurred where the bull quite evidently had nothing to do with them. B. abortus, the specific organism, has been found in the milk and in the discharge from the vagina of cows that have aborted; thus, these are sources of infection.

242. Preventive measures.—Since we know that abortion and related troubles are due to an infection but are not sure as to its source or method of spreading, the preventive measures must be primarily those of general sanitation. Cows which abort or calve prematurely and even those which calve normally may have a discharge from the vagina which is dangerous to other animals. Such a cow should be placed in a separate pen until the discharge has ceased. A cow should be so isolated as soon as there is any evidence that an abortion or premature birth is likely to occur. If abortion takes place the foetus and afterbirth should be burned. When a cow is removed from the separate pen after the discharge has ceased, the bedding should be burned and the pen scrubbed and sprayed with a coal-tar disinfectant. This isolation cannot be expected to stop all abortions, for others will occur from cows already infected and cows may become infected from some other source. Isolation simply shuts off one channel of infection.

There is no point in keeping a cow that has aborted isolated after the discharge has stopped. It is true that she may retain the infection in her system, but there is little danger of the spread of the disease merely from a cow being stabled next to one that has aborted. Further, cows which are due to abort may be giving off the infection in their milk and thus be a menace, but they cannot be isolated because they are not recognized.

243. Infection in calves.—It is a good practice not to feed milk from a cow, which has just aborted, to calves, since the specific organism has been found in milk and since it may enter through the digestive tract. However, this is only a partial safeguard since cows which have not yet aborted may be infected and may infect their milk.

244. Infection from bull.—Since infection is possible through the bull, the question comes up as to what preventive measures should be used with him. Here we are handicapped by lack of knowledge. This method of infection is difficult to combat and we do not know how big a factor it is and thus how much it is worth while to try to do. Some douche the sheath of the bull before and after each service. This could be done after instruction from a veterinarian but we do not know whether it is worth while or not. A periodic examination of the bull by a veterinarian would help but we are not prepared to say that the danger of infection is great enough from this source to justify the cost of the service.

This brings up the question of how far the breeder should go in getting veterinary service in connection with abortion. This depends on the value of the herd and the distance from the veterinarian. We believe he can be of service in advising as to sanitary measures to be carried out, in examining the cows and bull, in cleaning out the genital organs, etc., and that with the real support and co-operation of the owner he can keep the herd reasonably free from the disease.

245. Liberal feeding a help.—Improper feeding cannot cause an infection but it may put the animal in such a condition as to be more susceptible to it. A properly fed animal will resist infection where a poorly fed one will succumb. As regards reproduction troubles, experience seems to indicate that the liberal feeding of heifers makes them less likely to abort. A cow which depletes her reserves during a heavy and prolonged lactation should reasonably be expected to stand the strain of calving better if these reserves are built up during the dry period. This consideration is being given particular attention at the present time with respect to the feeding of minerals. Both experimental

work and practical experience indicate that a continued lack of adequate mineral matter may increase breeding troubles. The minerals which are important here are lime and phosphorus. The evidence is not sufficient to say that a lack of these minerals is an important cause of abortion, but we do believe that adequate mineral nutrition should be considered along with the general question of feeding to put the cow in the best possible condition at calving time. (**12, 13, 38, 89**)

246. Retained afterbirth.—The afterbirth should normally drop away in a few hours. Cows which abort are likely to retain it. Only an experienced person should attempt its removal, for if not properly removed and at the proper time, sterility is apt to result. Sterility frequently follows retained afterbirth anyway, but proper handling of the afterbirth will decrease the likelihood of its occurrence. (**17**)

247. Sterility.—Sterility frequently follows the troubles previously mentioned. A variety of causes may prevent conception or cause the early, unobserved expulsion of the foetus. Where an animal fails to conceive, a veterinarian can sometimes correct the trouble and his services should be enlisted if the cow is of sufficient value; otherwise, get rid of her. Get rid of her anyway if the veterinarian fails to correct the trouble.

248. Cutting down breeding losses.—In summary, we believe every breeder can decrease his breeding troubles by thorough sanitary measures. When an abortion takes place the foetus and afterbirth should be immediately burned. Any cow which has a discharge from the vagina, even if she has calves normally, should be placed in a separate pen until the discharge has ceased. When she is removed from the pen, it should be scrubbed and disinfected and the bedding burned. No milk from cows which have recently aborted should be fed to calves. One should not buy an animal which has just aborted nor purchase from a herd with a high record of abortions. Finally, we believe that every breeder that can possibly afford it should put his herd in the hands of a competent veterinarian, for we do feel that the cost of the service will be more than repaid in decreased losses.

CHAPTER XVIII

A FEW COMMON AILMENTS OF CATTLE

249. Garget.—This is a disease of the udder characterized by inflammation and swelling and the production of stringy and sometimes bloody milk. It may occur at any time either during the lactation or dry period. One or more quarters may be affected. Exposure to severe weather, lying with the udder on a cold floor, bruises and overfeeding are the most frequent causes of garget. An infection is probably always present in a gargety udder; thus the trouble may be spread by the hands of the milker and in other ways.

250. Treatment.—Mild cases of garget if promptly recognized and treated can usually be cured by home measures. A physic such as a pound of epsom salts should be given and the grain ration reduced by at least one-half. Follow the purgative by a tablespoon of saltpeter each day for three days. It frequently helps to massage the udder with lard, camphorated oil or some similar oil. The cow should be milked regularly and frequently—perhaps as often as every two hours. Catch the milk in a pail and throw it away outside the barn, rather than let it go on the floor and thus give the infection a chance to spread. We advise against the use of a milking tube because of the danger of further infection. The animal should be kept in warm dry quarters and her ration should be laxative and light.

If the trouble does not respond to the above treatment in a day or two, a veterinarian should be called. If the disease comes on suddenly and the udder becomes hot and tender and no milk can be drawn from it, it is best to call a veterinarian at once. These severe cases are very likely to result in the loss of a quarter, or perhaps the entire udder, for the rest of the lactation period, or even permanently.

Good bedding will remove one cause of garget. Thorough washing of the hands after milking a gargety teat is essential to

prevent the spread of the infection to the other teats of the cow and to the other cows of the herd. The inflammation of the udder frequently occurring at calving is not the same thing as garget. (16, 17, 18)

251. Bloat.—In this trouble the paunch fills up with gas and there is an excessive distention of the left side in front of and above the flank. Bloat is caused by eating spoiled feed or too much green feed, particularly when the cow is not used to it. The trouble frequently occurs when cows are first turned out on legume pasture. It may occur with any kind of feed. Mild cases of bloat may be relieved by giving a good physic and keeping the animal's mouth open so as to let the gas escape. If a piece of fork handle is tied in the mouth as a bit, the cow chews the stick and gas comes up. If a bloated animal is kept moving this stimulates the action of the rumen and may help liberate the gas.

If none of the above remedies relieve the trouble it is necessary to pierce the flank and let out the gas, for if bloat continues death may result from suffocation or from rupture of the stomach. For piercing the flank, special instruments, a trocar and cannula, are needed, but a pocket knife may be used in an emergency. This is a task for a veterinarian, unless one knows just how to do it.

252. Indigestion.—This trouble may result from a variety of causes the most common of which are overeating, spoiled feed and a sudden change in the ration. The first symptom is refusal of food and frequently the cow stops chewing her cud. The manure is usually abnormal, sometimes hard and dry, sometimes liquid. In severe cases the bowels may refuse to move. Treatment consists of giving one pound or one pound and a half of epsom salts, or a quart or more of raw linseed oil. When the cow commences to show appetite again a light palatable ration should be given.

253. Foot rot.—This trouble, also called foul foot, is an infectious disease generally occurring between the toes. The first symptom is lameness and there is a foul odor due to the discharge of pus. Once foot rot is present in the herd it is difficult to get rid of it, because the germs live in the mud around the barn. The first treatment should be to make sure that the affected animal

has a dry place to stand in. This means a dry cattle yard. The diseased hoof should be thoroughly cleaned, using a brush and soap suds. Then it should be swabbed with a 20 per cent solution of creolin. The cleaning may be repeated. If the treatment does not prove effective, veterinary assistance should be obtained.

254. Prevention.—A very simple way to treat foot rot and prevent its spread is to have all the animals walk through air-slaked lime. Put a shallow box of lime just inside the stable door. Build it as wide as the stable door and five or six feet long and four inches deep. Put into it about three inches of loose air-slaked lime. Stir the lime up each day before the cows come into the stable. This will help with foot troubles coming from muddy pastures.

255. Teat troubles.—Frequently the teats become sore. In cold weather this may be due to chapping. To treat this, first wash with warm water and castile soap, then rub on carbolated vaseline. Sometimes the ends of the teats become sore due to an infection. This soreness is very hard to get rid of. Our suggestion is to take a 5 per cent solution of creolin in a basin and dip the ends of the teats in it regularly after milking.

256. Lice.—Cattle are frequently infested with lice, particularly in the winter season. Calves and young stock are most often affected. Lice may be suspected where the animal is frequently rubbing its neck and shoulders against posts, trees, etc. The hair may come out in long-standing cases. Kerosene emulsion is an excellent remedy. To make this emulsion, first dissolve one ounce of ordinary soap in one pint of boiling soft water. Then add this to one quart of kerosene. Place the mixture in a bottle or Mason jar large enough so that the mixture can be well mixed by shaking. Cork up the bottle and shake until a foamy emulsion is formed. Finally, add nine quarts of water and apply with a spray gun or brush. The hair of the animal must be thoroughly wetted. In winter time, if the quarters are cold, one should hesitate about following this procedure. An alternative is to brush crude oil thoroughly into the coat. Whatever treatment is used it must be repeated at least once after fourteen to sixteen days to kill lice

which were in the egg stage during the first treatment and thus unaffected.

257. Warbles.—Everyone is familiar with the lumps on the cow's back caused by the warble fly, but few appreciate that these lumps are just one phase of the effect of this fly. The warble or heel fly lays its eggs on the heel. The eggs develop into grubs which burrow into the skin and travel all through the body. After about eight months they work up under the hide on the back and develop further, producing irritation and pus formation, until they finally emerge and drop off to change to mature flies and start the egg-laying process again. The grubs harm the animal all the time they are in the body and hurt the value of the hide for leather. The treatment consists of squeezing them out of the hide and killing them so they will not develop into the egg-laying flies. If this is done thoroughly for the entire herd, the pests can be got rid of.

258. Wire in feed.—So many cases of death in cattle occur from the swallowing of wires and other sharp objects which later pierce the heart, that it seems worth while to emphasize the need of preventive measures. The wires of label tags on the feed bags, wire bristles out of the cleaning brush, nails, screws, tacks and many other sharp objects have caused death through heart puncture. Of course the thing to be done is to be constantly on guard against such objects getting into the hay or feed that the animal eats.

259. Scours.—Both common and white scours have been discussed (**63, 64**) in connection with the rearing of calves.

CHAPTER XIX

THE DAIRY BARN AND OTHER BUILDINGS

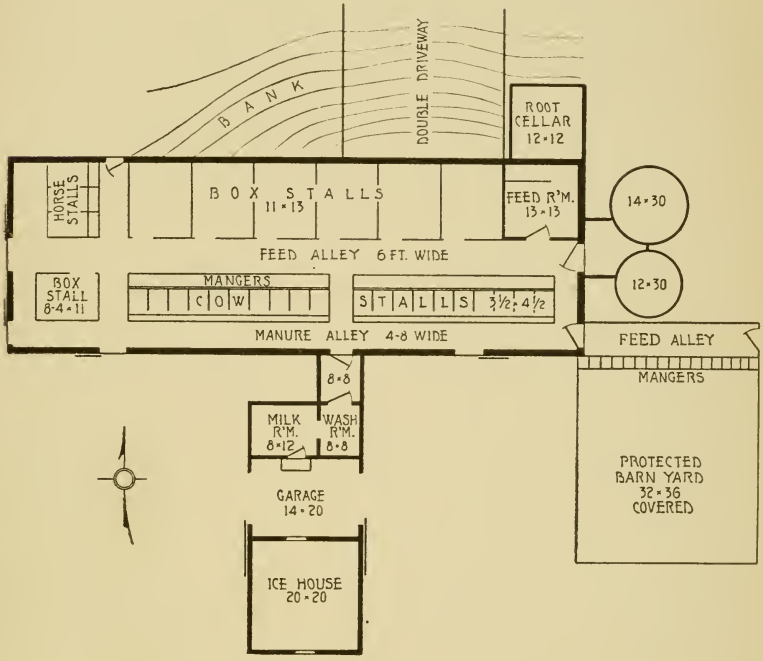
More than anything else the dairy barn should be a place where the cow will be comfortable and be able to do her best. That production is greatest in the early summer on pasture is partly due to the feed, but the ideal surroundings are also a factor. There is an abundance of fresh air and sunlight and the temperature is moderate. The animal is free to move and the surroundings are clean and in every way comfortable. We should reproduce these conditions in the barn as far as possible. Thus it should be well lighted and ventilated, warm and clean. Space should be provided so that the cows need not be stanchioned all the time.

260. Convenience.—The dairy buildings must be constructed with an eye to the convenience of the dairyman so that he can do his work as easily and quickly as possible. This calls for the proper location of each building with respect to the other and the proper arrangement within the dairy barn. How these things may be realized is best indicated by describing a specific plan for a dairy barn and related buildings. Such a plan is shown.

261. A suggested plan.—The plan on page 163 does not go much into detail but serves to illustrate a type of layout which provides for the cow's comfort at all times and saves many steps for the dairyman. The plan is actually being worked out on an eastern farm. It provides for a bank barn, with the bank on the north side, but the bank does not extend more than one-half the length, so that there will still be plenty of light in the basement stable. A basement stable with light along one side only does not allow sufficient window space, nor proper ventilation, unless a special system is installed. Space for 20 cows in stanchions is provided and there are several box stalls. There is also provision for three horses.

The barn is 100 feet long and 34 feet wide. This gives a working space inside 98x32. It is better in planning a new barn to build

36 feet wide. We give the plan of the smaller barn to show how the space could be used in remodeling an old barn. We do not think it worth while to show many elaborate plans. Each man must work them out for himself. Start with the ideas we suggest



Floor Plan for Handy Dairy Barn

and then plan very, very carefully the modifications you want to make suited to your own conditions. The dimensions we give should be modified if necessary to suit your own farm.

262. The covered barnyard.—We are very firm advocates of the covered barnyard. The plan suggested is one which one of the authors is working out on a farm of which he is part owner. He is buying an old barn and moving it to the farm to make this covered yard and a run for young stock and a bull pen.

263. Arrangement of barns and yard.—The buildings other than the barn proper are all arranged both with the idea of convenience and also of protecting the barnyard from winds. The milk house, ice house and garage form the west side of the yard. On the east is another barn with an open basement. The basement is designed to furnish a shelter and feeding place for young stock and dry stock, since it is convenient to the silo and feed room. The bull pen will go in this barn. Up over this basement or covered barnyard is to be stored the hay for the young stock. Along the north side of the covered barnyard is shown the feed alley for the young stock. It is intended that the manure should go through this alley into a manure pit on the east. Along this alley are to be mangers in which the young stock are to receive their grain. It is intended that they shall be tied up only a short time while they are eating their grain and silage, with the idea that they will have free access to hay in racks somewhere else in the covered barnyard.

Two silos are shown. The smaller one will be used as a summer silo.

264. The plan of management.—The open barnyard is very well protected on the north, west and east sides. On pleasant days the dairy cows can be turned out into the sun. If it is a little too cold for the milking cows to go out into the open barnyard, the young stock running in the covered barnyard can be turned out into the open barnyard and the milking cows put into the covered barnyard for their exercise. This will enable the dairyman to insure reasonable exercise for his cows every day and he can take care of his young stock in the open barnyard with a minimum of labor. This covered barnyard connected with the sheltered yard and stable will insure the maximum of comfort with a minimum of labor.

265. Care of the manure.—It is planned to build a manure shed with pit at the east end of the feed alley shown in the covered barnyard. Then the manure can go easily from both the stable and the covered yard to this manure shed. We believe a manure shed should be provided because it is seldom convenient to get out

the manure every day even though highly desirable. Hogs can run on the manure in the manure shed and thus it will keep better. It is desirable also for hogs to follow the young stock and dry cows in the covered yard in the same way that hogs follow beef cattle to clean up the grain wasted in the droppings.

266. Ventilation and light.—The plan gives no details of construction. Proper ventilation must be provided. In very cold weather it is difficult to secure the proper amount of ventilation with windows alone without overdoing it. Ventilation which is satisfactory in all temperatures requires some special construction. A large flue opening from the ceiling and extending to the roof takes out the foul air. Fresh air comes in by several smaller openings. This system will work only where the barn is so tightly constructed that the air cannot get in or out, except through the flues provided. (**272**)

To provide adequate light there should be four square feet of window glass per cow. The bottom of the window should be about four feet from the floor and the window should extend to the ceiling.

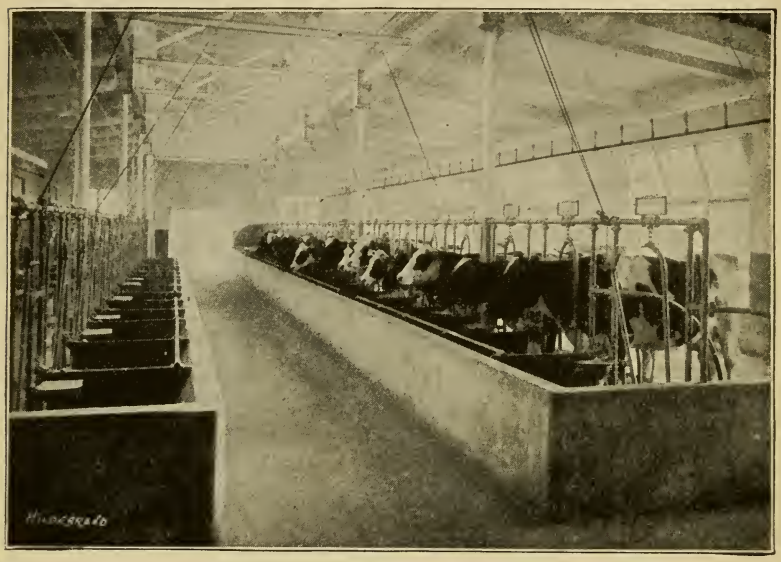
267. Dampness.—To guard against dampness, the barn should be located where there is good drainage and the floor should be so constructed as to be impervious to moisture. A poorly drained location means a muddy barnyard. This in turn means dirty cows, more chance of foot rot and rheumatic troubles. An ideal dry floor can be constructed by putting down a layer of concrete, then a layer of tar paper and covering it with concrete two inches thick. Do not finish the concrete smooth. Leave it rough so that the cows will have a better foothold.

In the plan we have described, the barn has its long way from east to west, with the side having full window space facing south, to take full advantage of the sun. Where no part of the barn is banked, it is preferable to have the long way from north to south to allow the sun to get at both sides at some time during the day.

268. Facing the cows.—It is always best to arrange the barn to provide for a double row of cows. The question frequently comes up whether the cows should face in or out. If a manure carrier is used, it is better to have the cows face in, as it saves time

in feeding and causes no loss in cleaning. We show a suggested plan for utilizing the space with a double row of cows in a barn 34 feet wide. In a 36-foot barn a wider feed alley and a wider walk behind the cows will be available.

269. Build for essentials.—In building a barn one should put his money into essentials only. Sometimes a farmer puts unnec-

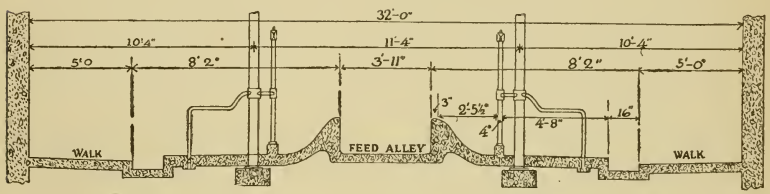


Interior of Modern Dairy Barn. Good Type Manger.

essary money into a barn in a desire to have a good looking one, perhaps a better one than his neighbors. The money should be spent for the things that make for labor-saving and for permanence rather than for show. A barn will last as long as its roof and foundations. Paint adds to the appearance but its importance in adding to the life of the barn has been overemphasized. After the essentials of housing have been provided, any extra money the farmer may have should be invested in animals, not in showy equipment. A good cow pays a dividend. An unnecessarily expensive barn means more outgo for taxes and upkeep.

270. Relate the barn to the farm.—There is one other thing worth while to bear in mind in planning a new building. It should be in keeping with the farm. One should not build an expensive barn on a cheap farm, nor a larger barn than the amount and quality of the land justifies. Money so spent will by no means be realized when the farm is sold. Even if it remains in the family, the money invested in buildings out of proportion to the value of the farm represents an over-capitalization which will give no return.

271. Remodeling old buildings.—The plan previously described represents what could be done if an entire set of dairy



Cross Section of Stable Showing Plan for Cement Work

buildings were to be built. Of course, the building problem that most face is one of remodeling or enlarging the dairy barn, or adding some unit such as a silo or milk house. In rearranging or adding to the farm buildings, a careful plan should be worked out looking towards convenience and labor saving. In the past farm buildings have been put up at different times, usually without any definite plan. The farmer cannot tear down his buildings and start over but he can go over his layout to see if there are not some changes which can be made sufficiently cheap to be justified in terms of labor saved. Further, he can work out a careful plan with respect to any building or remodeling he may do in the future, so that any further construction may correct, in so far as possible, the mistakes of previous haphazard building.

272. Aids to building.—The strongest suggestion we can make is to build on paper before doing anything else. The manufacturers of barn equipment are very willing to help any farmer

with his building problems. Consult them and get their advertising booklets. The illustrations will help and give many useful ideas. These companies maintain competent engineers who will furnish plans for new buildings or for the rearrangement of old ones. The cost of this service is very small compared with the help that can be obtained. The best known companies are the James Manufacturing Company, Fort Atkinson, Wisconsin, or Elmira, New York; the Louden Machinery Company, Fairfield, Iowa, or Albany, New York; or Hunt, Helm, Ferris & Company, Harvard, Illinois, or Albany, New York.

Most of the agricultural colleges of the various states have agricultural engineering departments in which the problems of farm buildings are treated. We have tried all through our discussions to interest our readers in utilizing these public agencies, namely, their farm bureau agents and their colleges of agriculture. Right here is an opportunity to get very definite help. One or two little suggestions from an engineer may be worth a great deal to a farmer planning to build. Again, be sure to build on paper first by drawing and studying plans.

CHAPTER XX

HOW TO PRODUCE CLEAN MILK

MILKING MACHINES

Clean milk can be produced if just two things are borne in mind in the operations connected with it. These two things are cleanliness and coldness. Cleanliness means a clean cow, clean utensils and a clean dairyman. The practical question is as to just what things must be done to get this necessary cleanliness. Entirely satisfactory milk can be produced by paying attention to a few essentials that need not entail much extra expense or labor.

273. First, a clean cow.—The first essential is a clean cow. This means a healthy cow. Milk from tubercular animals or those with udder troubles is dangerous. Then the cow must be clean on the outside to keep dirt and manure from getting into the milk. Many think of this as meaning lots of washing and grooming but these processes can be reduced to a minimum if care is taken to keep the cow from becoming covered with manure and dirt in the first place. This means good bedding and keeping the stable clean. Then, by brushing the cow daily to remove loose dirt and hairs, giving especial attention to the region of the udder, a satisfactorily clean cow will result. It will also help to sponge off the udder and teats with clean water. A small-topped milk pail is the simplest way to keep the dirt out.

274. Clean utensils.—Pails, strainers and other utensils should be first cleaned with warm soap and water, using a brush. Be sure to get into the cracks along the seams and elsewhere. The utensils should next be rinsed and then scalded with boiling water. Heating in steam is better if it is available. The object of this thorough cleaning is to kill the bacteria, which will multiply rapidly as soon as warm milk is put in the utensils. The scalding is the most important part of the cleaning process. Hanging the utensils in the sun to dry will also help a lot. It is better to let the

utensils dry by themselves than to wipe them out. Finally, do not forget to wash the brush used in scrubbing the pails.

275. A clean farmer.—The dairyman himself must be clean—he must have clean clothes and clean hands. The overalls worn by the milker do not need to be white but they should be different from those bearing the accumulated dirt of the farm and they should be washed frequently. The next thing is clean, dry hands. There should be soap and water and a towel at a convenient place. Milk should not be handled by anyone suffering from a contagious disease.

276. Cool the milk at once.—Keeping the milk clean as we have outlined above keeps most of the bacteria out. But the few that do get in can multiply rapidly and the next essential is to cool the milk at once and keep it cool to keep down the bacteria as much as possible, for the product is graded with respect to cleanliness by counting the bacteria in it. Effective cooling means bringing the milk to 50° F. or lower within an hour after it is drawn. There is no question but that cooling the milk to near its freezing point is better but it is expensive. The best way to cool the milk down quickly is to run it over a cooler in which cold water also circulates. Many such coolers are on the market. Ice water is preferable to use for this cooling but many farmers pump well water through the cooler with satisfactory results. Sometimes the water as it comes from the cooler is run into the watering trough.

277. The milk tank.—Next to the use of a cooler through which water circulates, the best method of cooling is to set the cans in a tank of ice water and stir the milk frequently. This method requires the least labor and equipment and is perhaps the most practical for the average dairyman. Once the milk is cooled it must be kept so until it is consumed, for cold does not kill the bacteria and they will become active if the milk gets warm again. Thus milk which has been run through a cooler should be kept in a tank of cold water thereafter.

There are other things sometimes emphasized in producing clean milk—avoiding dust in the air at milking time, having the barn floors and ceilings tight, etc. Dust does add dirt to the milk

but this is of very small importance compared to the dirt that gets in from the dirty cow or from the milker who is careless as to his personal habits.

278. Flavors and odors.—Garlic is particularly apt to give milk a bad flavor if eaten in any quantity. Large quantities of cabbage or turnips may do it. Sometimes it is something else which the animals have eaten in the pasture. Milk will absorb odors and sometimes it gets contaminated while standing in the barn. Spraying the cows immediately before milking is occasionally responsible. Where tainted milk occurs the farmer must check up on what his animals are eating and the other possibilities in an endeavor to locate the trouble. To guard against flavors and odors getting into the milk after it is drawn, the milk should be removed from the stable at once. It will help to have the milkroom separated from the barn by a passage so that the milkroom itself will always be clean and free from barn odors.

Feeds that might flavor the milk through the cow should be fed only and at once after milking. The flavor will then not get into the milk. Cows may be pastured on wild onion or garlic infested pastures if they can be removed from such a pasture four hours before milking.

279. Milking machines.—With the increasing difficulty of getting men who like to milk, or those that will do a thorough job, many owners of good-sized herds are wondering whether they should install a milking machine. Many factors are to be considered, and perhaps we can help a man make a decision by pointing out some of the things that have been found out about milking machines by those who have used them.

280. Labor saved by machine.—In the first place, does a milking machine save labor? Mr. H. E. Babcock gave a direct answer to this question in the Jan. 27, 1923, number of the "American Agriculturist." In summarizing the experience on one of his own farms he wrote: "Based on our experience to date, it would seem that one man using a milking machine can milk and care for eighteen cows three times a day about as comfortably as he can milk nine head by hand." Others have given similar evidence.

281. Yield is maintained.—How does the use of a milking machine affect the yield? Experience indicates that where cows are stripped by hand after machine milking, as they always should be, no decrease in yield is, in general, evident. Of course, some cows do not take kindly to the machine and sometimes cows shrink prematurely with machine milking. These instances are not common. A larger question deals with the quality of the milk —whether as clean milk can be produced by a machine. The answer is, "yes, with proper care." The care is a question of properly cleaning and sterilizing the machine after use. Some very satisfactory methods of doing this have been worked out at the New York State Experiment Station at Geneva, New York, from which the exact details can be obtained. We know of cases where certified milk has been produced with milking machines, following the Geneva methods as to care.

282. Machines save money.—The relative cost of machine and hand milking is another very important question. Bulletin 241 of the Illinois Experiment Station, published in 1923, furnishes an exact and up-to-date answer to this question. By a survey of some sixty farms it was found that the average annual saving in expense resulting from the use of milking machines was $3.23 per cow in herds of less than 25 cows, and $5.70 in herds of over 25 cows. These differences are based on a labor rate of 17.5 cents per hour. For higher rates, the advantage would be more in favor of the machine.

283. Milking machines not complicated.—It is generally accepted that the milking machine has been perfected so that it is mechanically satisfactory. It will give no more trouble than the more common pieces of machinery used on the dairy farm. Users are also in fair agreement that the use of the machine does not harm the cow in any way, provided she is stripped by hand to avoid udder troubles.

284. Keeping individual records.—One drawback to the use of the milking machine is that it prevents the keeping of individual production records. Such records are desirable for proper feeding and for keeping tab on whether a cow is a profitable producer. The

only way to get around this difficulty is to milk each cow by hand at frequent intervals, say once a month. Of course, this means extra work and many will not do it. Thus, the use of the milking machine is objectionable because it is wholesale milking. Interest is lost in the individual animal because the owner does not know what she is doing.

We have covered the common questions about milking machines. In herds of twenty cows or more, it would seem to be economical on a cost basis. We believe that most dairymen will find the milking machine satisfactory.

285. A special market.—The dairymen who are apparently making the most money are those who are marketing their milk direct to consumers at a high price. Good, clean, cold milk is worth fifteen cents or more per quart and cannot be manufactured and sold in bottles for less and yield a reasonable profit. There are thousands of families in a thousand towns that want clean milk and they are glad to pay fifteen cents a quart for it delivered to them cold in bottles. These special markets can be developed in almost any town of 5000 people or more by dairymen who will go after their customers and give them clean milk. (**39**)

286. Four per cent milk wanted.—The milk should be guaranteed at least four per cent butter fat and if the cows do not produce this kind of milk it should be standardized to this per cent by separating some of the milk, using the skimmed milk for feeding calves and pigs and using the cream to bring the balance of the milk to four per cent. It is probable that one will do better in developing a special retail market to choose one of the breeds that will produce a milk testing four per cent or better. Then advertise and push that milk.

287. Ten thousand bacteria the limit.—In developing a special market, cleanliness is all-important. The clean cow, the clean utensils, the clean stable, the clean wagon, the clean man, and most of all it is the attitude of the man doing the work which keeps the bacteria count down and the milk cold. Clean milk must be delivered with a bacteria count of less than 10,000 to command the price that will make a profit.

288. Milk must be uniform in quality.—The milk must be the same in quality every day. This is not hard if it is watched at all points. Two fundamental things are true. The milk is clean in the udder and it will keep clean if the dirt is kept out and the milk is kept cold. Keep the dirt out, as it cannot be strained out if once it gets in, and cool the milk at once and keep it cold. If this is done with clean utensils the bacteria count will be low.

289. Advertise.—When you once know that you have a clean, uniform product, advertise that milk at a good price and you will get the trade. Invite the doctors, teachers, ministers, and mothers to visit your farm and show that you have a clean place, clean cows, clean helpand clean milk. They will all tell their neighbors. Not all of us can have a special market, but more can have one than have one now by just knowing the meaning of the word "clean."

CHAPTER XXI

BUYING AND SELLING DAIRY CATTLE FITTING FOR SALE AND SHOW

Grade Cattle

We should figure our income principally on the receipts from the milk produced by our cows every day. That should really be the foundation of our business. Therefore, the utmost attention must be paid to feeding, breeding, care and handling of our herds. However, the buying and selling of cows will always be a big factor in the money success of the dairy farmer.

290. Buying grade cows.—When we go to buy cows we should look for size, evidences of production, and a good amount of flesh. It is always a good thing to buy some feed along with a springer. If she is too thin she will not carry through in her next lactation to the best advantage. The lesser price at which the thin cow can be bought will not pay for the feed that will be necessary to put her back into condition to do the best at the pail.

291. Disease.—Find out if you can the health history of the herd from which you buy cows. Buy only tuberculin tested animals. Buy only from herds that are free from abortion. It is a big job to find herds that are as clean as we suggest, but it will pay to look further and pay a little more to get this kind of stock. Because if we are to carry out our plans and breed these cows, they must be clean when we get them. If we buy springers and are going to save their heifer calves, we must get cows that are bred to good pure bred bulls.

Wisconsin probably sells more grade cattle than any other state in the Union. Professor G. C. Humphrey and A. O. Collentine, in a circular published in October, 1922, summarize what good buyers demand.

292. Dairy cattle market demands.—"Buyers demand certain standard conditions that will enable them to buy most con-

veniently and successfully the cattle they wish to obtain. The most important of these are:

"Communities or counties that are organized and producing a large number of cattle of a given dairy breed. This condition enables buyers to secure their 'pick' quickly, with little travel, and to load and to ship from a single shipping point at the least expense in time, trouble and money.

"Community breeders' associations for the improvement of dairy cattle have been growing in Wisconsin since 1906. They have been the means of securing united effort by a large number of farmers within their territories on the breeding of high grade and pure bred dairy cattle and in serving buyers in the most advantageous manner. Some of these associations have reached a development where the secretary or some member devotes his entire time to promoting the interests of the association and waiting on buyers.

293. Animals that are well-bred and well-developed are wanted.—"Two questions are invariably asked, 'Are the cattle sired by a pure bred dairy sire?' and, where animals are of breeding age, 'Are they bred to a pure bred sire?' Nearly all of the buyers who come to Wisconsin to make purchases are either judges of cattle or are accompanied by a county agricultural agent or a dairy specialist capable of exercising good judgment in making selections. Experience has taught, or is fast teaching, farmers that the best cattle are the most profitable for them to select for foundation stock and milk-producing herds. A common remark made by buyers is: 'If I can only take back this first car of the right kind the farmers of my community will be in the market for many more carloads. If they can see but once the value of a *real* cow they will convince their neighbors of the importance of securing good cows.'

294. Cattle of known production are in demand at a premium.—"Cows with known and creditable production, or the offspring of such cows, are always in demand at highest prices. Cow-testing associations enable many farmers in Wisconsin to know records of their grade cows and to secure from $10 to $25 more a head for production record cows than buyers are willing

to pay for untested cows. For several years Wisconsin has established a 'Register of Production' for 'a-pound-a-day' cows, those that make a cow-testing association record of 365 pounds or more of butter fat in a year. This register is helpful in locating herds and cows with creditable records of performance made in cow-testing associations. There are 110 active cow-testing associations in Wisconsin with a membership of 3,200 members having

Guernsey Cows at Pasture

54,661 cows on test. Buyers seeking pure bred cattle demand the offspring of those having official or semi-official records. Such animals command a much quicker sale at much higher prices than purebreds without such records. Testing for official or semi-official records of pure bred cattle is becoming a more common practice in Wisconsin each year.

295. Only cattle free from disease are wanted.—"It is not only desirable for buyers to purchase cattle free from tuberculosis

in order to establish clean herds, but it is necessary for them to secure such cattle, owing to health certificates that must be furnished before cattle can be shipped to most of the states. Wisconsin breeders are able to furnish buyers with animals free from disease. For several years a campaign to eradicate disease has been carried on, and Wisconsin has been one of the leaders in tuberculin testing. There are more federal-state accredited herds and more herds under supervision in Wisconsin than in any other state in the United States. Large areas have tested all animals, which fact lessens possible chances of infection and makes it possible to buy stock generally free from disease.

296. Buyers from out of the state naturally prefer to go to counties having a county agent.—"Practically all of the purchasers coming to Wisconsin to buy cattle are instructed or accompanied by their own county agent or dairy specialist. These men recognize the Wisconsin county agricultural agent and realize that he is familiar with the cattle of his county; county agents take particular pride and interest in having buyers secure the kind of cattle that will be of lasting credit to the county in which they are purchased and become a standing advertisement for future business. With the aid of the agent who is familiar with his county, buyers save much time and inconvenience in making purchases. In the encouragement and assistance that county agricultural agents can give to the breeding and selling of dairy cattle they are of great service in giving the state its deserved reputation."

Pure Bred Cattle

At the time when this book is being written (1923) it is surely a seed time for the pure bred cattle business. Pure bred cattle are relatively low in price. The harvest is coming in the next ten years. The world is not always going to be upset. As the world settles down and foreign markets develop, the pure bred cattle market will improve.

297. Buying pure bred cattle.—We had the pleasure of buying the bred Guernsey heifer, Aurora of Willow Lane, 120016, for a friend at the Wisconsin State Sale of Guernseys in March,

AURORA OF WILLOW LANE

Born February 28, 1921

Owned by American Milling Co., Peoria, Ill.

Imp. Flora's Sequel II of Le Briquet No. 61807

This bull has an exceptionally good pedigree. He is backed by some of the best breeding. His dam is by the only bull of the breed to have over 100 A. R. daughters.

His sire's dam has a record of 783.10 lb. B. Fat, which was made on Island of Guernsey and she was a wonderful show cow.

His dam's dam is by Golden Noble II (1836 P S) A. R.

Sire of 29 A. R. daughters including several with records over 700 lb. B. Fat.

Valentine's Honor of the Passee (R G A S 3784 P S)

6 A. R. daughters including:

Imp. La Belle Valentine A. R. 9333

Milk 10722.90 lb. Fat 552.28 lb.

Imp. Valentine II of Carteret

Milk 9789.10 lb. Fat 550.79 lb.

Imp. Flora of Edgemoor No. 94252

Milk 11035.70 lb. Fat 530.30 lb. at 2 yrs.

Dam of Imp. Lady Flora II of the Briquet

Milk 6517.50 lb. Fat 349.19 lb.

Honoria's Sequel II (2816 P S)

King's Cup, 1913.

14 A. R. daughters including:

Imp. Sylph's Milkmaid of Albamont

Milk 13699.0 lb. Fat 647.0 lb.

Valentine III (7514 P S)

(Island A. R. 75)

Milk 15477.75 lb. Fat 783.10 lb.

1st prize, Champion and Challenge Cups, Whit, 1915.

King's Cup, 1915.

Governor of the Chene (1297 P S)

109 A.R. daughters including:

Imp. Loulou's Maid A. R. 5412

Milk 12191.40 lb. Fat 730.80 lb.

Imp. Bon Espoir XII A. R. 2738

Milk 15918.90 lb. Fat 713.30 lb.

Flora II of Le Briquet (R G A S 8724 P S)

Milk 11429.20 lb. Fat 573.56 lb.

Imp. Marie II of Quesnard No. 94241

A. R. 11131

Milk 7512.30 lb. Fat 416.80 lb.

Class CC.

Emperor of Quesnard (R G A S 194 P S)

Sire of Imp. Wild Rose of Grand Rue

Milk 8012.70 lb. Fat 337.55 lb.

Imp. Marie II of Quesnard

Milk 7512.30 lb. Fat 416.80 lb.

Lady Bird of La Siegneurie

Milk 7221.32 lb. Fat 414.3 lb.

Marie of Quesnard (R A A S 1098 P S)

Dam of Imp. Marie of Quesnard A. R. 11131

Milk 7512.30 lb. Fat 416.80 lb.

Umpire of Quesnard (R A A S 73 F S)

Sire of Imp. Cypress of Sarnia A. R. 5648

Milk 8969.60 lb. Fat 423.48 lb.

Daisy of Quesnard (R A A S 1986 P S)

Conqueror (R A A S 72 P S)

6 A. R. daughters including:

Imp. Lucy of the Courtils A. R. 1996

Milk 9709.30 lb. Fat 526.40 lb.

Imp. Duchesse of Chateau a l'etocq A. R. 2408

Milk 10249.50 lb. Fat 524.40 lb.

Betsey of Quesnard (R A A S 568 F S)

1923. Her pedigree is given on page 179 to illustrate what could be purchased at this time in the way of breeding in a very nice, straight heifer for $270. Her pedigree is well balanced along the lines illustrated in Chapter XV. One outstanding fact in her case was the fact that she was bred and safe in calf to Cinderella's King of Mound City, 40476, whose dam has a yearly record of 909 pounds of fat at six years. Therefore, a calf from this heifer, bull or heifer, will have a sire whose dam is a 909-pound cow. This illustrates some of the things to look for in buying purebreds along with individuality.

298. Advertising.—When owning purebreds it is well to have them of families that are being widely advertised. Then it pays to show all we can at fairs. Enough prize money can be won with good individuals practically to pay expenses, and inquiries for stock and sales made later will justify the adventure from every standpoint. It is a good thing to line one's animals up against a neighbor's for an impartial judgment and find out where one stands.

299. Fitting for show and for sale.—When selecting dairy animals for show they should have good size for their age. Straight top lines, good middles and clean-cut features in general are important. The females should have good udder development. The size, shape and quality of udder must be right. Well-placed teats are important. Cows just fresh or about to freshen show to advantage.

R. S. Hulce, Associate Professor of Animal Husbandry at the University of Wisconsin and a judge of dairy cattle of national reputation, teaches his students the following in regard to fitting dairy cattle for show and for sale:

300. The fitting ration.—"A good fitting ration might consist of equal parts by weight of wheat bran, ground oats, hominy and oil meal. Bran and oats tend to lighten the ration and give variety; the hominy puts on soft flesh and the oil meal helps to condition the animal and put on a sleek coat. Good clover or alfalfa hay and corn silage are important. The silage, however, should be discontinued some time before the animals leave home,

so that they will be receiving the same feeds that are to be fed while at the fair.

301. Blanketing and clipping.—"Each animal should be stabled and blanketed several weeks before the date for showing. The animals may be clipped or the long hair may be worked out by brushing the body with coarse sand paper tacked to a block for convenience in handling.

"The purposes of blanketing are to:

(1) Keep the animal clean;

(2) Sweat the hide and better its handling qualities;

(3) Help shed old hair and make the rest lay to the body.

"To aid in putting the skin and hair in condition, wash a few times with green or castile soap and water. Rub the hide well with a mixture of equal parts of sweet oil, soap liniment and alcohol. A mixture of goose grease and sweet oil is also very good. These mixtures not only improve the quality of skin, but add a gloss to the hair and give the body a very clean appearance. The mixtures mentioned should not be applied to white hair on an animal later than four or five days before showing because of coloration. For grooming, a soft brush is advisable. Avoid the use of a curry comb except for the purpose of removing dirt that clings tightly.

302. Horns and hoofs.—"The horns must receive attention. Scrape down the rough portions by the use of a file. The edge of a broken piece of glass is sometimes used after filing. Be careful not to make the skin sore at the base of the horns. When the horns have been worked down nicely, rub them with emery cloth to put on a smooth surface. For polishing, fix up a paste using sweet oil, powdered pumice stone or tripoli and add a little alcohol. Apply this paste mixture to the horn and rub with a woolen cloth. If the horns have been put in good condition before leaving home, polishing will be all that is necessary at the fair. The hoofs may be trimmed by use of pinchers followed by a rasp.

"It is necessary to do some clipping just previous to showing. This will include the tail above the switch and usually the ears and portions of the head or face and the belly. In the case of females, the udder should be clipped.

303. Training for the ring.—"A point often overlooked is that of breaking the animal to lead and to stand properly. If the efforts of the attendant are taken up in dragging and pushing an entry about, many of the good points which the animal might otherwise show are concealed. An exhibitor should have just one thought in mind while showing in the ring, and that is to give his entry every possible chance to show at an advantage. By this is meant that when his animal stands its feet are properly placed, back straight, and head alert. Any movement either on the part of the attendant or the animal should be as graceful as possible. A good animal poorly shown does not always get its just dues. 'Keep one eye on the judge and the other on the animal,' is the advice of experienced showmen. Until the ribbons are placed a good showman takes no chances of his animal slumping or going to sleep.

"Two or more breeders who feel that each individually does not have a sufficient number of animals that they wish to enter may well go together and put on a combination exhibit. This plan, carried out on a more comprehensive scale, may be made an excellent advertisement for a community or county association."

304. Fitting for private sale.—All the points covered so far for getting animals ready for the fair or the sales ring apply at home in the barn, if we are selling regularly our surplus stock at private sale. Appearances play a big part in the sale value of any herd. A buyer makes up his mind often when he first steps into the barn. He cannot help it. Therefore, keep the herd arranged properly in the barn to make a good show. Properly stabled they will appear uniform in size. The larger ones should be where they can be seen first. If the udders and tails and coarse hair on any part of the body are kept clipped off, much will be added to the appearance of the herd. Besides, it will be more pleasant to milk and the milk will be cleaner. Keep the switches washed and brushed out. This dressing up of the herd will add dollars to the selling price. We do not sell cows just "to get rid of them." Good salesmanship pays on the farm just as well as anywhere else, and is accomplished by attention to details.

CHAPTER XXII

HERD IMPROVEMENT

Keeping records of individual production is essential to profitable dairying. Not only are such records essential for economical feeding but also for eliminating from the herd the cows that are not producing enough to pay for their feed. It has been repeatedly shown that in herds where no records are kept, 25 per cent to 50 per cent of the animals are not producing enough milk to pay for their feed and care. They are an actual loss to the farmer every day he keeps them, yet such animals may stay in the herd for years. It is a surprising thing that such animals are found even in herds which as a whole are showing a good profit. This is because even the observing and experienced dairyman will frequently fail to discriminate between a profitable and unprofitable animal, unless he has some record of their production.

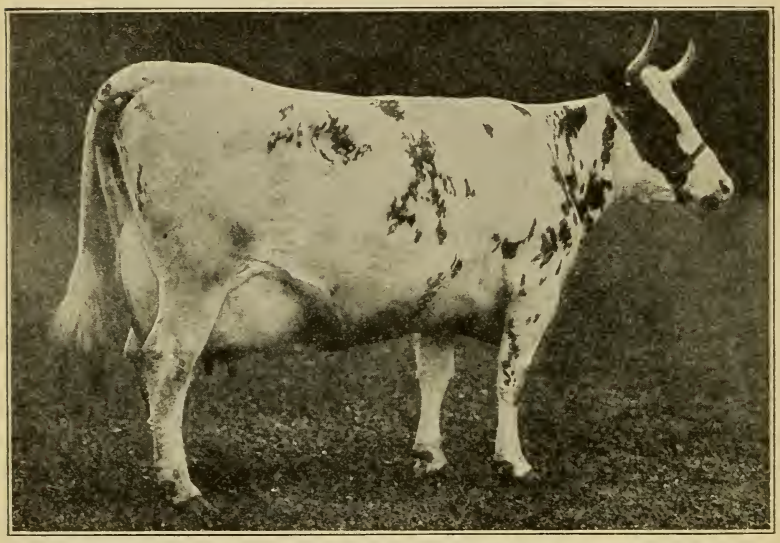
305. Production records.—Many farmers do not keep any production records because of the trouble and expense. It is a lot more expensive to keep several animals at a loss. The dairyman who will keep such records and act on them to get rid of his poor producers will save the cost many times over.

The records that are needed are the amount of milk produced, its fat content and the amount of feed eaten. From these records the dairyman can tell whether a given cow produced milk of sufficient value to pay for her feed and give him a fair return for his labor. These records may be kept by the dairyman himself or through some organization like a cow-testing association.

It will be easier to explain how these records are kept by first showing how it is done in an association.

306. Cow-testing associations.—A cow-testing association is made up of a group of farmers who employ an agent to make tests and keep records for them. This man visits each herd at least once a month, makes a record of the day's milk produced by each cow and determines its fat content. From these figures the amount of

milk produced during the month and its value are computed. The tester also observes what the farmer is feeding and weighs the day's feed, both grain and roughage. A good dairyman can give the tester a pretty good idea of how the amount fed on that day corresponds to what the cow has been getting during the month. The amount of feed for the month is thus estimated and its value computed. All of these figures are entered in a book



LILY OF WILLOWMOOR 22269

Record Ayrshire cow for butter fat. Yearly record 22,596 pounds of milk, 955.56 pounds of butter fat. Owned by Gossard Breeding Estates, Martinsville, Ind.

which the farmer keeps in his possession. There he can see just what each cow produced during the month and compare the value of the product with the cost of the feed. Thus he learns what animals are not paying their way and discovers what ones are the best producers. The associations may be organized somewhat differently in different states. It costs about $40 a year to belong to an association in New York State.

Of course, a farmer cannot join a cow-testing association unless there is one in his neighborhood, or unless he can persuade sufficient of his neighbors to form one. On the other hand, there is nothing that the expert employed by an association does that a dairyman cannot do for himself if he will. In fact, he can have more complete and more accurate methods thereby, and there are other advantages that will be mentioned.

307. Weighing the milk.—To get a record of the amount of milk, all that is required is a spring balance. Many milk scales are on the market which have two indicators, one of which can be set according to the weight of the pail, making it possible to read the weight of the milk directly. Such a balance will cost about $5. Where a farmer has his own balance he can weigh his milk oftener than once a month as is done in an association, and thus have a more accurate record of production. He should do it at least once a week and preferably at each milking. It is not much trouble to hang the pail on the balance at the end of the milking and record the weight of milk on a record sheet tacked up in a convenient place. In fact, many members of cow-testing associations weigh their milk frequently during the month and turn the figures over to the tester when he comes around, thus enabling him to make more accurate calculations.

308. Testing the milk.—The determination of fat requires a special apparatus,—the Babcock tester. The cost of such a tester will depend on its size—that is, on the number of samples of milk that can be tested at once. For a herd of 15 cows, a tester holding eight samples is a satisfactory size. Such a tester complete with necessary glassware will cost around $18. A run with such a tester can be made in an hour. Two runs would take care of the 15 cows. A careful test once a month will give a fair idea of the fat content.

309. Keeping the records.—To keep a record of the feed there should be a sheet on which there can be recorded just what each cow is getting at the start—say, the first of the month. Then all that is required is to make a record when the feed is changed, which will not be often. Even if the farmer makes no change he

should check up on the weights of the feed occasionally to make sure that he is actually feeding what he thinks he is.

The calculation of the value of the milk and the cost of the feed will require some arithmetic. In fact, the dairyman who starts to keep his own records should have more detailed directions than we have space to give him here. His Farm Bureau Agent will be glad to help him get started or put him in touch with some other farmer who has had experience.

The man who keeps his own records will get more benefit from them than where they are kept through an association. He will gain a better knowledge of his animals and after taking the trouble to get the records he will be sure to make the maximum use of them in improving his herd. Unfortunately, few dairymen will go to the necessary trouble. Either they think the process is too complicated to try, or else they start but do not stick at it. Thus, most of the records are actually kept through cow-testing associations, where the figures are all set down in a book, so the farmer can see at a glance just what should be done to improve the herd. Unfortunately, some farmers fail to open the book.

310. Dairy improvement clubs.—There was recently developed in Wisconsin a plan for general herd improvement through organizations called "Neighborhood Breed Clubs"; somewhat similar organizations have been started in New York State under the name of Dairy Improvement Clubs. These organizations are in their infancy and one cannot predict how successful they will be or how they may be changed. In these clubs as organized in New York State, a group of farmers weigh their own milk, keep their own feed records and have their milk tested for fat at intervals of three or four months at a local creamery. Once in two months the farmers bring their records to a group meeting where a representative of the State College goes over the records with them and makes recommendations. Under this plan there is a group stimulus to urge the farmer to keep his own records. The method of keeping them and of making the necessary calculations is explained to him. He receives specific recommendations from an expert as to how to improve his herd on the basis of his records. Further, he has a

chance to hear his neighbors' problems discussed and thus increases his knowledge as to the general business of dairying. It will be interesting to watch the development of this plan which seems to have much in its favor.

311. Herd improvement.—We have discussed the different methods of keeping records of milk produced and feed consumed. Now, we want to point out just what value these records have and how they may be used to improve the herd and make it more profitable.

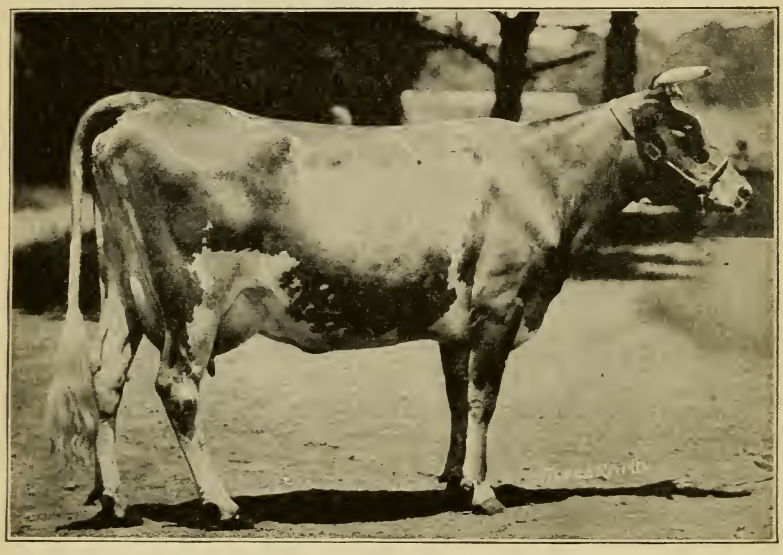
The first thing the records tell is what cows are not paying for their feed. Obviously these cows should be disposed of at once. Next, the dairyman will know just how much each of the rest of his cows is paying for his labor, interest on his investments, etc. When these things are taken into consideration, the value of the product should be at least twice the value of the feed to justify keeping the cow, except under special conditions as will be mentioned later. Thus, the records show what cows should be sold and what ones should be kept.

312. Weeding out poor producers.—The question arises as to what period of time the records should cover to justify a decision to get rid of a cow. Many factors enter in here. For an old cow a month's record may be sufficient to condemn her; on the other hand, a younger animal should be given a much longer test. A cow may give a very poor yield following an abortion, yet recover her production in a succeeding lactation. Certainly an animal with a good previous record should not be discarded on the basis of her production following an abortion. Again, a cow with a good record may lose a quarter and thus become a poor producer and yet warrant retention in the herd because of the possible value of her calves. The idea which should constantly be borne in mind is to get rid of the lower producers year by year and thus continually raise the standard of the herd, for the higher the production the greater the profit.

313. Breeding value of cows.—Another big possibility of herd improvement through production records is the knowledge furnished as to breeding value. Obviously, the heifers from the

high producing cows should be kept in the herd. The breeding value of a bull shows in the records of his offspring. One cannot hope to make much improvement along these lines without records.

Keeping records produces a return in herd improvement and value in many other ways. When cows are to be sold the good ones



LANGWATER CLEOPATRA 47043

Yearly record 15,364.7 pounds of milk, 792.51 pounds of butter fat. Sold in 1922 to R. L. Benson, Princeton, N. J., for $19,500.00, the record price for the Guernsey breed.

will bring more if the owner can show their records. A calf from a cow with a good record will sell for much more than from a cow with no record. The farmer who begins keeping records will find himself taking more interest in his herd, giving them better care and increasing their value thereby. By giving each cow just what feed she should have on the basis of her production, more economical feeding will result. The tests for fat will serve as a check on the test given by the milk purchaser.

Part V
THE FEEDS

CHAPTER XXIII

THE COMPOSITION OF FEEDS AND THEIR MANURIAL VALUE

The feeding of animals consists of supplying them with certain chemical substances called nutrients which their bodies require for life and growth and for the manufacture of some product such as milk. Thus, the value of a given feed rests on its content of these nutrients. The chemical substances which we will consider in this connection are: water, proteins, carbohydrates, fats, and mineral elements.

314. Water. Dry matter.—Water forms about 50 per cent of the live weight of the animal body. All feeds contain some water but we are primarily interested in the part which is not water, which is called dry matter. All the other nutrients are parts of the dry matter and thus the more water the less the content of these other nutrients in the feed.

315. Proteins.—These are complex compounds containing nitrogen. In the body the muscles, the organs, the skin and the hair consist almost entirely of proteins. Thus, it is easy to understand that the animal requires large amounts of these compounds in its feed both for growth and for replacing worn out body tissues. Similarly, milk contains a high percentage of proteins and therefore the dairy cow needs a liberal supply for milk production.

Everyone is familiar with the term, crude protein, used in expressing the analysis of feeds. Actually there are several different kinds of proteins in a feed and feeds differ among themselves in this respect. A given amount of protein in one feed may cause more growth or produce more milk than the same amount in

another feed. Thus, we speak of differences in quality of proteins, meaning that one may have a higher feeding value than another. Though we know that these differences occur, we do not yet know how to classify the feeds on this basis, so we use the general term, crude protein, or simply protein, to cover all the proteins. However, we do know that certain combinations make for high quality —for example, a leafy roughage combined with cereal grains.

316. Carbohydrates.—These comprise substances which are familiar to all, namely, sugars, starches, and celluloses. They are of only limited occurrence in the animal body, but occur in plants in a larger proportion than do any of the other chemical compounds. Cellulose forms the framework of plants and the protective coating of seeds, while starches and to a less extent sugars constitute the reserve material which furnishes energy for growth and for building new tissue.

Over one-third of the dry matter of milk consists of the carbohydrate, lactose. Thus in milk production the carbohydrates of the feed may serve not only to furnish energy for the process but also as a source of one of the constituents of the product.

There are two other terms used in connection with carbohydrates which we should know, namely, crude fiber and nitrogen free extract (N.F.E.). These terms do not represent distinct chemical groups but rather classes into which all carbohydrates have been divided, using feeding value as a basis. Crude fiber is what is left of the carbohydrates of a feed after the removal of the more soluble ones by the use of certain chemical agents. This residue is woody in nature and consists principally of the more complex celluloses. The remaining carbohydrates—the sugars, starches, and some of the celluloses—form the group known as the nitrogen free extract.

317. Fats.—These compounds occur in all parts of the animal body as fatty tissues. In plants they occur especially in the seed portion, and many seeds, such as the seeds of cotton and flax, are very rich in them. Like the carbohydrates, the fats of the feed serve as sources of energy. The fat which is stored in the animal body constitutes the energy reserve to be drawn on in time of need.

The process of fattening consists of building up this reserve by continuous feeding of energy-forming material in excess of the animal's requirements for it. Since fat is one of the principal constituents of milk, the production of the latter requires a liberal amount of fat-forming material in the feed.

318. Protein important.—Of the nutrients mentioned, protein is the dominant one, because no other nutrient can serve as a substitute for it, either for growth or milk production. The case is different as regards carbohydrates and fats in that, although the body must have energy to carry on its processes, either of these two nutrients can supply it. If both are insufficient, protein itself can be used as energy. Similarly, carbohydrates and fats can be used interchangeably for the manufacture of these nutrients in milk and for the production of fatty tissue, or even protein may be employed for these purposes by means of certain chemical changes in the body. Thus we have become accustomed to state that the body requires a certain amount of protein plus sufficient total nutrients to supply the needed energy, with the understanding that fats, carbohydrates and proteins may all serve to furnish this energy.

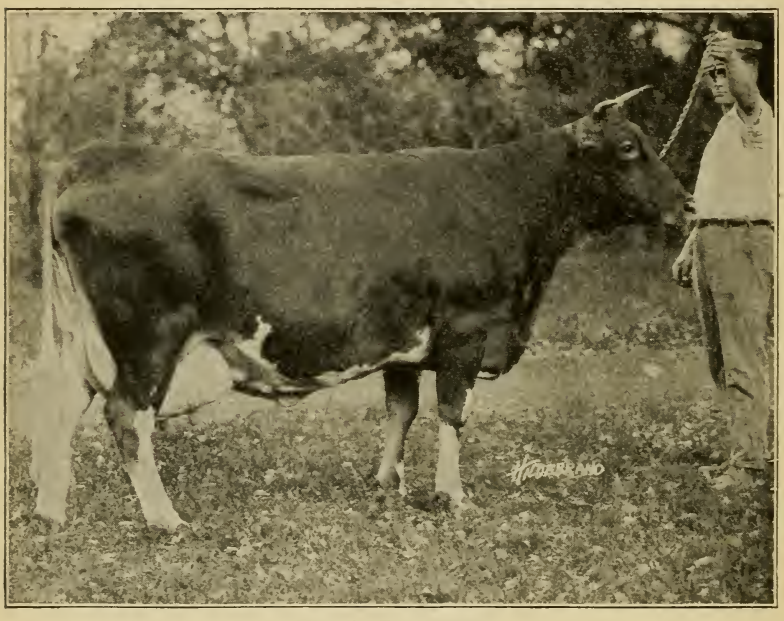
319. Mineral elements.—This group of nutrients, collectively referred to as ash, comprise two to four per cent of the animal body. There are many different mineral elements but only two, aside from common salt, require consideration in putting together rations.

320. Phosphorus and lime.—The phosphorus of plants occurs principally in the seeds where it is located in the germ or branny coating. It does not occur in any considerable amount in hulls or stems. The leaves have more than the stems but less than the seeds.

Lime, on the other hand, occurs in largest amounts in the leaves, to a lesser extent in the stems, and only in small amounts in the seeds. Thus, the chief source of this mineral is the roughage, and leafy roughage is far superior to the other kind. The farmer who feeds plenty of alfalfa or clover and a grain mixture made up of high grade feeds has the ration which is best from the standpoint

of lime and phosphorus. Of course common salt must be provided for all animals at all times in a suitable way. (**12, 13**)

There is one other mineral that may be lacking in the diet in certain areas. This mineral, iodine, is the one connected with the development of the most common type of goitre. Its lack is also responsible for the hairless pig. In the goitre area, cows are



Pearl's Dot 57445

Yearly record 19,602. 5 pounds of milk, 965.8 pounds of butter fat. Owned by D. D. Tenney, Crystal Bay, Minn.

sometimes affected. It has been recommended that cows in these areas receive one-tenth of one pound of potassium or sodium iodide per thousand pounds of grain.

321. Measuring the value of feeds.—The first thing we want to know about a feed, in estimating its value, is its chemical analysis,—that is, its content of the nutrients we have just mentioned, namely, protein, fat, carbohydrates, etc. However, chemical anal-

ysis is only a rough measure of value. It shows what is in a given feed, but feeds having the same analysis are not necessarily of equal value because the animal body makes better use of the nutrients of some feeds than of others. The big difference lies in the extent to which a feed is digested. Finally, in comparing the general usefulness of feeds we should consider their manurial value.

322. The manurial value of feeds.—It has been stated that the part of the feed which is excreted in the feces represents the indigestible portion from which the animal gets no value. However, this portion is very useful as fertilizer as we all know. This is such an important item, if the manure is properly handled so that its fertilizing value is not lost, that it should be taken account of in considering the value of feed.

323. Manure the cheapest fertilizer.—Every crop which is grown takes nutrients out of the soil and the land becomes poorer and less productive each year unless these nutrients are returned either as manure or commercial fertilizer. Of course the use of manure ls much the cheaper method. Here the dairyman has a great advantage over the hay and grain farmer because he has a lot of manure to use, coming from both feeds he raises and feeds he purchases. In order to make the most of this advantage he must know the feeds from which he can get the most fertility.

324. Conserve the urine.—The fertilizing constituents we are interested in are nitrogen, phosphoric acid and potash. Of course, we must include the urine as well as the solid excreta under the term manure. The urine contains on the average 40 per cent of the nitrogen and 60 per cent of the potash of the total fertilizing constituents excreted. This shows how important it is to see that the urine is not lost. Of the total fertilizing constituents in a given feed the amount of each actually excreted in the manure will depend on the animal. Unless an animal is growing or storing fat or making some product such as milk, nearly all of these constituents eventually appear in the feces and urine. A horse which is not gaining in weight, developing a foetus, or nursing a colt must thus return as manure nearly all of the fertilizing constituents of

the feed. On the other hand the dairy cow which puts part of the nutrients of her feed into milk can, of course, return the balance only as fertilizing constituents.

325. The fertilizer in feeds.—The following table from Cornell Reading Course Lesson 141, by Fippin, shows the percentage of fertilizing constituents returned in the manure under different conditions:

	Per cent
Nitrogen	
Dairy animals	35 to 75
Meat animals	65 to 90
Work animals	85 to 95
Phosphorus	
Young growing animals	35 to 50
Dairy animals	50 to 80
Work animals	75 to 95
Potassium	
Dairy animals	65 to 85
Meat animals	75 to 90
Work animals	90 to 98

326. Legume roughage the highest.—As regards home-grown feeds, we have in manurial values another argument for using legume roughage. Clover and alfalfa are higher in protein than are other hays and the manure from them is higher in the fertilizing constituent nitrogen. Of course, one might raise the objection here that legumes must also take more nitrogen out of the soil and that this fact would offset the greater amount of nitrogen returned in the manure. Fortunately, this objection is not a real one because legumes are able to take nitrogen out of the air and under proper conditions of cultivation leave the soil actually richer in nitrogen than before the crop was grown. No other crop can take nitrogen out of the air. Thus legumes have the double advantage of enriching the soil during growth and in addition furnishing more nitrogen in the manure than other roughages.

327. Importance of manurial values.—To show the importance of a consideration of manurial values in buying concentrates a table has been constructed to show what part of the cost of a feed may be returned as fertilizer. The table has been made on the basis that 55 per cent of the nitrogen, and 65 per cent of the phosphoric acid and 75 per cent of the potash of the feed of the

dairy cow are voided in the manure, these figures being averages of those given in Fippin's table previously listed. The costs per ton are current prices and the figures used for getting the value of the fertilizing constituents were as follows: nitrogen, 15c per pound; phosphoric acid, 4c per pound; potash, 5c per pound.

Feed	Cost per ton	Manurial value per ton	Net cost per ton
Corn meal	36.50	3.10	33.40
Ground oats	38.60	4.22	34.38
Wheat bran	35.05	7.18	27.87
Gluten feed	49.80	8.75	41.05
Cottonseed meal 43%	58.05	14.48	43.57
Linseed oil meal	59.05	9.97	49.08

Of course, the figures shown in the above table will vary according to feed prices and the values placed on fertilizing constituents. More important, however, it must be remembered that the manurial values represent the maximum return and assume that all of the manure reaches the soil without loss. No farmer obtains these values in full and many get only a small percentage of them. However, the table is of value for two reasons: First, it shows that it pays to conserve the manure; and secondly, it demonstrates that the difference between the cost of high and low protein feeds becomes less when the value of the manure is considered.

328. Care of manure.—The first thing of importance here is to see that the urine is not lost since it contains such a large percentage of the nitrogen and potash. To prevent this loss there should be plenty of bedding to absorb it, the gutters should be tight, and in cleaning the stable any urine in the gutter should be soaked up by the bedding and other manure. Fermentation causes a large loss of nitrogen in manure. The strong smell common in horse stables is due to ammonia, the form in which nitrogen largely escapes through fermentation. The fertilizing constituents may also be washed out of the manure by rains if it is stored out doors. The best way to avoid both these losses is to draw out the manure and spread it on the fields daily. Where this is not possible it should be stored under cover in compact piles, preferably under shelter.

If horse and cow manure are mixed the cold cow manure will keep the horse manure from heating and result in a large saving of nitrogen otherwise lost through fermentation. It is a fine thing if the manure can be stored in such a place that it can be tramped down into a compact mass by hogs or other animals. If the manure must be stored outside it should be in high compact piles and by no means under the eaves where rain running off the roof will wash out its constituents.

CHAPTER XXIV

THE DRY ROUGHAGES

329. Legumes vs. non-legumes.—The legumes are the leafy roughages, such as clover, alfalfa and peas. They are much higher in protein and lime than are the non-legumes as is shown by the following table:

Crop	Protein	Lime
Red clover hay (legume)	12.8%	1.60%
Alfalfa hay (legume)	14.9	1.95
Timothy hay (non-legume)	6.2	0.25
Corn fodder (non-legume)	7.8	0.66

Considering that neither class of roughages has a marked advantage as regards other nutrients, the above figures show clearly the greatly superior feeding value of the legumes. The latter have another point of superiority. By the aid of certain bacteria which grow in nodules on their roots, legumes obtain nitrogen from the air to form protein. Therefore, instead of depleting the soil of its nitrogen as do other crops, under the right conditions of culture they actually leave the soil richer by adding to it nitrogen from the air. In this way the legumes furnish more protein for feed with less depletion of the soil than do non-legumes. However, the same thing does not hold true as regards lime. Legumes, due to their high lime content, take lots of this element from the soil and they will not grow unless the soil contains plenty of it either naturally or through its addition as fertilizer. In fact, this is the big reason why it is difficult to grow legumes in many places—the soil does not contain enough lime; it is too "acid" or "sour," as we commonly say. Liming overcomes this.

330. Legumes the best roughage.—From the standpoint of feeding value and keeping up the fertility of the soil, everything is in favor of the dairyman's raising legumes for his dry roughage. The only disadvantage is that they may be more difficult to grow because they require special soil conditions.

Alfalfa Hay

331. Comparative yield.—The crop for roughage which produces the greatest yield and the greatest amount of digestible protein per acre is alfalfa. In the production of total digestible nutrients it is equalled only by corn. These facts are shown by the following table, given by Henry and Morrison.

	Yield per acre, lbs.	Dig. crude protein, lbs.	Total dig. nutrients, lbs.
Alfalfa hay	4372	463	2250
Clover hay	2624	199	1336
Timothy hay	2340	70	1134
Corn (ears and stover)	3574	150	2251

These figures are averages of country-wide returns and do not represent what may be expected in every locality. However, they leave no doubt as to the widespread superiority of alfalfa, and explain why its acreage is so rapidly increasing. A good stand, once secured, will last for at least five years. Every dairy farmer should consider first the possibility of growing alfalfa for his roughage.

332. How to get a stand of alfalfa.—Three things are of prime importance for growing alfalfa successfully: (1) a well-drained, fertile soil; (2) lime; and (3) inoculation.

The soil selected for growing alfalfa must be well drained. The crop will not live on wet land and is particularly sensitive to standing water during the winter months. On certain hardpan soils where the water table comes close to the surface in winter, alfalfa culture is very uncertain due to winterkilling.

333. Good soil necessary.—Alfalfa will not do well on a poor soil. It is not a crop suitable for building up the latter as is clover. Unless the soil will produce a good yield of other crops such as corn or wheat it is not suitable for alfalfa until manured and fertilized.

334. Lime indispensable.—Certain crops do best on an acid soil, others will not grow at all on such a soil, while still others are rather indifferent to this condition. Alfalfa and red clover are crops which simply will not grow where the soil is acid. Acid soils

are primarily those which lack lime. This element is supplied naturally in certain soils as those containing limestone; to others it must be supplied for growing crops which require it. The majority of the cultivated soils of the eastern states are acid. This is the principal explanation why so little alfalfa is grown in this section. With conditions otherwise suitable this difficulty can be overcome by liming. If the farmer does not know whether his soil is acid or not the best thing for him to do is to take it up with his Farm Bureau Agent and ask him to have the acidity determined. In this way he can learn just how much lime is needed per acre. Probably the answer will be in terms of quicklime, also called burnt lime. This is the most concentrated form. Where ground limestone is used, twice as much is required as of the quicklime to get the same effect. Lime can be spread on the land any time when there is no crop growing.

335. Inoculation.—Supplying the soil with the bacteria which enable legumes to take nitrogen out of the air is called inoculation. We have mentioned that legumes are the only crops which can do this, and how the soil is enriched in nitrogen in this way. However, this cannot occur unless the right bacteria are present in the soil and the chances are that they are not, unless the legume crop to be sown has been grown recently on the land in question. Thus, the soil must be inoculated. One way to do this is to send to your College of Agriculture, telling them the number of acres to be grown and asking for a "culture of the bacteria for alfalfa." The College will either supply a sufficient amount of the culture for the acreage in question at a nominal cost, or advise where it can be obtained. Another method of inoculation is to take soil from an old alfalfa field and apply it at the rate of 200 to 300 pounds per acre to the new field. This assumes that the cultures were actually present in the old field. If there is any doubt here the method should not be used. One can tell whether the bacteria are present where alfalfa is growing by noting whether there are any nodules on the roots. Where soil from an old field is used, it should be taken at a depth of two or three inches. It is best applied and harrowed in immediately. Exposure to air, wind, and sun destroys the bacteria.

336. Seeding.—The soil should be well prepared and compact, as the crop will not winter well in a loose seed bed. Sowing in midsummer can be practiced except on heavy soils or where dry summers are the rule. On heavy soils the plants may not get sufficient start to live through the first winter. In a dry season it is difficult to prepare the seed bed properly. Earlier sowing is the alternative. Many prefer to sow in June. Weeds bother more at this time, but they can be killed if the soil is frequently harrowed from early spring until sowing. On very heavy soils still earlier sowing, say May 1, may be advantageous if the soil can be properly prepared. Usually it is best to sow no nurse crop with alfalfa since the young plants are tender and must be favored at the start. Where the land is especially well adapted to alfalfa a nurse crop may be used.

337. Use only good seed.—Only the best seed should be used. Northwestern grown seed of the Grimm variety is the kind best adapted to New York State and areas of similar climate. Recommendations differ widely as to the amount of seed to use. We suggest 20 pounds to the acre, but believe that the farmer should be governed by the practice in his own locality and by the advice of his Farm Bureau Agent, since many local factors affect the question as to the amount of seed to be used.

338. Time to cut alfalfa.—For the largest total yields alfalfa must be cut promptly whenever it is ready. Some judge this by the extent of the bloom, cutting it when it is one-fourth in bloom. However, in certain sections of the country the plant fails to bloom at all. Thus a better general rule is to cut as soon as the new buds at the base of the plant are well started. By harvesting the crop at this early stage the hay will contain more protein and less fiber and be more digestible than if cut later. Further, early and frequent cutting means maximum yield. The number of cuttings will, of course, depend on the growing season. Usually a cutting can be made every 30 or 40 days during this season.

339. Curing.—The ideal hay for feeding must be bright in color and have a nice, sweet aroma. It is very important that as little as possible of the leafy material be lost. The leaves are tender

and break off easily. Good alfalfa should be about one-half leaves. These leaves have four-fifths of the protein, as well as most of the lime and over one-half of the fat and of the more digestible carbohydrates. Unless care is taken to save the leaves, the advantage of growing alfalfa is largely lost. The hay should be free from dust and mold. On new seeding or where land is overflowed the hay may be dirty from such a source, but usually dirt and dust result from improper curing.

340. Save the leaves.—It is a very common practice at present to cure hay in the windrow instead of in cocks. The curing is speeded up by frequent tedding, raking into windrows and loading without cocking, by the use of the hay loader. This method is a time-and-labor saver but it does not make the best hay because of the loss of color and leaves, due to exposure to the sun.

We prefer to cure legumes in the cock because we believe that the smaller loss of feeding value more than pays for the extra labor. Where the hay is cut in the morning after the dew is off it should be raked up and cocked as soon as well wilted and while hot. By allowing the minimum time to elapse before cocking, the hay is not unnecessarily exposed to the bleaching action of the sun which hurts its color. In the cock, fermentation continues during the drying and the best color and aroma are thus developed. Also the movement of water from stems to leaves continues so that more uniform drying results. Where the hay lies as mowed too long the leaves dry much quicker than the stems and more of them are lost. The day after the hay is cut, or perhaps the second day, the cocks should be opened out into large flakes, shaking as little as possible. Of course, the hay should then be drawn in as soon as sufficiently dry. Where the hay is cut in the afternoon it should be cocked up the next morning as soon as the dew is off and drawn in the next day. These directions assume fair weather. Unfortunately rain is a frequent trouble-maker in haying time. Everybody understands how the curing process must be modified where rain interferes.

341. The use of hay caps.—The use of caps to protect the cocks from rain and dew has long been advised, since water leaches

out the nutrients and destroys the bright color. It is now known that alfalfa hay, cured in cocks under caps, has much more of the factor aiding mineral assimilation than where cured in the windrow. Here we have a further argument for this method of curing. Curing in cocks, particularly under caps, means a product higher in protein, lime and vitamines and a more palatable feed. (38)

342. Alfalfa as a feed.—In previous pages we have shown the great value of alfalfa hay in the dairy ration due to its high protein content resulting in less of the costly high protein feeds being

FIELD OF GOOD ALFALFA
The best roughage.

needed, its lime content, its palatability, its laxative effect and its vitamines. These qualities, coupled with its superiority over all other forage crops as regards yield, give it undisputed first place as hay for dairy cows where it can be grown successfully. The second and third cuttings are more valuable than the first. We believe that many dairymen who think they cannot grow it on their farms could do so if they would bear in mind the things we have mentioned about its culture. Getting a stand may mean extra trouble and expense at first but success will mean so much that it is worth a trial.

343. Alfalfa for summer feeding.—Alfalfa is a fine crop for soilage because of its high yield and because it furnishes several cuttings throughout the summer. As a pasture grass it is not very successful because the stand is rather easily injured by grazing, particularly when the ground is soft.

Alfalfa finds some use as a silage crop but a poor product frequently results when it is ensiled alone. The first crop may be put in the silo to save it in poor weather. Because of its palatability as hay there seems to be no advantage in ensiling it unless it cannot be cured properly for hay.

344. Alfalfa meal.—Grinding the hay does not take it out of the roughage class and the dairyman will find in general that he can raise his roughage cheaper than he can buy it. It is more difficult to judge the quality of alfalfa after it is ground. Frequently the meal contains more stems and less leaves than a good alfalfa hay should. Thus, in buying, the guarantee on the tag should be noted. A good meal, having the proper proportion of stems to leaves, should not contain over 30 per cent crude fiber.

The Clovers and Other Legumes

Red clover stands very close to alfalfa from the standpoint of feeding value but is ranked below it as a roughage crop for the dairy farm because of its much poorer yield. However, as regards extent to which it is grown, it is the more important forage crop.

345. Soils for red clover.—Red clover differs from alfalfa in not requiring as fertile a soil and in preferring a less dry soil, thus drainage is not so important. However, clover requires lime the same as does alfalfa and will not live on an acid soil. It also requires, for satisfactory growth, the presence of the proper bacteria which enable the plant to take nitrogen from the air, as we have described for alfalfa. Where the soil has grown clover before, these bacteria are probably present; otherwise, it must be inoculated as we have mentioned in the case of alfalfa.

346. Seeding.—Red clover is largely sown in March or April, as it is best to sow it when alternate freezing and thawing are taking place. However, it may be scattered on the land in most

any winter month with fair assurance of success. Do not sow it in midsummer because the young plants do not do well in hot weather. The crop is usually sown on winter wheat or spring grains. If sown alone, 10 to 12 pounds per acre is the proper rate.

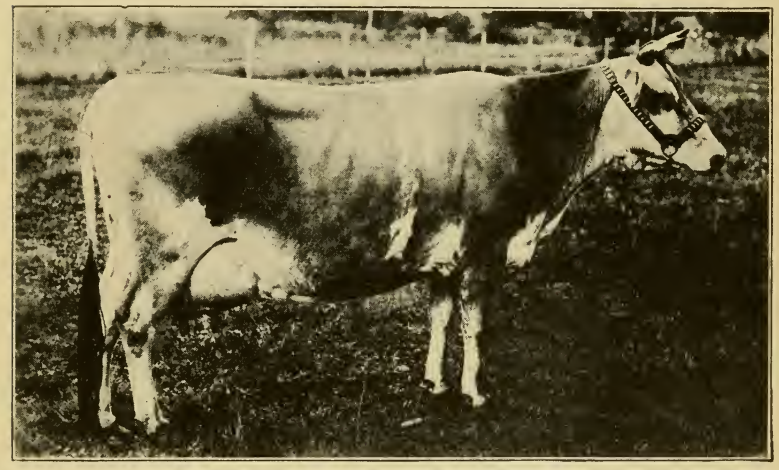
347. Clover with timothy.—It is a common practice to sow red clover with timothy. By so doing a greater yield of forage is obtained because timothy does not come to full yield the first year while clover does, the clover dying out the second year as the timothy comes to maximum production. In the meantime the clover, through its ability to take nitrogen from the air, has benefited the soil and made possible a better crop of timothy. Further, the two crops go well together because the clover roots penetrate much deeper and thus the roots from the two plants do not compete directly for the same nutrients.

348. Red clover in rotations.—All good farmers practice crop rotation; that is, on a given field they alternate cultivated crops and grain crops with grass and clover. Such a system aids in keeping up the fertility of the soil. Crops with different root systems are grown in different years, the nutrients being drawn from different depths of the soil accordingly. A field continually sowed to grain crops rapidly loses its humus or supply of decaying organic matter, which results in a loss of fertility. Grass crops maintain or increase this humus. Rotation helps to control weeds, diseases and insects. Having a legume in the rotation aids in keeping up the nitrogen content of the soil by bringing it nitrogen from the air. Red clover fits into a crop rotation better than any other legume. It can be sown with a grain crop one year, harvested at full yield the next season and then plowed up for sowing grain again. Growing red clover once in four years will maintain the nitrogen and humus content of the soil.

349. Harvesting red clover.—Clover usually yields two cuttings per season, the second being lighter but of better quality. The crop should be harvested when in full bloom. After this period the stems become more woody and some of the leaves are lost. When harvested alone it is difficult to cure. Harvested with timothy there is the disadvantage that it matures about two weeks

before the timothy is ready and some of its nutritive value is lost. This is the only disadvantage of growing the two together. We have discussed in detail the curing of legume hay for roughage under alfalfa. The same applies to clover. (**339, 340, 341**)

350. Red clover as a feed.—We have mentioned that clover ranks with alfalfa as a dry roughage for dairy cattle and that these two legumes are in a class by themselves for the purpose. Every dairy farmer should try to grow a liberal amount of one or the



DARLING'S JOLLY LASSIE 435948

Champion Jersey Cow. Yearly record 16,425 pounds of milk, 1141.28 pounds of butter fat. World's Champion Junior four year old, all breeds. Owned by Pickard Bros., Marion, Ore.

other. Red clover is a valuable crop for soilage and may furnish three or four cuttings annually under favorable conditions. It is also a good pasture grass but one should be careful in turning cattle out on clover the first time because they may eat too much and bloating result.

351. Alsike clover.—This clover is finding increasing favor as a legume crop for poorer soils because it will grow in many places where both alfalfa and red clover will fail. The big point in its favor is that it will flourish on soils too acid for the legumes

previously mentioned. Alsike will withstand more cold and heat than will red clover, and will grow in regions where the latter will winterkill, as well as in sections too hot for red clover to thrive. Alsike is the hardier plant and will continue four to six years on a good soil. However, it furnishes only one cutting a season and thus is at a disadvantage as regards yield. Where red clover does well, alsike cannot compete with it but the dairyman who does not succeed with either red clover or alfalfa, due to the nature of his soil, has a much greater promise of success in alsike. The culture of alsike is very similar to that of red clover. A mixture of three parts red clover, three parts timothy and one part alsike often gives splendid results.

Other clovers which are grown to some extent for hay are sweet clover, mammoth clover, crimson clover, and hubam clover.

352. Peas and oats.—Field peas are not usually sown alone because it is difficult to harvest the low vines. The favorite combination is peas and oats. Using equal parts of seed, three to four bushels should be sown to the acre. The yield of the mixture will be two to three tons of dry forage per acre. Barley and spring wheat may also be sown with field peas. For the best growth of peas the soil should be inoculated. A culture of bacteria for peas can be obtained through your State College of Agriculture.

When cut early, field peas, either alone or in combination with a cereal, make a palatable and nutritious hay for dairy cows. Peas and oats make the best soilage crop for the northern states. The combination also makes very good silage.

353. Soybeans.—This legume crop is especially adapted to a hot dry climate, and can be grown for hay wherever corn will mature for silage. The hay is nearly equal in feeding value to alfalfa and a yield of one to three tons per acre may be expected. Soybeans are a comparatively new crop, but are proving very useful for growing in sandy soils and where other legumes do not flourish.

354. Cowpeas.—This crop is a very important legume for roughage in the cotton belt but will not thrive in the more northern latitudes.

The Non-Legumes

The feeding value of non-legumes lies principally in their carbohydrate content. They are much lower in protein and in lime, and in general are less palatable than the legumes. In actual practice the low protein content is their most serious disadvantage. It can be overcome only by buying more high protein feeds for the grain ration.

355. Timothy low in protein.—Timothy has less than one-quarter as much digestible protein as has alfalfa. Where it is the sole roughage the grain mixture must contain one-half again as much protein as where all legume hay is used. Where the latter is available to mix with timothy the protein content of the grain mixture can be changed accordingly. Of course, most dairymen will grow some timothy for their horses, but for dairy cows this roughage should be looked upon as a supplement to an insufficient supply of legume roughage. Since timothy hay is not very palatable it is especially important that the dairyman feeding large amounts of it should have plenty of silage. Timothy is also somewhat constipating and this fact must be remembered in choosing the rest of the ration.

For dairy cattle timothy should be cut at full bloom since this is the time that it contains the greatest amount of total digestible nutrients and makes the most palatable hay. It is a little more difficult to cure at this time, but since even at its best it is much less palatable than legume hay, it must be so harvested as to be as valuable as possible.

356. Hay from mixed grasses.—We use this term to denote a hay which many farmers have, through cutting the same field year after year, a hay which varies according to the season. Such hay consists largely of timothy, but may in wet years contain considerable clover. In some years it may consist largely of weeds. Such a roughage must vary greatly in feeding value, and we mention it to call attention to the fact that the rest of the ration must be adjusted according to the nature of the cutting in a given season. The thing to bear in mind regarding such hay is that the more clover in it the better it is in palatability and protein content.

Where weeds occur in large amount, the reverse is true. The other feeds must be chosen accordingly.

357. Corn fodder and stover lack protein.—Corn fodder means either the fresh or cured corn plant grown primarily for forage, with any ears produced on it. Corn stover is cured shock corn from which the ears have been removed. No dairyman can afford to be without a silo, and preserving the entire corn plant as silage rather than as fodder means less loss of nutrients and a more nutritious and palatable product.

When corn is grown thickly, harvested while still green, cured in well made shocks, and drawn in as soon as dry, a very nutritious roughage results. Corn fodder is high in carbohydrates and low in protein. It is best fed along with a legume roughage and necessitates the use of a high-protein grain mixture, even as does timothy.

Corn stover has less protein and less feed value than the fodder and is much less palatable. The best course for the farmer to follow who has stover as a by-product on his farm is to place it before his dairy cows and young stock, and let them eat what they will of the leaves and more tender stalks.

358. The cereal straws.—Straw has less feeding value than corn stover and can have little place in the ration of the dairy animal. A limited amount of oat straw, if of good quality, may be used to supplement better roughage. The cows should be allowed to pick out the more tender parts of the straw and then the remainder can be used for bedding. Barley straw stands next to oat in value. Wheat and rye straws are too coarse and woody to feed.

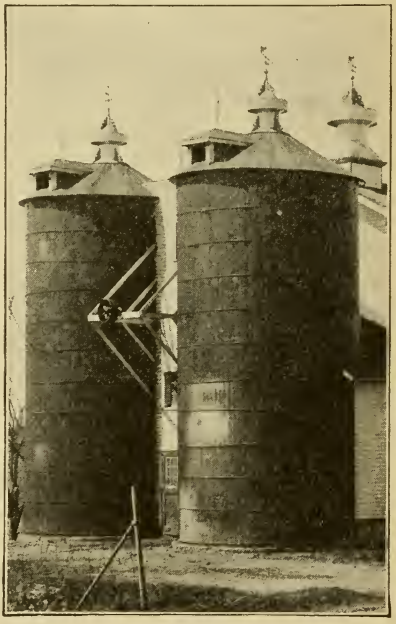
359. Computing the amount of hay in a mow.—Frequently one wants to know how much hay is left in a mow. In a mow of timothy hay of average depth, there will be a ton of hay for every 500 cubic feet. Of course, the hay is heavier toward the bottom of the mow. Near the bottom 450 cubic feet will make a ton. On the other hand, near the top 550 cubic feet would be required. Clover and alfalfa weigh somewhat less than timothy. About 1200 cubic feet of settled wheat straw are required to make a ton.

CHAPTER XXV

THE SUCCULENT ROUGHAGES

The Silo and Silage Crops

Making silage is a method of food preservation. Decay of food is caused by the action of minute organisms, bacteria, yeasts and molds. There are three common methods of preserving food. The organisms are not active where moisture is not present, thus food may be preserved by drying. This is the method we employ in curing hay. Neither are the organisms active at low temperatures, thus fruits and vegetables are stored in cold cellars. We store roots for winter feeding in a similar manner. Finally the absence of air is another preserving factor. Making silage is based on this principle. At the start there is considerable action by the micro-organisms due to a certain amount of air present, but the action stops at a definite point as will be described.



The Stave Silo
Notice power pulley for filling.

360. Keep out the air.— When a green forage is so packed in a closed space as to exclude most of the air, fermentation sets in and the sugars present are largely changed to acids. The process is similar to the formation of vinegar. When a certain amount of acid is formed fermentation stops and the

acid serves to preserve the green material even as vinegar preserves vegetables in pickling. This, in brief, is the process which takes place in the silo. Thus, the green forage is preserved in nearly its original condition with less loss of nutrients than when cured for hay, and a more palatable feed results.

361. Silos.—A good silo should have air-tight walls, otherwise the silage will spoil. A cylindrical silo is preferable to any other shape because it provides the greatest storage capacity for a given amount of building material and because it is easier to pack the silage down in it thoroughly than where corners must be filled. The silo should be deep because this means increased compactness due to the pressure of the upper layers, and the more compact the silage the less loss of dry matter through fermentation. This pressure of the upper layers requires strong walls for the silo, otherwise it will collapse. These walls should be smooth, otherwise, as the silage settles, pockets will be left and here spoiling will occur due to contact with air.

The Wood Wrapped Silo
A good type of modern silo.

362. Types of silos.—There are several kinds of silos in use. The stave construction with iron hoops is the most popular because of its low cost and ease of building. The stave silo is not as lasting as a more permanent construction such as concrete or brick, but if well built of the right kind of wood and not allowed to go into disrepair it will last from ten to twenty years. Since it has been shown that on many farms such a silo will pay for itself in one year, it certainly must be a very excellent investment for every farmer.

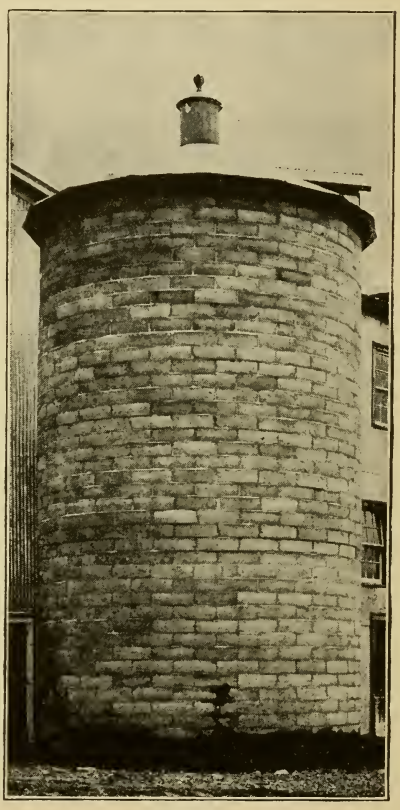
Manufacturing concerns have specialized in stave silo construction and in most cases the farmer can purchase such a silo to better advantage, when length of life is considered, than he can build himself.

363. The wood-wrapped silo.—Using the stave type of construction as a basis other silos have been designed with double or triple walls. These silos are more durable, furnish more protection against freezing, and, of course, withstand wind and weather to better advantage. They cost more but are probably worth it.

364. Masonry silos.—The use of brick, concrete or hollow tile is increasing for silo construction. These materials make a much more permanent silo but, of course, are considerably more expensive and many farmers cannot afford to make such a large investment. Further, it may not be profitable for them to do so. Concrete is cheaper than brick or hollow tile.

In trying to decide what kind of a silo to build, it will help to look through the dairy papers and send for literature on the various ones advertised. It would also be a good thing to talk with neighbors who have silos and with the Farm Bureau Agent.

365. Size of silo.—The size of silo to be built will depend on the size of the herd, assuming, of course, that the farmer can grow a sufficient



Concrete Block Silo

crop to fill it. Two things are important here. In the first place, the silo must be large enough to hold a year's supply. In the second place, the diameter of the silo must be small enough so that enough will be fed off each day to prevent spoiling at the surface. This means one and one-half to two inches in winter and somewhat more in summer.

366. Capacity of silos.—The following table can be used in estimating the weight of silage at the time filling is completed, and thus will show what size of silo must be built to hold a given amount. The table is taken in a condensed form from Missouri Circular 89 by Eckles. The figures assume that the silage is well tramped down and that after settling two days the silo is refilled:

Depth of silage (feet)	Inside diameter of silo (feet)				
	10 Tons of silage	12 Tons of silage	14 Tons of silage	16 Tons of silage	18 Tons of silage
20	22.8	32.8	44.6	58.3	73.8
25	31.3	45.2	61.3	80.0	101.3
28	36.8	53.0	72.1	94.1	119.2
30	40.6	58.5	79.5	103.8	131.6
32	....	64.1	87.2	113.8	144.5
34	....	69.8	95.1	124.2	157.4
36	....	....	103.2	134.7	170.7

367. Calculating the requirement.—Knowing the size of the herd, the rate fed per day and the feeding period, the tonnage needed is easily computed. A herd of 15 cows consuming 35 pounds per day for 300 days would require:

$$\frac{15 \times 35 \times 300}{2000} = 78.8 \text{ tons}$$

By referring to the above table we see that a silo 14 feet in diameter by 30 feet deep would hold 79.5 tons. The figures in the table must not be relied upon too closely because the capacity of a given silo in terms of tonnage will vary according to the condition of the corn as it goes in and the method of filling.

368. Calculating the acreage.—In determining the acreage needed to produce the tonnage desired, the farmer must be guided by his own experience as to what his land will produce. A good crop of corn will yield 10 to 15 tons of silage to the acre.

Most silos are constructed 14 feet in diameter. This is small enough to allow sufficiently rapid removal of the silage in winter for a herd of 15 animals. Where silage is fed in summer there is an advantage in having one of small diameter, so that it may be fed off sufficiently rapid to prevent spoilage at this time when less is fed per cow. A 14-foot silo for winter feeding and a 12-foot silo for summer is rather an ideal combination for a herd of 20 to 30 cows.

369. Crops for silage.—Corn, sorghum, peas and oats, sunflowers, alfalfa, soybeans and rye are among the crops grown for silage. Corn is the ideal crop for the silo. There is considerable difference of opinion as to whether a well matured corn which will furnish the largest yield of dry matter, or a type furnishing greater succulence but less dry matter is to be preferred.

370. The variety of corn to grow.—In New York State, Luce's Favorite is the most popular type of corn at present. It is a type which will mature or nearly mature at a latitude, and under the climatic conditions of central and western New York. It thus makes a silage containing a considerable proportion of ears and represents the type to grow where maximum yield of nutrients rather than succulence is desired.

Cornell 11 is another variety of corn for silage where a mature type is desired. It is not quite as good a yielder as Luce's Favorite but matures somewhat earlier and thus may be more suitable to localities with a short growing season.

371. Grow to glazing stage.—We believe that the variety which will reach the glazing stage before the first frost will give the best satisfaction. Luce's Favorite and Cornell 11, in New York, and Golden Glow and Silver King, in Wisconsin, are such varieties. Many states are making much improvement in their strains of corn. Follow the recommendations of your State College.

The time to harvest corn for silage must vary with the locality. It should be done before the first frost. In such a latitude as central New York this means around September 10.

372. Filling the silo.—The corn should be cut in uniform lengths not over one inch and so delivered to the silo as to distribute evenly the pieces of stalk, ear and leaf. The material must

be thoroughly packed in the silo to get minimum loss during fermentation and to secure largest tonnage for size of silo. Once the silo is filled, it should not be entered for some time because of danger to life from the accumulation of carbon dioxide given off during fermentation. The danger can be overcome by removing the door near the surface of the settled silage and allowing it to air out before entering.

373. Adding water.—If the corn is overripe or very dry when placed in the silo a certain amount of water should be added with it. It is difficult to decide how much water to add, for too much means silage of poor quality and too little may mean moldy silage. The best guide here is to add enough water so that it will pack well. The only really satisfactory way to get the silage thoroughly and evenly wet is to run the water in through the blower of the silage cutter.

374. Silage from frosted corn.—We have recommended cutting corn for silage before the first frost. This is because frosted corn is more difficult to handle properly to preserve its nutrients. However, in an effort to let the corn come to the proper stage of maturity for maximum yield the farmer in the more northern sections must take some chance on having his corn frosted, and the question frequently comes up as to how it should be handled. Corn which has been frosted should be cut at once, otherwise there will be a loss in the field due to leaves dropping off. Further, rain will leach nutrients out of frosted corn as it does out of corn in the shock. When frosted corn is put in the silo, enough water must be added to make it pack well, putting it in through the blower of the silage cutter. If the farmer will cut his corn as soon as frosted and can put it in the silo with the proper addition of water, he can be certain of good silage from frosted corn, and he can afford to take a chance on frost, if necessary, to secure maximum yield through proper stage of maturity.

375. Silage remaining in a silo.—A farmer often wants to know how much silage he has left. This can be found out from the following table, taken from Missouri Circular 89, which shows the estimated weight of settled silage:

Depth of silage (feet)	Inside diameter of silo (feet)				
	10 Tons of silage	12 Tons of silage	14 Tons of silage	16 Tons of silage	18 Tons of silage
10	13.7	19.7	26.9	35.1	44.4
12	16.7	24.1	32.8	42.9	54.2
14	19.9	28.6	39.0	50.9	64.3
16	23.0	33.2	45.2	59.0	74.5
18	26.2	37.7	51.4	67.1	84.8
20	29.4	42.4	57.7	75.3	95.2
22	32.6	47.0	64.0	83.5	105.6
24	35.9	51.7	70.4	91.9	116.1
26	39.2	56.4	76.8	100.3	126.8
28	42.5	61.2	83.4	108.9	137.6
30	45.9	66.0	90.0	117.5	148.5

Suppose after the silage had settled, a man had 24 feet of silage in a silo 14 feet in diameter. By the table, he had 70.4 tons. Suppose that on a given date his silage remaining indicated that he had fed off 16 feet. This would mean that he had used 45.2 tons according to the table. This amount subtracted from the original weight would show 25.2 tons left in the silo.

376. Sunflower silage.—The great popularity and proven merit of silage rests largely on results secured from corn, and today probably 90 per cent of the silage used is from the corn plant. However, the remarkable results with corn have caused other crops to be tried, particularly for conditions where the corn crop cannot be depended upon. Many farmers and Experiment Stations recently have been trying sunflowers for silage. Satisfactory results have been obtained as regards yield and quality of silage to give this crop a real place, at least in sections too cool and too high in altitude for corn to thrive.

377. Sorghum silage.—Silage made from the sorghums cut at the proper stage of maturity ranks close to corn in value. The sorghums are primarily grown in the Southwest, although certain early varieties may be grown in the North.

378. Silage from legumes.—The legumes make rather uncertain silage when used alone because due to the higher protein and less carbohydrate content the proper fermentation may not take place. However, certain combinations of legumes and grains, such as oats and peas, make excellent silage of higher protein

content than corn. However, none of them are equal to corn in terms of food value produced per acre.

Pasture, Soilage, Roots and Other Succulent Roughages

For two or three months of the year or even longer, dairy animals depend primarily on pasture for their feed. When cows are

Ayrshires at Pasture
Owned by Edgerstown Farm, Princeton, N. J.

on pasture the dairyman gets his milk for the least trouble and expense for feed and thus it is very important that he maintain his pastures in as good shape as possible.

379. Improvement of pastures.—Most of the land used for pasture is that which is either too wet, stony or hilly for cultivation, or too worn out to grow crops satisfactorily. A large proportion falls into the latter class and thus the question of better pastures is largely one of improvement of these poor lands. Most

of these lands are acid, clover has disappeared and weeds have taken its place. The best aid in building up these pastures so that a good stand of grasses will come in is the use of lime. Acid phosphate will also help. Getting clover back into the pasture through the use of lime and acid phosphate means more nutritious forage and the improvement of the soil through the addition of nitrogen by the legume.

380. Use lime and acid phosphate.—If one does not wish to go to the labor of plowing up the old pasture and reseeding or if its nature makes plowing difficult, the lime and phosphate may be added as a top dressing. However, the effect is much slower, for it takes time for the materials added to penetrate the soil. It will take at least three years to get much effect from such a top dressing.

381. Ploughing and reseeding.—On the poorest land where the vegetation is mostly weeds, ploughing and reseeding are certainly the best practice. The weeds will be destroyed at once and the lime and phosphate will take effect immediately. The pasture is best ploughed late in the fall, the lime and phosphate being applied either before harrowing or early the next spring. Use one ton of lime and 200 pounds of acid phosphate per acre. The next spring the grass seed mixture can be sowed with oats. The next year a crop of hay may be cut and the third year the land is ready to be pastured. It may be pastured lightly the second year, but cutting for hay enables the clover to come in better. Further, a good hay crop will repay in part for the labor and fertilizer used to establish the pasture. A good pasture lasting many years should result, where the soil is not too poor.

382. Grasses for reseeding.—Only certain grasses will grow on a distinct soil type. If the farmer knows by previous observation what grasses will grow on the land in question he should sow these only. However, he usually does not have this knowledge and further the soil may differ in the same field. Thus, it is safer to use a mixture of several grasses.

Montgomery, in Cornell Extension Bulletin 46, suggests the following mixtures and amounts for one acre:

1. Field to be hayed one or two years, then pastured		
Hay plants	timothy	8 pounds
	red clover	2 pounds
	alsike clover	2 pounds
Pasture plants	Kentucky bluegrass	2 pounds
	white clover	2 pounds
	redtop	2 pounds
	Orchard grass*	2 pounds
	Total	20 pounds
2. Field not hayed—pasture only		
	Timothy	4 pounds
	Alsike clover	2 pounds
	Kentucky bluegrass	2 pounds
	White clover	2 pounds
	Orchard grass	2 pounds
	Redtop	2 pounds
	Meadow fescue	2 pounds
	Total	16 pounds
3. For very unproductive or wet land:		
	Alsike clover	2 pounds
	Canada bluegrass	4 pounds
	White clover	2 pounds
	Orchard grass	4 pounds
	Redtop	4 pounds
	Total	16 pounds

*Meadow fescue may be substituted for orchard grass on the best limestone soils.

383. Grasses differ in value.—The feeding value of pasture grass will depend upon the variety of grasses. A pasture containing considerable clover will furnish the cow much more protein and lime than where the grasses are made up of non-legumes. The same advantage for legumes hold here as in the case of the dry roughages and this is an important thing to remember in seeding and fertilizing the pasture.

384. Pasture aids assimilation of lime.—There is a response in milk production when animals are turned out on pasture,—a response which seems out of proportion to the feed. It has been explained on the basis of succulence, the high digestibility of the grass, its content of easily assimilated minerals and on other grounds. Now, as we have mentioned in discussing minerals, we know that green feed contains something which aids in lime assimilation. When this important discovery is considered in the light of the fact that on a winter ration a dairy cow takes lime out of her bones to make milk and that this drain on her bones must be

replaced, the response of animals to pasture takes on a new meaning. The desirability of good pasture, even during the dry period, since lime is being restored to the bones at this period, thus becomes increasingly important. (**13, 38**)

385. Soiling crops.—These crops are grown to furnish a succession of green feed to supplement the pasture as it fails in the late summer and fall. Peas and oats, soybeans, alfalfa, corn and various clovers and grasses are among the crops grown for this purpose.

A chart should be prepared showing the crops to be grown, the acreage, and the time of sowing and harvest. The kinds of crops and the times of planting will depend on the locality. The acreage will be governed by the number of animals. However, the farmer cannot plan very accurately here because the kind of season which will cause the pastures to fail early, thus making the amount of green crops needed a large one, will also probably cause a poor yield of these crops.

386. Planning for green feed.—The following table illustrates what we mean by a chart to be used in planning for a succession of soilage. The acreage suggested should provide a reasonable amount of supplementary green feed for a herd of 12 or 15 cows, assuming that some pasture is available:

Crop	Acres	Date of Seeding	Period of Cutting
Oats and peas	½	Apr. 2	June 25—July 4
Oats and peas	½	Apr. 10	July 5—July 10
Alfalfa, second cutting	½		July 11—July 20
Oats and peas	½	May 5	July 21—July 31
Alfalfa, third cutting, or clover, second cutting	½		Sept. 1—Sept. 15
Sweet corn	1	June 10	Sept. 16—Oct. 15

Soiling crops should be reasonably mature before they are cut for feeding, because when too green they are mostly water,—peas should be podded, oats should be in the milk stage, etc. The best results are obtained by cutting and hauling the green crop to the barn daily. If left in the field it wilts rapidly and the object for which it is grown, namely, to provide succulence, is lost. At the barn the crop should be fed the day it is cut unless it can be spread

out. If left in piles it spoils quickly in hot weather. Some farmers find it convenient to spread the green crop out on the barn floor. This will keep it from spoiling but the more it dries out the less is its value as succulence. It must be remembered that soiling crops contain lots of water and that two or three times as much must be fed as of dry roughage to furnish the same amount of nutrients. (47)

387. Mangels.—Mangels are the favorite roots for the dairy farm, because they can be grown with the least labor and because they have the best keeping qualities. They are the greatest yielders, in terms of green material, but in terms of dry matter their superiority is not so great. Mangels, as is the case with all roots, should be stored where it is dry, dark, well ventilated, and cool. They should not be fed in any large amount when freshly harvested, as scouring may result.

388. Other root crops.—Rutabagas and sugar beets are other roots which may be grown. The former, also called swede, are the easier to cultivate, but do not produce as much dry matter. They should be fed after, rather than before, milking because, otherwise, they may taint the milk. Sugar beets are very palatable and are the roots preferred by many for feeding cows on test.

389. Feeding roots.—Roots are generally fed by slicing them and placing in the manger with the grain sprinkled over them. From 30 to 60 pounds per day can be fed. To obtain the same amount of food value the amount fed must be somewhat larger than with silage because the latter has more dry matter. For the cow on test the addition of roots seems to increase the milk flow even where silage is being fed. This is attributed to their cooling effect. It has been shown that, except where records are sought, the feeding of roots in addition to silage is not justified because the increase in milk will not pay for the additional feed. However, where roots are fed somewhat less grain is necessary. Ten pounds of roots will replace one pound of grain.

CHAPTER XXVI

CORN AND WHEAT AND THEIR BY–PRODUCTS

Corn and Its By-Products

The corn kernel is lower in protein than most of the other cereal grains. It contains little fiber, is rich in starch and fat, and thus ranks high in total digestible nutrients. It is low in mineral matter, especially lime.

390. Corn meal.—This is the entire ground corn grain. Because of its high percentage of oil it becomes stale to the taste on standing, and thus its palatability decreases. It possesses little bulk, and, therefore, is "heating." We may have either white or yellow corn meal. There is considerable evidence that the latter has a higher vitamine value but there is no other difference. Corn chop is another name for corn meal.

391. Corn and cob meal.—This product consists of the ground ear corn. The cobs have a rubber-like consistency and require

Corn is the Foundation of all Good Rations

much power for grinding. The product must be fine or the animal will not eat it. It is not likely to become rancid and has better physical condition than corn meal because the cobs add bulk. It is nearly equal to corn meal in feeding value.

392. Cereal milk by-products.—In cereal mills, corn is milled to produce the so-called "breakfast foods" such as hominy, corn flakes, etc. The by-products used as feeds are corn bran, corn feed meal, hominy feed and corn germ meal.

393. Hominy feed.—This feed has more fat and somewhat more protein than corn meal. It has more fiber and is therefore more bulky. Due to its greater bulk and smaller percentage of water, hominy will keep better in storage than corn meal. It is also better adapted to combining in rations than is corn meal, which requires special feeds to supplement its lack of bulk. Thus, hominy is much more widely used in the dairy ration than corn meal, although on the basis of nutrient content the two feeds are about equal. When the word "hominy" is used, white hominy is meant. Most of the corn used in the cereal mill is white. There is also a similar feed from yellow corn, called yellow hominy feed. Hominy meal and hominy chop are other names for hominy feed.

394. Corn germ meal.—This feed is nearly twice as high in protein as corn meal, and is somewhat higher in fat and also in fiber. It is an excellent medium protein feed of high digestibility, but its palatability decreases on standing since rancidity develops from its high fat content. Corn germ meal is one of the less important corn feeds because a relatively small amount of it is produced. A similar product is obtained in the manufacture of starch from corn.

395. Corn feed meal.—Corn feed meal is a by-product either from the manufacture of cracked corn or table meal. It is rather variable in analysis and, therefore, in feeding value, depending on how the milling process is carried out. It is usually spoken of as similar to corn meal. Actually, by reason of its higher fiber and bulk, it more closely resembles hominy, However, it must be remembered that it is more variable in value than either corn meal or hominy.

The manufacture of oil, starch, sugars, and syrups from corn gives us gluten feed, gluten meal and corn germ meal.

396. Gluten feed.—This product has over twice as much protein as corn meal and is about equal in total digestible nutrients. It is one of the most useful feeds, as it is a high protein feed which is usually comparatively cheap and which has the proper bulk to lend itself well to combination with a large variety of materials. The protein of gluten feed is not of as high a quality as that of many other feeds, thus gluten feed should not be fed alone. It should never make up over one-half the grain ration.

397. Gluten meal.—Gluten meal is that portion of the corn kernel that remains after the separation of the larger part of the starch, germ and bran in the manufacture of starch and sugars. This product has nearly 50 per cent more protein than gluten feed and somewhat more total digestible nutrients. It has little fiber or ash and is a heavy feed. Its lack of bulk limits its usefulness as compared with gluten feed. The particular place of gluten meal in the ration is where a heavy, high protein feed, low in fiber, is needed to supplement ingredients which are low in protein and bulky.

398. Corn distillers' grains.—This is the corn feed which is a by-product of the distillery. Corn distillers' grains is a high protein feed, which is very digestible. It has the proper bulk and a high feeding value. The feed is very useful as an ingredient of the ration for cows on test. Unfortunately, there is little of it on the market at the present time.

Wheat and Its By-Products

In the manufacture of flour the miller tries to separate from the rest of the wheat kernel as large a percentage as possible of the white floury portion. He actually gets about 70 per cent of high-grade flour in the process. The remainder goes into feed. It consists of bran, middlings, red dog flour, and screenings. Taken as a whole these by-products have a higher percentage of protein, fat and minerals than the flour, and have a greater nutrient content than the entire kernel, except as regards carbohydrates. Thus, the wheat by-products have a high feeding value.

399. Whole or ground wheat.—It is well known to all that the entire grain is used relatively little for feed. However, wheat having many broken or shrunken kernels and containing a considerable amount of screenings brings a poor price for milling, yet its feeding value may not be appreciably lowered. Thus the farmer should feed such wheat rather than market it. Whole or ground wheat contains more protein and mineral matter than corn and is at least equal in carbohydrates, but is much lower in fat. It is a palatable, highly digestible feed.

400. Screenings.—Previous to milling, the wheat is cleaned to separate out bits of straw, imperfect kernels, weed seeds, etc. These materials, called screenings, are either mixed and sold with the other wheat by-products, or marketed in proprietary feeds.

Screenings vary greatly in feeding value. A sample consisting largely of broken wheat and other grains has a high feeding value, while one consisting of straw, dust and certain weed seeds may be practically worthless. Screenings must be ground so as to destroy the life of the weed seeds. It is believed that most mills using screenings in quantity are equipped to do this. Thus, this objection is no longer a serious one.

The screenings in wheat feeds do not present a serious question, because by law they cannot be present in greater amount than is contained in the wheat from which the feed was made. The purchase of a proprietary feed containing screenings is another question. Because of the indefinite nature of the ingredient in question, it is believed that no mixed feed containing screenings should be bought unless manufactured under an open formula by a firm whom the farmer feels he can trust. (**113, 114, 115**)

401. Wheat bran.—The outer layers of the wheat kernel comprise the bran. The product is very rich in phosphorus. Though containing more protein than the entire wheat kernel and other cereal grains, bran is not equal to them in total digestible nutrients. This is partly due to its rather high fiber content. It seems, however, to have a value not shown by its nutrient content, particularly in rations for dairy cows. This extra value is probably due to its laxative effect and to its bulk, making it

very useful for combining with a wide variety of materials in the dairy ration.

A good sample of bran should consist of large flakes, light in weight and free from foreign materials. Where the screenings contained in the wheat from which the bran was made is combined with it, the feed is sold as "wheat bran with mill run screenings." This is the usual product now found on the market.

402. Red dog flour.—This product consists of flour with some fine particles of bran. Its protein and fat content are similar to that of bran but it contains a minimum of crude fiber and thus exceeds bran in total digestible nutrients. It is a much more expensive feed than bran and lacks the bulk and laxative properties which make the latter so valuable in the dairy ration. Red dog is a very useful feed where low fiber is desired, being especially valuable for young pigs and calves.

403. Standard middlings.—This product is intermediate between bran and red dog, consisting of fine particles of bran together with some flour. It contains less fiber than bran but more than red dog, as would be expected. Similarly, its bulk lies between the two. The protein and fat content of the three feeds is similar. Pound for pound, bran is preferred to standard middlings in the dairy ration. The middlings may be used if cheap enough, provided it is recognized that this feed is not a substitute for bran as regards bulk and laxative effect.

404. Flour middlings.—This feed is a mixture of standard middlings and red dog flour in the proportions obtained in the usual milling process. Its properties and value are thus evident.

405. Wheat mixed feed.—This is a term used for various mixtures of bran, red dog flour and middlings. Its feeding value varies according to the mixture.

406. Palmo middlings.—This material is a by-product from the manufacture of tin plate. In putting the finish on the latter, it is passed through palm oil and the excess oil later removed by absorption on wheat middlings. The middlings are later cleaned and sold as palmo middlings. The product is usually lower in moisture and higher in fat than the original middlings.

CHAPTER XXVII

OTHER GRAINS AND THEIR BY-PRODUCTS

Oats, Barley, Buckwheat, Rye and Rice

Oats are one of our most useful feeds, not only for horses but for dairy animals as well. The part left after the hull is removed is called the groat. This is the part used for human food. The hull has less than one-third as much protein and over three times as much fiber as the entire kernel.

407. Whole and ground oats.—The oat kernel is covered with a husk or hull which constitutes an average of 30 per cent of its weight. This hull together with its awn and beard makes the oat light. In very light oats, the husk may comprise as much as 45 per cent of the entire kernel. The lighter the oat, the lower is its protein, the higher its fiber, and the less its feeding value.

Oats have somewhat more digestible protein than corn but are lower in total digestible nutrients. They contain much more fiber than corn due to the large percentage of hull. This fact makes them bulky and better adapted than corn for combining with a variety of materials in the ration. Oats are particularly useful for lightening up a heavy mixture. They are palatable and easily digested. For the dairy ration they should be crushed or ground. We prefer crushed oats to a finely ground product.

408. Oats good for young stock.—Oats are very useful as an ingredient of the grain ration for calves and young stock. Some feeders recommend the whole kernels for this purpose but we believe that they will be better digested if the hull is broken by crushing rather than if mastication and rumination are depended upon to do it. If the indigestible hull is not broken the digestive juices cannot get at the material beneath. Even crushed oats alone will serve fairly well as a grain ration for young stock.

Ground or crushed oats also make an excellent ingredient of the mixture used in fitting animals for test. Their value here has been

repeatedly proven according to the records of how cows have been fed in preparation for records. Doubtless much of the good effect obtained from including them in the ration here is due to their lightness, bulk and ease of digestibility.

Ground oats with the hulls sifted out make a feed low in fiber which, though rather expensive, is frequently used for feeding young calves and pigs. Such a material is frequently found in proprietary calf and pig meals under such names as oatmeal, oat flour and ground oat groats.

409. Oat feed.—Everybody is familiar, through many a breakfast, with the human food obtained from oats. The milling of this cereal for oatmeal is one of our largest food industries. The by-product sold for feed is called oat feed or oatmeal-mill by-product. It has very little feeding value, but merits discussion because of the large amount which is sold in proprietary dairy feeds.

The residue from the oatmeal-mill consists of oat hulls, oat shorts, oat middlings and dust. However, the hulls are in by far the largest proportion and this is what makes oat feed so poor. Its average analysis is as follows: protein, 5.5 per cent; fat, 2 per cent; carbohydrates, 52 per cent; fiber, 27 per cent. The above analysis shows that oat feed does not have a higher nutrient content than timothy hay. It contains somewhat more digestible protein but less total digestible nutrients. Thus, oat feed must be classed as a low grade roughage, not as a concentrate. This fact must be borne in mind in considering the place of oat feed in the dairy ration. No one would think of buying chopped oat straw to put in his grain ration.

410. Clipped oat by-product.—Oats are frequently clipped to decrease their bulk either at oatmeal mills or elevators. There are removed during this process the fuzzy ends, a little of the inner kernel and also the refuse matter from the grain, such as chaff, straw and weed seeds. Oat clips or clipped oat by-product is the name under which the resulting product appears on the market. The product is light, bulky and of a chaffy, fibrous character. The material is widely used in proprietary feeds as an absorbent for molasses. Though we believe that the clips on the average

should have a somewhat greater feeding value than oat feed, they must be classed with the poorer roughages.

411. Ground barley.—The barley kernel is covered with a hull which constitutes some 15 per cent of the entire seed, in comparison to the oat kernel where the hull makes up 30 per cent of the whole. Barley is a rather bulky, highly digestible, low protein feed, which may be used more or less interchangeably with corn and oats, if it is available on the farm. It is believed that for all classes of dairy animals, crushed or ground barley is preferable to whole. For milk production, tests indicate that ground barley is equal to corn meal, while for feeding pigs it is also a close competitor of corn. Ground barley is a useful feed for calves and young stock.

412. Feed barley.—In general barley will be found more expensive to purchase than a mill feed of equal value as regards total digestible nutrients, such as hominy. Where barley is purchased one must be careful to secure a good product since varying amounts of foreign material may be present. By law, ground barley must be made from grain containing not less than 90 per cent pure barley. "Mixed feed barley" is a term used to cover a product containing not less than 75 per cent of pure barley, while "feed barley" is a name under which barley screenings may be sold. These terms are very confusing, particularly as they must be distinguished from barley feed and barley mixed feed, to be described later. However, the only way to be sure of not being cheated is to know what these various terms mean.

413. Brewers' dried grains.—The malting of barley furnishes two by-products for feed, malt sprouts and brewers' grains. The latter has about 25 per cent of protein. It is bulky and its high fiber content must be balanced off by using with it other feeds, low in fiber. On the basis of digestible nutrients furnished, it ranks somewhat above wheat bran but considerably below gluten feed.

414. Malt sprouts.—This by-product is also a bulky feed having as much digestible protein as brewers' grains, though of a poorer quality. The feeding value is less than that of brewers' dried grains.

415. Barley feed.—At the cereal mill two products may be manufactured for human food,—pearl barley and barley flour. The residues from both processes appear to be similar, namely chaff, outer coatings and floury residues. However, the pearl barley product called barley feed contains more of the flour and less of the hull than does the flour by-product, barley mixed feed. The former contains somewhat more protein and twice as much fat and fiber as ground barley and should be at least equal to it in feeding value. Barley mixed feed is a poorer and more variable product.

416. Ground buckwheat.—Though not one of the cereals, buckwheat is usually discussed with them but ranks lower in feeding value. It contains somewhat more digestible protein than corn, but is much lower in total digestible nutrients. The kernel is about one-third hull and as a result ground buckwheat has a high fiber content,—about the same as oats. This hull has much less nutrient value than wheat straw. Ground buckwheat is most nearly like ground oats and wheat bran and could replace these feeds in mixtures we have listed. Though containing somewhat more total digestible nutrients than bran, buckwheat does not contain as much protein nor is it laxative and thus does not have as great an all-round value for mixing in rations. It is believed that where prices are such that the farmer can sell his buckwheat and buy an equal amount of bran with the money he had better do so.

417. Buckwheat middlings.—The milling of buckwheat to produce flour for human food is carried on in a number of small mills. The by-products are hulls and middlings. Buckwheat middlings is a very excellent feed for milk production provided it is as free as possible from hulls. A high-grade product will contain more protein than gluten feed and will be nearly as high in total digestible nutrients. Thus buckwheat middlings may be substituted for gluten in mixtures. Since some samples contain more hulls than others, the purchaser should make sure that he is getting a good grade by looking at the guarantee, bearing in mind that an average sample should contain 28 per cent of protein and not over 6 per cent of fiber.

418. Buckwheat feed.—It has been stated that hulls are a by-product of flour milling. They contain 45 per cent of fiber and little protein or fat and thus have practically no feeding value. They should be thrown away. Many millers are unwilling to do this, but instead mix hulls with middlings and sell the product as buckwheat feed. Such a feed may be fairly good or practically worthless depending on the amount of hulls added. Of course, the more hulls, the less protein and the more fiber and thus the guarantee will give an indication of the value of the feed. However, many small millers sell buckwheat feed locally without any guarantee and cause the dairyman to buy a lot of hulls under the impression that a feed nearly as good as buckwheat middlings is being bought at a bargain. Mixing a worthless material such as buckwheat hulls with a high-grade feed like the middlings is wrong in principle even if a fairly good feed results. The high-grade feed should be sold for what it is worth and the useless stuff thrown away. Certainly buckwheat feed should not be bought except under a definite guarantee as to analysis.

419. Ground rye.—The rye kernel is very similar to wheat in analysis. The ground grain may be used in the dairy ration in place of such feeds as oats, barley or corn. It ranks somewhat higher in total digestible nutrients than barley, but lower than corn. It may be doubted whether ground rye is as valuable as either ground barley or corn meal for milk production but it is a useful feed where the farmer can grow it to advantage over the other grains or finds it especially suited in his rotation of crops.

420. Rye middlings or rye feed.—Formerly in the milling of rye for flour, bran and middlings were separated as by-products and sold separately. Now they are usually combined and sold under the names rye feed or rye middlings. The rye by-products are similar in analysis and feeding value to the wheat by-products, but so little of them are produced that they are of small importance as feeds.

421. Rice bran.—This is a highly nutritious feed containing around 12 per cent each of protein, fat and fiber. The fat content is rather variable and frequently runs considerably higher than the

figure given. Due to this high fat content rice bran may quickly cake and become rancid. It is high in the B vitamine and contains protein of excellent quality. Rice bran could be used in place of wheat bran in mixtures.

422. Rice polish.—This feed is somewhat lower in protein and fat than the bran, but also is very much lower in fiber. A good product should not contain over 3 per cent. Thus the polish is especially useful for feeding young calves and pigs, and is a frequent ingredient of calf meals. It could replace corn meal in various rations.

423. Rice hulls.—The hulls are woody and tasteless, and have sharp flinty edges and needle-like points, which are irritating to the lining of the digestive tract. They should never be fed to animals. Reputable millers use them for fuel or packing or throw them away altogether. The best samples of rice bran contain some hulls due to inability to get a complete separation. Some millers may allow considerably more of the hulls than necessary to go into the bran.

424. Rice feed.—A mixture of hulls and bran is sometimes offered for sale as rice feed. Needless to say, it should not be bought because the hulls are not only useless but also harmful.

CHAPTER XXVIII

THE OIL MEALS AND MISCELLANEOUS BY–PRODUCTS

The oil meals comprise a class of feeding stuffs which are the residues left after the extraction of the oil from various seeds and nuts. In general, oil-bearing seeds are much higher in protein than the cereals, while the fat content is some ten times as high. Cottonseed and linseed oil-meals are by far the most important, but cocoanut oil meal, peanut oil meal and soybean oil meal are finding increasing use, particularly in certain sections of the country.

425. Cottonseed by-products.—The cottonseed, formerly allowed to rot after the cotton was removed, now furnishes a great variety of products for industrial use and for human and animal food. The oil, which is the main product of the cottonseed industry, is largely used for human food as salad oil and lard and butter substitutes.

426. Cottonseed hulls.—The hull is of smooth, hard texture and has little if any feeding value. As separated in the manufacturing process the hulls contain over 40 per cent of crude fiber with only 4 to 5 per cent of protein and 2 per cent of fat. The protein and fat content is mostly due to incompletely separated meats. Despite their low value the hulls are largely marketed in cottonseed products sold as feed and occasionally as "filler" in proprietary feeds.

427. The cottonseed meals.—Three grades of cottonseed meal are recognized by official definition: 41.12 per cent protein (choice quality), 38.56 per cent protein (prime quality) and 36 per cent protein (good quality). Color, lint content, etc., are other differentiating factors, besides protein. The best grade is the brightest in color. While it is true that products differ in composition according to the place where the source was grown, the principal difference among the three grades is hull content,—the more hull the less protein and the more fiber. It is not possible

to separate the hulls from the meats completely and the extent of separation differs in different mills according to their machinery and practice. On the other hand, extra hulls may be added to the meal as it is ground. This is a common practice. That is, the presser merely dilutes 41 per cent protein meal up with hulls and makes 36 per cent. Such a practice makes possible a larger disposal of the hulls as feed. It is believed to be wrong in principle to dilute a high-grade product with a material so poor in feeding value that the farmer would not think of buying it at any price if offered to him separately.

428. Choice quality most economical.—The 41 per cent protein cottonseed meal is, of course, the highest in price, but on the basis of total digestible nutrients it is in general the most economical to buy, particularly when its higher manurial value is considered. We believe that dairymen should purchase the highest grade meal. At least they should remember that there are three grades and not merely buy meal regardless of protein content. A little experience enables one to judge roughly the quality of cottonseed meal by its color and hull content. Frequently the hulls are ground, but this darkens the meal even though the hulls as such cannot be recognized.

429. Cottonseed feed.—Any mixture of meal and hulls containing less than 36 per cent protein must by law be designated as cottonseed feed. In addition to being a further dilution of the meal with low-grade material, it is open to the additional objection of being a product of very indefinite value. There is no limit to the percentage of hulls that may be added. Cottonseed feeds have been reported with as high as 80 per cent of hulls. Such a product could have little if any feeding value.

430. Feeding cottonseed meal.—Cottonseed meal is in most years about the cheapest source of protein which can be bought for the dairy ration and it is a very satisfactory feed for milk production. It is somewhat constipating and this fact must be remembered in choosing the other ingredients.

That cottonseed meal is harmful to young calves and pigs is well known. We do not know just what property of the meal

causes trouble but it is generally believed that the meal contains a poisonous substance. Dairy cows are little susceptible to the trouble and there is no danger in feeding them any moderate amount of the meal. We do not believe the grain ration should in general contain more than 30 per cent cottonseed meal, but this amount may be raised somewhat if the animals are on pasture or receiving silage liberally. There is some basis for the belief that cows fed heavily on cottonseed meal are likely to develop garget or other udder troubles. Whether this possibility is due to the same property that causes trouble in young pigs and calves is not known, but it is believed that the meal may be fed in the amount we have stated with little if any extra likelihood of udder troubles.

431. Flaxseed products.—Ground flaxseed is sometimes fed to young calves along with skim milk or as an ingredient of a calf meal. The seed is about one-third oil, thus the ground product quickly becomes rancid.

In the oil pressing process, the cleaned seeds are ground, heated and pressed to extract the oil. The residue which is in the form of hard slabs or "cake" is ground to give the oil meal. This method is called the old process (O. P.) in distinction to a new process, which at one time came into use but was later largely abandoned, whereby the oil was dissolved out instead of being extracted by pressure.

432. Linseed oil meal.—This feed is laxative and stimulating to appetite and milk flow and helps keep the animals in good condition. A fine, sleek, oily coat results from the feeding of linseed oil meal. It is widely used in feeding for records and is a particularly fine feed for growing animals. We like to have it as an ingredient of every dairy ration, particularly where no silage is fed. It is generally somewhat more costly on a total digestible nutrient basis than cottonseed meal, but it is worth more because of the special qualities we have mentioned, and the price difference at most times is not so great but that at least 5 or 10 per cent can be included in the ration. Its laxative properties will result in scouring when used in too large amounts. The upper limit

may be considered as 20 to 30 per cent, depending on the rest of the ration.

433. Peanut oil meal.—This feed contains approximately 47 per cent protein, 8 per cent fat and 5 per cent fiber, and being highly digestible, is thus somewhat more valuable pound for pound than choice cottonseed meal. It is palatable to dairy cattle and is a very excellent feed for milk production. Due to its high fat content, peanut oil meal will become rancid on storage in hot weather. Sometimes the product sold as meal has been adulterated with shucks. Such an adulteration lowers the protein content and raises the fiber. Thus, a meal which falls much below the average in these respects should be regarded with suspicion.

Unhulled peanut oil feed has one-third less protein than the meal and four times as much fiber, due, of course, to including the shucks. We do not believe the farmer should purchase a feed containing peanut shucks.

434. Cocoanut oil meal.—The dried kernels of the cocoanut, called copra, are pressed for oil which is used largely in nut-oleos, sold as butter substitutes. The feed is also called copra oil meal from the name of the dried kernels. It has a protein content of somewhat above 20 per cent, thus ranking much lower in this respect than the other oil meals. On the basis of its digestible nutrients it may be considered nearly as valuable pound for pound as gluten feed. Cocoanut oil meal has a pleasant odor and taste which make it palatable to dairy cows and it is a very satisfactory feed for the dairy ration. It is reported not to keep well in warm weather, but our experience is that this difficulty is not a serious one, provided the feed is dry.

435. Soybean products.—The soybean is a very important crop in the Orient and is rapidly gaining in favor in the temperate regions of the United States. The bean is rich in oil which is pressed out for human food and industrial use, leaving soybean oil meal as feed. The beans themselves are also being advocated as a high protein home-grown feed which could be substituted for much of the high priced protein supplements now purchased.

Recent experiments with laboratory animals and with hogs indicate that the soybean contains protein of very high quality compared to other vegetable sources. This fact, coupled with the excellent results obtained in the limited trials that have been made with dairy cows, cause us to regard this source of feed as one well worth trial and investigation.

436. Soybean oil meal.—The residue from the extraction of oil contains somewhat more digestible protein and total digestible nutrients than choice cottonseed meal. The use of this feed has been limited to certain sections of the country, notably to the Pacific Coast where it is imported from the Orient. There are some mills in the South where soybeans are pressed but the amount of the oil meal on the market is very limited. It appears to be highly liked by dairymen where it has been tried and farmers may well bear this in mind, as an increasing output may be expected.

437. Sugar factory by-products.—The two sources of the sugar used on the table are the sugar cane and sugar beet. Most of the molasses used for feed is a by-product from the manufacture of cane sugar. The beet sugar process furnishes dried beet pulp as well as some beet molasses.

438. Cane molasses.—A good grade of cane molasses should contain not less than 53 to 55 per cent of total sugar, not over 6 per cent of ash and not over 21 to 22 per cent of water. The feeding value of molasses is based primarily on its sugar content. It contains some 3 per cent of protein but only one-third of this is digestible. There is no fat. An average grade of molasses is worth about three-fourths as much as corn meal on the basis of its total digestible nutrients, though, of course, it has much less protein. However, molasses has a special value in toning up the system and in keeping the bowels open. It also puts a nice smooth coat on the animal. Because of these beneficial effects, many feeders like to have a little molasses in the ration even though it may be a costly source of total digestible nutrients. Particularly this is true in rations for cows on test. For this purpose molasses finds a very general use.

439. How to feed molasses.—The feeding of molasses presents some difficulty. The best way is to thin it with warm water and pour it over the roughage. Used in this way, an extra amount of roughage will be consumed. Particularly, molasses will add palatability and increase the consumption of poor roughage. Molasses diluted with water may be used to soak up beet pulp. This is a frequent practice in feeding test cows.

We are in favor of 5 to 10 per cent of molasses in the dairy ration provided it can be bought at a reasonable price. We are willing to pay somewhat more for it than its digestible nutrients would warrant, due to its special properties. These properties are of particular value where no silage is fed. In the ordinary ration with silage available, we do not recommend the purchase of molasses where it costs more than corn.

440. Beet molasses.—This product is the residue from the crystallization of sugar out of beet juice. It contains fully as much sugar as cane molasses but has a distinct disadvantage as a feed due to its content of alkaline salts which give it a purgative action. Thus, beet molasses can be fed in limited quantities only.

441. Dried beet pulp.—After extracting the juice from the sugar beets there remains a residue which when dried contains 9 per cent of protein, 60 per cent of nitrogen free extract, and 19 per cent of crude fiber, with about 1 per cent of fat. On the basis of its nutrient content it ranks somewhat below corn in feeding value and its high fiber content limits the amount that can be used in the ration. However, beet pulp is a very useful feed because of its palatability, bulk and laxative effect. These qualities cause it to be highly esteemed to lighten up a heavy ration fed cows on test. It has another property which gives it special value. It will absorb two or three times its weight of water. Thus moistened beet pulp may be used to furnish succulence where no silage or roots are to be had. Similarly, diluted molasses can be fed on it as has been mentioned.

N. C. State College

APPENDIX

THE CHEMICAL COMPOSITION OF COMMON FEEDINGSTUFFS

In Table I are given figures for total analysis and for digestible nutrients in the common feedingstuffs used for dairy animals. This table has been compiled mainly from the extensive data in Tables I and III of "Feeds and Feeding," eighteenth edition, by Henry and Morrison, by special permission of the authors.

Table I. Analyses of Feedingstuffs

Feedingstuffs	Total Nutrients						Digestible Nutrients in 100 lbs.	
	Water Per cent	Ash Per cent	Crude Protein Per cent	Carbohydrates		Fat Per cent	Crude Protein Lbs.	T.D.N. Lbs.
				Fiber Per cent	N.F.E. Per cent			
Concentrates								
Barley, ground	9.3	2.7	11.5	4.6	69.8	2.1	9.0	79.4
Beans, navy, ground	13.4	3.6	22.7	5.8	53.0	1.5	18.8	71.9
Beet pulp, dried	8.2	3.5	8.9	18.9	59.6	0.9	4.6	71.6
Brewers' grains, dried	7.5	3.5	26.5	14.6	41.0	6.9	21.5	65.7
Buckwheat, ground	12.1	2.1	10.8	10.3	62.2	2.5	8.1	63.4
Buckwheat middlings	12.0	4.8	28.3	4.8	42.7	7.4	24.6	76.6
Cocoanut meal	10.2	5.6	20.7	10.3	44.8	8.4	18.6	78.8
Corn, dent, ground	11.3	1.3	9.3	2.3	72.0	3.8	6.9	83.8
Corn-and-cob meal	10.4	1.5	8.5	7.9	67.6	4.1	6.1	78.1
Corn and oat feed	11.4	2.8	9.6	7.4	65.0	3.8	7.3	75.6
Corn germ meal	8.9	2.7	22.6	9.0	46.0	10.8	16.5	82.5
Cottonseed meal, 43%	7.5	6.2	44.1	8.1	25.0	9.1	37.0	78.2
Cottonseed meal, 36%	7.9	6.4	37.6	11.5	28.4	8.2	31.6	74.8
Distillers' grains, dried, corn	6.6	2.6	30.7	11.6	36.3	12.2	22.4	88.9
Dried blood	9.7	3.3	82.3	....	3.8	0.9	69.1	71.1
Fish meal	10.5	28.1	51.4	....	....	8.3	40.1	58.8
Gluten feed, corn	8.7	2.1	25.4	7.1	52.9	3.8	21.6	80.7
Gluten meal, corn	9.1	1.1	35.5	2.1	47.5	4.7	30.2	84.0
Hominy feed	10.1	2.6	10.6	4.4	64.3	8.0	7.0	84.6
Kaffir grain	11.8	1.7	11.1	2.3	70.1	3.0	9.0	80.0
Linseed oil meal	9.1	5.4	33.9	8.4	35.7	7.5	30.2	77.9

Table I. Analyses of Feedingstuffs—(Continued)

Feedingstuffs	Total Nutrients						Digestible Nutrients in 100 lbs.	
	Water Per cent	Ash Per cent	Crude Protein Per cent	Carbohydrates		Fat Per cent	Crude Protein Lbs.	T.D.N. Lbs.
				Fiber Per cent	N.F.E. Per cent			
Malt sprouts	7.6	6.1	26.4	12.6	45.6	1.5	20.3	70.6
Molasses, cane or blackstrap	25.7	6.1	3.2	....	65.0	....	1.0	59.5
Oats, ground	9.2	3.5	12.4	10.9	59.6	4.4	9.7	70.4
Peanut oil meal	6.6	4.8	44.8	7.6	26.0	10.2	40.3	83.5
Red dog flour	11.1	2.5	16.8	2.2	63.3	4.1	14.8	79.2
Rice bran	10.1	9.7	12.1	12.4	44.3	11.4	7.9	65.8
Rye, ground	9.4	2.0	11.8	1.8	73.2	1.8	9.9	81.0
Rye feed	11.5	3.8	15.3	4.7	61.5	3.2	12.2	74.5
Skim milk	90.1	0.7	3.8	....	5.2	0.2	3.6	9.1
Soybean seed	9.9	5.3	36.5	4.3	26.5	17.5	33.2	94.1
Soybean oil meal	10.5	4.9	43.2	5.3	29.5	6.6	39.7	84.5
Tankage, 60% protein	7.9	15.3	60.4	5.3	3.7	7.4	56.2	71.4
Wheat, ground	10.2	1.9	12.4	2.2	71.2	2.1	9.2	80.1
Wheat bran	10.1	6.3	16.0	9.5	53.7	4.4	12.5	60.9
Wheat mixed feed	10.1	5.2	16.8	7.6	55.7	4.6	12.9	67.0
Wheat middlings, flour	10.7	3.7	17.8	4.7	58.1	5.0	15.7	78.2
Wheat middlings, standard	10.5	4.4	17.4	6.0	56.8	4.9	13.4	69.3
Whey	93.4	0.7	0.8	....	4.8	0.3	0.8	6.2
Dry roughage								
Alfalfa hay, whole or ground	8.6	8.6	14.9	28.3	37.3	2.3	10.6	51.6
Barley straw	14.2	5.7	3.5	36.0	39.1	1.5	0.9	42.5
Bean straw	10.5	7.2	7.3	30.8	42.9	1.3	3.6	47.6
Clover hay, alsike	12.3	8.3	12.8	25.7	38.4	2.5	7.9	47.3
Clover hay, red	12.9	7.1	12.8	25.5	38.7	3.1	7.6	50.9
Corn fodder	18.3	5.0	6.7	22.0	45.8	2.2	3.0	53.7
Corn stover	19.0	5.5	5.7	27.7	40.9	1.2	2.1	46.1
Kaffir fodder	9.0	9.4	8.9	26.8	43.1	2.8	4.1	52.9
Millet, common or Hungarian	14.3	6.3	8.3	24.0	44.3	2.8	5.0	55.0
Mixed hay, all grasses	12.8	5.6	7.6	28.8	42.7	2.5	4.3	51.3
Mixed hay, clover and timothy	12.2	6.1	8.6	29.9	40.8	2.4	4.0	46.2
Oat hay	12.0	6.8	8.4	28.3	41.7	2.8	4.5	46.4
Oat straw	11.5	5.4	3.6	36.3	40.8	2.4	1.0	45.6
Peas, field, hay	11.1	7.9	15.1	24.5	37.9	3.5	12.2	56.6
Peas and oats	16.6	7.3	11.4	25.6	36.5	2.6	8.3	48.8
Peas, oats and barley	16.5	6.0	12.6	29.5	32.4	3.0	9.2	50.1

Table I. Analyses of Feedingstuffs—(Continued)

Feedingstuffs	Total Nutrients						Digestible Nutrients in 100 lbs.	
	Water Per cent	Ash Per cent	Crude Protein Per cent	Carbohydrates		Fat Per cent	Crude Protein Lbs.	T.D.N. Lbs.
				Fiber Per cent	N.F.E. Per cent			
Prairie hay	6.5	7.7	8.0	30.5	44.7	2.6	4.0	47.9
Sorghum fodder	9.7	7.8	7.4	26.1	45.9	3.1	2.8	52.1
Timothy hay	11.6	4.9	6.2	29.8	45.0	2.5	3.0	48.5
Wheat straw	8.4	5.2	3.1	37.4	44.4	1.5	0.7	36.9
Fresh green roughage								
Alfalfa	74.7	2.4	4.5	7.0	10.4	1.0	3.3	14.6
Alfalfa silage	46.0	5.3	10.0	14.2	22.0	2.5	5.1	29.1
Beets, garden	87.0	1.5	1.6	0.9	8.9	0.1	0.9	10.2
Carrots	88.3	1.2	1.2	1.1	8.0	0.2	1.0	10.6
Clover, red	73.8	2.1	4.1	7.3	11.7	1.0	2.7	17.1
Clover, red, rowen	65.6	2.5	5.3	9.1	16.2	1.3	3.3	20.5
Corn and soybean silage	74.9	2.0	2.6	6.7	12.8	1.0	1.6	17.4
Corn fodder	78.1	1.2	1.9	5.2	13.0	0.6	1.0	14.7
Corn silage	73.7	1.7	2.1	6.3	15.4	0.8	1.1	17.7
Corn stover silage	79.4	1.3	1.5	6.8	10.5	0.6	0.6	12.2
Kaffir fodder	76.4	1.9	2.4	6.6	12.0	0.7	1.1	14.4
Mangels	90.6	1.0	1.4	0.8	6.1	0.1	0.8	7.4
Millet, common or Hungarian	72.4	2.1	2.9	8.4	13.3	0.9	1.9	18.1
Mixed grasses	70.3	3.0	5.1	6.3	13.8	1.5	3.6	20.1
Oat fodder	87.0	1.6	4.9	1.7	4.0	0.8	3.4	8.6
Oat and pea silage	69.9	3.0	4.1	10.0	11.7	1.3	2.8	17.6
Pea, field, Canada	83.4	1.6	3.6	4.0	6.9	0.5	2.9	10.7
Peas and oats	77.4	2.0	3.2	6.3	10.1	1.0	2.4	14.4
Pea cannery refuse silage	76.8	1.3	2.8	6.5	11.3	1.3	1.6	15.0
Potatoes	78.8	1.1	2.2	0.4	17.4	0.1	1.1	17.1
Pumpkins	91.7	0.9	1.4	1.3	4.2	0.5	1.1	6.7
Rape	83.3	2.2	2.9	2.6	8.4	0.6	2.6	13.3
Rutabagas	89.1	1.0	1.2	1.4	7.0	0.3	1.0	9.4
Sorghum fodder	75.1	1.4	1.5	7.0	14.0	1.0	0.7	17.1
Soybeans	76.4	2.4	4.1	6.3	9.8	1.0	3.2	14.5
Soybean silage	72.8	3.5	4.2	7.9	10.1	1.5	2.8	15.6
Sunflower silage	78.1	2.2	2.0	6.4	10.2	1.1	1.0	12.6
Timothy	62.5	2.2	3.1	11.7	19.3	1.2	1.5	22.2
Wheat fodder	72.6	2.7	3.6	7.5	12.8	0.8	2.8	19.3

FEEDING STANDARDS

A feeding standard is a statement of the amount of digestible nutrients required by an animal over a certain period of time for a given purpose, such as milk production, growth, etc. Several investigators have worked out feeding standards for the various classes of animals. We reproduce here in Table II the feeding standard for a dairy cow worked out by Professor F. B. Morrison of the University of Wisconsin, as published in "Feeds and Feeding," previously mentioned.

Table II. Morrison Feeding Standard for Dairy Cows

	Digestible Protein (pounds)	Total Digestible Nutrients (pounds)
1. Dairy cows*		
For maintenance of 1000-pound cow....	0.700	7.925
To allowance for maintenance add:		
For each pound of 2.5 per cent milk.....	0.045–0.053	0.230–0.256
For each pound of 3.0 per cent milk.....	0.047–0.057	0.257–0.286
For each pound of 3.5 per cent milk.....	0.049–0.061	0.284–0.316
For each pound of 4.0 per cent milk.....	0.054–0.065	0.311–0.346
For each pound of 4.5 per cent milk.....	0.057–0.069	0.338–0.376
For each pound of 5.0 per cent milk.....	0.060–0.073	0.362–0.402
For each pound of 5.5 per cent milk.....	0.064–0.077	0.385–0.428
For each pound of 6.0 per cent milk.....	0.067–0.081	0.409–0.454
For each pound of 6.5 per cent milk.....	0.072–0.085	0.434–0.482
For each pound of 7.0 per cent milk.....	0.074–0.089	0.454–0.505

*Cows producing 1.0 lb. of fat daily should receive about 21 to 25 pounds dry matter per 1000 pounds live weight.

In Table II the figures give the amount of nutrients required for a 24-hour period. In the first place, it is noted that a certain amount is required for maintenance. Figures are given for a 1000-pound cow. The requirements for other weights are proportional. An 800-pound cow would require only eight-tenths as much. Next, a certain amount of nutrients is added according to the amount and richness of the milk.

These figures are the same no matter what the weight of the cow. In stating certain limits, instead of an absolute requirement for each unit of production, Professor Morrison gives an opportunity for choice according to feed costs. He states that feeding the upper limits of protein and total digestible nutrients will usually increase

production slightly but that it may not be economical to do so where feed prices, particularly for protein-rich feeds, are high. Feeding standards are used for computing rations.

442. Computing a dairy ration.—Suppose it is desired to compute a ration for a 1200-pound cow producing 30 pounds of milk testing 3.5 per cent fat, using those feeds which at current prices will give the cheapest ration and still be satisfactory in other respects. For maintenance the cow will require 1.2 times the requirements for a 1000-pound cow given in Table II. For her production requirements we will use an average of the limits set in the table. For one pound of 3.5 per cent milk this would be 0.055 pounds digestible protein and 0.30 pounds total digestible nutrients. For 30 pounds it would be 30 times as much. The cow's requirements would thus be as follows:

	Digestible Protein	Total Digestible Nutrients
For maintenance	0.84	9.510
For 30 lbs. of 3.5% milk	1.65	9.000
Totals	2.49	18.510

The above shows the nutrients the cow must have in a day's ration. Suppose there are red clover hay and silage available on the farm. To obtain the proper variety at least three concentrates must be bought. The next thing to do is to find out from the feed dealer the current prices of various feeds and compute their relative cost in terms of total digestible nutrients. The latter can be obtained for a given feed by multiplying the total digestible nutrients in 100 pounds, as given in Table I, by 20 and dividing the result into the price per ton. This result, the cost per pound T.D.N., multiplied by 100 gives cost per 100 pounds T.D.N. This is illustrated below for hominy:

$$\frac{\$38.05}{84.6\times20}\times100=\$2.25$$

Suppose the following feeds are available at the prices named:

Feeds	Cost per ton	Cost per 100 lbs. T.D.N.
Corn meal	$36.50	$2.18
Hominy feed	38.05	2.25
Flour middlings	38.80	2.48
Standard middlings	35.05	2.53
Wheat mixed feed	36.30	2.71
Ground oats	38.60	2.74
Wheat bran	35.05	2.88
Gluten feed	49.80	3.09
Cottonseed meal, 43%	58.05	3.71
Linseed oil meal	59.05	3.80

Having the necessary information as to feeds available we are ready to select the kinds and amounts to be used. When a cow is fed the right proportion of roughage to concentrates she will consume daily about one pound of hay and three pounds of silage for every hundred pounds of live weight. Thus, as a starting point we decide that our ration should contain 12 pounds of hay and 36 pounds of silage. The next problem is to select the grain ration so as to make up the rest of the requirements. At the same time we must keep the dry matter within the limits noted under Table II. Of course, if we added enough we could get all the requirements by using only low protein feeds, but this would increase the dry matter much above the upper limit and might make the ration in excess of what the cow would consume. The dry matter allowance for a 1200-pound cow is 1.2 times that given in the note in Table II, or 25 to 30 pounds.

Experience tells us that to get sufficient protein and the proper amount of dry matter in a grain mixture a part of it must come from a high protein feed. Gluten feed is the cheapest feed in this class according to the table. Hominy is a cheap, low protein feed, but we cannot make the mixture entirely of gluten and hominy because it would lack variety and come entirely from one plant. Thus, let us include one of the wheat feeds. We prefer bran to middlings but it costs considerably more and we may compromise by using a mixture of the two—wheat mixed feed. We will also select ground oats to use in a small amount to add further variety. Next we start constructing the table shown on page 244 trying different amounts of the concentrates selected until the figures come out as we want them.

Feeds	Dry Matter	Digestible Protein	Total Digestible Nutrients
12 lbs. red clover hay	10.45	.912	6.11
36 lbs. corn silage	9.47	.396	6.37
2 lbs. hominy feed	1.80	.140	1.69
1 lb. ground oats	.91	.097	.70
3 lbs. wheat mixed feed	2.70	.387	2.01
2 lbs. gluten feed	1.83	.432	1.61
Totals	27.16	2.364	18.49

Table I does not give figures for dry matter but they can be obtained by subtracting the figures for water from 100. To construct the above table we thus multiplied the pounds of each feed by the appropriate figure for analysis from Table I, remembering that we had to point off two places. For example. the computation for clover hay was as follows:

$12 \times (100 - 12.9) = 10.45$ lbs. dry matter
$12 \times 7.6 = .912$ lbs. digestible protein
$12 \times 50.9 = 6.11$ lbs. T.D.N.

It takes some time to construct the table so as to have it come out the way we want it, but it goes much easier after a little practice. It is easy to get the dry matter to come in the range specified. We try to come within .2 pounds for the digestible protein and .5 pounds for the total digestible nutrients. The grain mixture we have selected would cost 16.2 cents for the eight pounds for a day's feeding, or $40.40 per ton.

We like to have some oil meal in the dairy ration where it is not too expensive. Here is a mixture containing it which would meet the requirements:

Feeds	Dry Matter	Digestible Protein	Total Digestible Nutrients
12 lbs. red clover hay	10.45	.912	6.11
36 lbs. corn silage	9.47	.396	6.37
3 lbs. hominy	2.70	.210	2.54
3 lbs. wheat mixed feed	2.70	.387	2.01
1 lb. gluten feed	.91	.216	.81
1 lb. linseed oil meal	.91	.302	.78
Totals	27.14	2.423	18.62

This mixture, containing slightly more protein, would cost 16.6 cents for the day's feeding or $41.50 per ton.

Of course this method is too complicated for regular use. The methods for putting together rations we have discussed in Chapter II are more practical. However, the question frequently comes up as to whether a given ration contains enough protein, or as to whether a cow is getting the right amount of nutrients for her production. Her ration can be easily checked up against the feeding standard. Finding whether a ration corresponds to the standard is much simpler than trying to make one fit it. For example, is 10 pounds of mixed hay, 25 pounds of silage and 8 pounds of equal parts of wheat bran and gluten feed a satisfactory ration for a 1200-pound Holstein cow producing 25 pounds of milk? Such a question came to us recently. The nutrient content of the ration works out as follows:

Feeds	Dry Matter	Digestible Protein	T.D.N.
10 lbs. mixed hay	8.72	.430	5.13
25 lbs. corn silage	6.58	.275	4.43
4 lbs. wheat bran	3.60	.500	2.44
4 lbs. gluten feed	3.65	.864	3.23
Totals	22.55	2.069	15.23

The cow's requirements are as follows, assuming 3.5 per cent milk:

	Digestible Protein	T.D.N.
For maintenance	0.840	9.51
For 25 lbs. of 3.5% milk	1.375	7.5
Totals	2.215	17.01

Thus, the ration is adequate as regards protein but low in total digestible nutrients and dry matter. It could be corrected by increasing the roughage. This would probably also add more protein than necessary, making it possible to substitute at least one pound of a lower protein concentrate which would cheapen the grain ration, or perhaps one pound of the concentrates could be omitted without further addition. However, the grain ration lacks variety as it stands.

WEIGHTS OF VARIOUS CONCENTRATES

A grain mixture will have the proper bulk if a quart of it weighs not more than a pound. Thus, in making up such mixtures it is useful to know the relative weights of the common feeds. The following table is taken from "Feeds and Feeding," eighteenth edition, by special permission of the authors:

Table III. Weights of Various Concentrates

Feedingstuff	One quart weighs	One pound measures	Feedingstuff	One quart weighs	One pound measures
	Lbs.	Qts.		Lbs.	Qts.
Barley, whole	1.5	0.7	Hominy feed	1.1	0.9
Barley, ground	1.1	0.9	Linseed oil meal	1.1	0.9
Beans, navy	1.7	0.6	Malt sprouts	0.6	1.7
Beet pulp, dried	0.6	1.7	Molasses, cane	3.0	0.3
Brewers' grains, dried	0.6	1.7	Oats, whole	1.0	1.0
Buckwheat, whole	1.4	0.7	Oats, ground	0.7	1.4
Buckwheat middlings	0.9	1.1	Rice bran	0.8	1.3
Cocoanut meal	1.5	0.7	Rye, whole	1.7	0.6
Corn, whole	1.7	0.6	Rye, ground	1.5	0.7
Corn-and-cob meal	1.4	0.7	Rye feed	1.3	0.8
Corn meal	1.5	0.7	Soybeans	1.8	0.6
Corn germ meal	1.4	0.7	Wheat, whole	1.9	0.5
Cottonseed meal	1.5	0.7	Wheat, ground	1.7	0.6
Distillers' grains, dried	0.6	1.7	Wheat bran	0.5	2.0
Gluten feed	1.3	0.8	Wheat mixed feed	0.6	1.7
Gluten meal	1.7	0.6	Wheat middlings, flour	1.2	0.8
			Wheat middlings, standard	0.8	1.3

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