

UNIVERSITY OF MISSOURI

COLLEGE OF AGRICULTURE

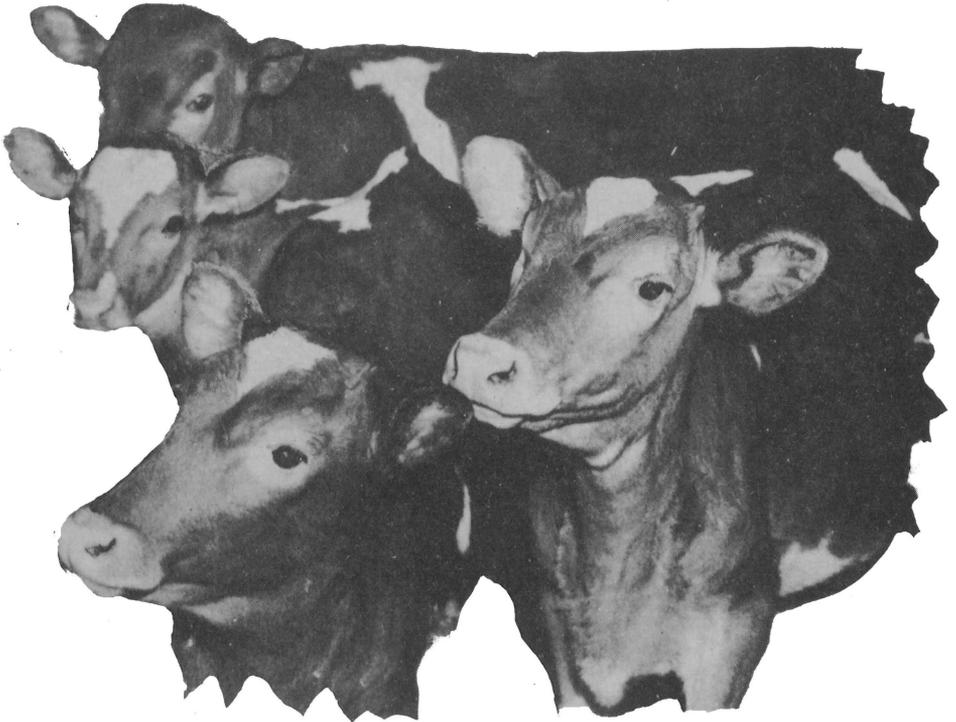
AGRICULTURAL EXTENSION SERVICE

4-H CLUB CIRCULAR 83

JANUARY, 1947

Dairy Production

4-H Dairy Projects



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Dairy Production

4-H Dairy Projects

I. INTRODUCTION

This circular was prepared especially for 4-H dairy project members. It is intended to help you to do a good job with your project. Your project leader, working closely with the Agricultural Extension Service of the Missouri College of Agriculture, will help you put to use the practices given here. Good information properly applied should bring good results.

The 4-H dairy project is built around the raising and management of one or more dairy animals. Whether you start with a calf, a bred heifer or a cow, we hope that you will expand your herd as fast as good heifers can be produced. Many fine dairy herds in this state started with a single well bred dairy heifer in a 4-H project.

II. SELECTING THE DAIRY CALF

The calf you select for a 4-H dairy project should be the kind that will give you pride and satisfaction. To the care and development of such animals boys and girls are happy to give their very best. The calf should actually belong to you, for only by complete ownership do the problems encountered teach real lessons.

The Breed and Family

Good animals of any breed command attention and respect. Usually the breed is a matter of local preference. Each breed has certain advantages of its own, yet the advantages of one breed over another are not sufficient to mean success or failure. A good job of dairying can be done with any breed.

You will be wise to consider the type of market found in the community. If the market requires milk of high butterfat content, you will choose one of the breeds having a high test, or vice versa. There are advantages in choosing a breed that is popular in the community and that has a good local organization of breeders.

Ayrshire.—The Ayrshire breed originated in Scotland and has been bred for hardiness and grazing ability. This breed is about medium as to milk production and percentage of butterfat. The milk tests about 4 per cent. Color markings are red or brown and white, body lines are straight, the horns are long and upstanding. Udders are well supported and symmetrical, cows average about 1100 pounds, bulls 1700 pounds in weight. Ayrshires are not numerous in Missouri.

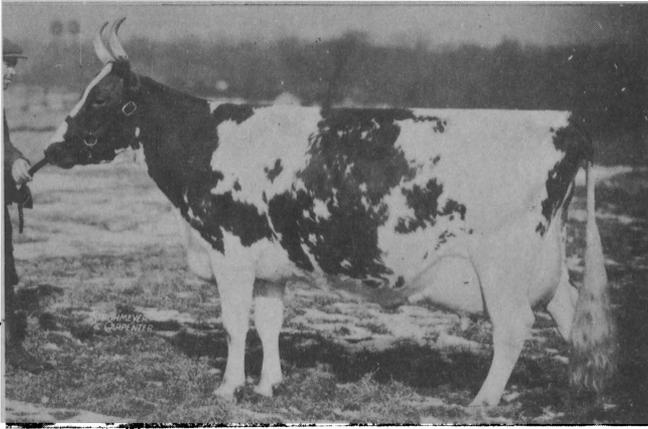


Fig. 1.—A desirable type of Ayrshire cow, Strathglass Lucky Puff.

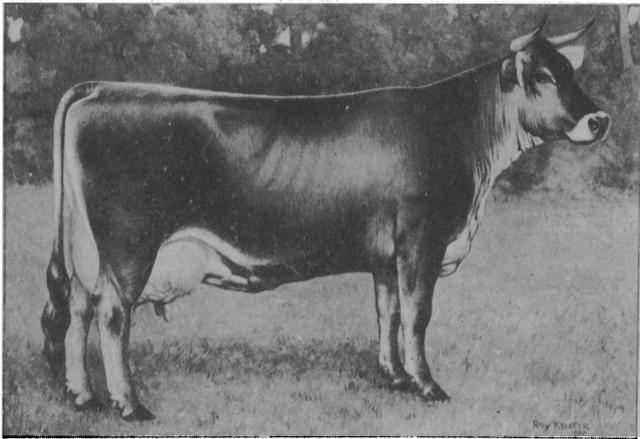


Fig. 2.—An ideal type of Brown Swiss cow.

Brown Swiss.—Brown Swiss are large animals, cows averaging about 1300 pounds and bulls 1800 or more. They are thrifty and rugged, and are persistent milkers. Milk production is relatively high and the milk tests about 4 per cent. Color varies from very light to dark brown with lighter grey-brown markings around the muzzle, ears, and along the back bone. Brown Swiss in the United States are all descendants of fewer than 200 animals imported from Switzerland. The breed is increasing in numbers and quality in Missouri and in the United States.

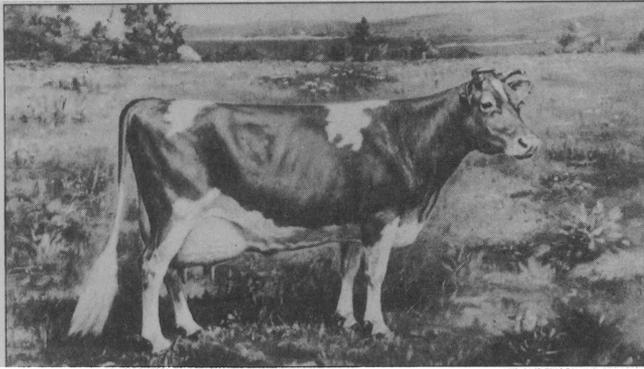


Fig. 3.—The ideal type Guernsey cow.

Guernsey.—The Guernsey cow is noted for the golden color of her milk. The milk tests above average, slightly less than 5 per cent.

The native home of the Guernsey is the Island of Guernsey. As a breed they have been increasing rapidly in popularity in the United States and in Missouri. .

Color markings vary from fawn to a deep orange with white markings. The nose should be buff color. Tongue and switch are usually white. Guernsey cows weigh about 1100 pounds, bulls about 1700.



Fig. 4.—A desirable type of Holstein-Friesian cow, Cornell Ollie Catherine.

Holstein-Friesian.—Holsteins are noted for their size and high milk production, although the milk is low in butterfat, averaging about 3.4 per cent. In the United States they exceed all other dairy

breeds in popularity. Holsteins are native to Holland. Color is distinct black and white. Average mature cows weigh 1300 to 1400 pounds and bulls 1800 to 2000 lbs.

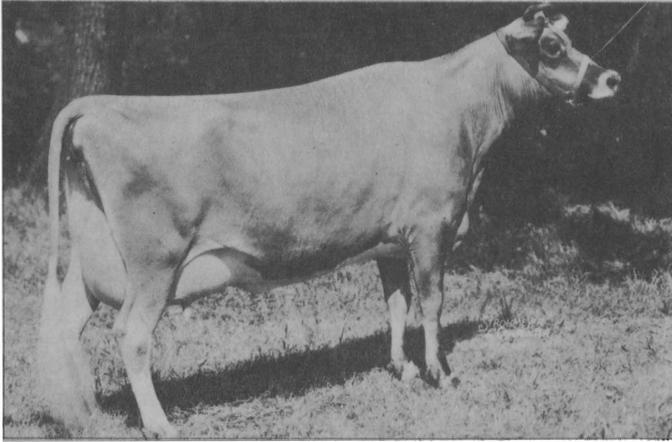


Fig. 5.—Champion Jersey cow, Cutie of La Vignette.

Jersey.—Jerseys are popular in Missouri, and in the United States—particularly in the South. Jerseys are noted for their rich milk which tests about 5.2 per cent. Cows average 900 to 1000 pounds, bulls 1500. Color varies from cream or light fawn to almost black. Some have white markings. The Island of Jersey is their native home. Importations to this country have been numerous.

The Calf's Family.—In selecting a calf, you should give close attention to the appearance and performance of its close relatives. They should be considered as the best indication of what the calf will be. The baby calf itself at a few weeks of age is an uncertain indicator of its future development and performance. Where possible, you will do well to study the older full brothers and sisters of the calf and the half-brothers and sisters, as well as the sire and dam. Select an animal from a family of high producers rather than one whose sire or dam is the only superior individual in the family. The more relatives of the calf you can observe, the more accurately you can judge what the calf will be like.

Herds on which records have been kept over a period of years are likely to produce calves of more uniformly high quality. Try to select a calf from a herd with an average production of not less than 350 pounds of butterfat per cow per year on twice-a-day milking. The dam of the calf should not be below the herd average.

If the calf is to be shown it may be best to select one at least 4

months of age in order that its type will be more apparent. It is difficult to judge type in very young animals.

As yearlings, heifers often are awkward or "leggy" but usually smooth up at maturity and attain more symmetry and balance.

As nearly as possible select a calf that is thrifty and vigorous and of normal size for its age and breed. It should have a straight strong topline from withers to tail-head. Ribs should be well sprung and long, giving it a deep, full barrel. The withers should be sharp and the neck long and tapering and fitted smoothly into the shoulders. It should be smoothly filled in back of the shoulders. The rump should be long and level. Although the udder is undeveloped in calves and young heifers, it should be attached high behind and carried well forward. Teats should be uniform in size, spaced well apart and hanging straight or slightly incurving at the rear.

Further information on type judging is given in Part X.

III. FEEDING AND CARE OF THE DAIRY CALF UP TO SIX MONTHS

Early Feeding

The most particular time in caring for the calf is during the first few months. If the calf is poorly cared for at this time it will be a great deal of trouble to raise and may not be a heavy producer when fresh. Proper care will pay better at this time than at any other period in the life of the animal.

It is usually best to raise the calf by hand. Letting the calf run with the cow after the third day is bad for the cow and does not do the calf any good. Two pounds of corn meal is about as good as one pound of butterfat for the calf, so it is cheaper to take the calf away and feed skimmilk and grain. Leave the calf with its mother for three or four days.

When the calf is first taken from the cow, let it go without milk for ten to twelve hours. Then it will be hungry and will learn to drink a good deal easier. Then take about three pounds of fresh warm milk, back the calf into a corner and straddle its neck. Hold the milk pail in one hand and with the other put two fingers into the calf's mouth and force its head into the pail. After repeating this two or three times the calf will learn to drink of its own accord.

The calf should be taught to drink milk slowly, and the bucket should be held up or placed on a rack about one foot from the ground while the calf is being fed. This practice will help to overcome some of the criticisms advanced against bucket feeding. The calf in nursing takes the milk slowly and mixes it with saliva. If the calf is permitted to gulp milk, or drinks rapidly, thus extending the esophagus, experi-

ments show that some of the milk "spills" over into the first stomach or rumen rather than going into the true or fourth stomach as intended, and since the milk cannot escape, undesirable fermentations take place. The result is usually an unthrifty, "pot-bellied" calf.



Fig. 6.—Teaching the calf to drink from a bucket. Normal thrifty calves can be raised on skimmilk as the principal food.

The use of "nipple buckets" for calf feeding is another way to avoid the harmful effects of too rapid drinking of the milk. The nipple bucket is an ordinary bucket with a spout at the bottom on which a nipple can be placed. The calf takes the milk through the nipple more slowly. This also avoids the necessity of teaching the calf to drink the milk from a bucket.

In using nipple buckets, you should take care to keep bucket and nipple clean at all times. Keep all buckets used to feed calves as clean and sterile as other milk utensils.

The digestive system of the young calf is very delicate and the stomach is limited in capacity. Under natural conditions the newborn calf will nurse a small amount several times a day. Overfeeding is a more common cause of calf ailments than underfeeding when

calves are raised on the bucket. Regularity, cleanliness, and exactness are necessary in calf raising.

All investigations and experience indicate that a calf must have chiefly milk the first few weeks of its life, as there is no acceptable substitute for whole milk during the first two weeks after birth. Avoid feeding milk very high in butterfat. Dairymen selling fluid milk often find it difficult to raise calves economically as whole milk is too expensive to feed after the first two or three weeks. Experiments have shown, however, that skim milk is an excellent calf feed and may be substituted for whole milk after the third week. Calf meals or grain mixtures may be used with good results if carefully handled.

Table 1.--Average Birth Weights of Jersey, Holstein, Guernsey, Ayrshire and Brown Swiss Calves.*

Breed	Birth Weight (lbs.)	
	Males	Females
Jersey-----	60	53
Holstein-----	95	90
Guernsey-----	71	65
Ayrshire-----	80	72
Brown Swiss†-----	85	80

*From Mo. Experiment Station Bulletin 336. †Weights estimated.

The digestive system of a young calf differs from that of the mature cow in that it is intended to digest milk only, during the first few months. As the calf grows older and begins to nibble a little hay its first stomach or rumen gradually develops until at about six months it functions about like that of a mature cow. Until that time the calf is not equipped to digest much roughage or pasture and requires some protein feed from animal sources (milk, blood-meal, etc.) and plenty of vitamins. In mature cattle the bacteria, yeasts and other micro-organisms that thrive in the rumen, convert poor protein into complete proteins and also manufacture most of the vitamins required, except vitamins A and D.

The young calf should have some good quality green legume hay after two weeks of age as this hay helps to develop its digestive system and furnishes vitamins. The calf will eat more hay as it grows in capacity, therefore it is best to keep a little fresh hay before the calf at all times until it goes on pasture. Calves will begin to eat grains at about two weeks of age if it is kept before them.

As long as the calf receives milk in some form, simple grain mixtures give good results. If milk is discontinued before four months of age the grain ration should contain dried skimmilk or soluble blood flour, as well as oil meals for satisfactory results. (See Table 2 for grain mixtures.)

Commercial calf meals or starters may be used where home mixed rations are not practical. The extent to which these feeds will replace milk depends largely on their composition. If they contain a high percentage of dried milk products and soluble blood-flour, etc., along with other food feeding materials, they may be used to replace part of the milk early in the calf's life.

Calves should not be put on grass until five months of age. After that they will gradually take more and more pasture to good advantage. After the first year little feed other than pasture is required. Calves under one year should always have grain while on pasture.

Calves need exercise and sunshine. A lot for exercise should be provided.

Methods of Raising Calves

There are several ways to raise calves. The method selected will depend on conditions on the farm. Allowing the calf to run with the cow is nature's way, yet any dairy cow worth keeping gives more milk than a calf should have. This method is too costly for the owner and is harmful to the cow. Below are listed some of the common ways of raising calves. The method selected will depend on what feeds are available, how dairy products are marketed, relative prices, and other conditions.

Skimmilk.—Practical where cream is sold and plenty of fresh skimmilk is available. Feed whole milk for three weeks then gradually shift to skimmilk. Provide a simple grain mixture and legume hay after two weeks of age. Increase skimmilk gradually until calf is getting 16 pounds daily at 16 weeks. (See Table 2.)

Reconstructed Skimmilk.—Same as above, except that "reconstructed skimmilk" is made from one part of dried skimmilk, by weight, and nine parts of warm water. This method is practical when the price of powdered skimmilk is not too high.

Dry Concentrate and Limited Wholemilk.—Feed whole milk for eight weeks, gradually reducing the amount after the fourth week as the calf is taught to eat more grain and good quality legume hay. Calf should be taking 1 to 2 pounds of a grain mixture containing 20 per cent of dried milk or blood-flour when milk is discontinued, and have good legume hay free choice after the second week. A commercial calf feed containing about 20 per cent of protein, part of

which is from animal sources (milk, blood, etc.) may be used. (See Table 2.)

Calf Meals.—Calf meals are mixed concentrated feeds, either commercial or home mixed, usually having a protein content of 25 to 30 per cent, part of which is from animal sources. They are used by mixing with water at the rate of one part of calf meal with 6 to 8 parts of water, by weight, and fed to the calf in place of skimmilk. Whole milk is fed the first four weeks, then the calf meal gradually substituted for the milk until at 6 to 7 weeks the calf is entirely on the calf meal mixtures. Grain and hay are fed as when skimmilk is used. Results are generally not quite as satisfactory as when skimmilk is fed.

Whey.—Whey may be used for calf feeding in place of skimmilk if fresh and sweet and if supplemented by a grain ration containing proteins from animal sources. Whey is lacking in protein. Whole milk must be fed at least during the first four weeks.

Table 2.--Feeding Schedule for Calves; Birth to Six Months

Daily Amounts are for Jersey or Guernsey Calf for Larger Breeds Increase 1/4 to 1/3).

Age of Calf	First Method		Second Method		
	Limited Whole Milk With Grain and Hay		Whole Milk and Skimmilk With Grain and Hay		
	Whole Milk	Grain	Whole Milk	Skimmilk	Grain
Under 1 week	4 - 6 lbs.		4 - 6 lbs.		
1 to 2 weeks	5 - 7 lbs.	(1) 1/16 lb.	5 - 7 lbs.		
2 to 3 weeks	6 - 8 lbs.	1/16 lb.	6 - 8 lbs.	--	(2)1/16 lb.
3 to 4 weeks	7 - 9 lbs.	1/4 lb.	8 - 1 lbs.	1 - 8 lbs.	1/8 lb.
4 to 5 weeks	6 - 8 lbs.	1/2 lb.		8 - 10 lbs.	1/4 lb.
5 to 6 weeks	4 - 6 lbs.	3/4 to 1 lb.		9 - 11 lbs.	1/3 lb.
6 to 8 weeks	4 - 0 lbs.	1 to 2 lb.		10-12 lbs.	2/3 lb.
8 to 12 weeks	0	2 to 4 lb.		12 - 14 lbs.	1 lb.
12 to 16 weeks	0	3 to 5 lb.		14 - 16 lbs.	1-2 lbs.
16 to 24 weeks	0	4 to 5 lb.		16 - 0 lb.	2-5 lbs.
	(1) Use Concentrate mixture I up to 16 weeks. Then shift gradually to grain mixture II.		(2) Use grain mixture II		

See below for grain mixtures and further notes on calf feeding.

Nurse Cows.—Cows that are old, or hard milkers, or have broken down udders often are used as nurse cows. Two to four calves may be raised on one cow. Calves should get 8 to 10 pounds of milk daily and nurse twice a day for the first eight weeks and once a day thereafter until weaned. Hay and grain are provided as in the limited whole milk method. (See Table 2.) Nurse cows must be free of mastitis, otherwise the calves, by sucking each other, may cause mastitis to develop in their rudimentary udders. In Table 2 is presented a feeding schedule in detail for two of the more popular methods of calf raising, Methods 1 and 3 outlined above. It must be remembered that figures given are average and that individual calves vary in capacity and vigor and must be handled accordingly, grain rations suggested are the more simple ones. Usually they are quite satisfactory but occasionally need to be supplemented with cod-liver oil, and alfalfa leaf meal to provide for dietary deficiencies occurring when calves fail to get good quality hay and sunshine.

All these methods of raising calves are presented in detail in Missouri College of Agriculture Experiment Station Bulletin 377, "Raising The Dairy Calf."

GRAIN MIXTURES FOR CALVES

I. Concentrate Mixture for Calves—Where Milk is Limited.

Ground Yellow Corn	30 pounds
Ground or Rolled Oats	30 pounds
Wheat Bran	10 pounds
Linseed Oil Meal or }	10 pounds
Soybean Oil Meal }	
Dried Skimmilk Powder or }	20 pounds
Dried Buttermilk Powder }	
Bone Meal (Feeding Grade)	1 pound
Salt	1 pound

(Soluble Blood Flour or Dried Whey may be substituted for the dried milk pound for pound, up to half the amount called for in the above ration.)

II. Simple Grain Mixture for Calves—Where Milk or Skimmilk is Fed Freely; and, for Calves Over 16 weeks of age.

Ground Yellow Corn	40 pounds
Ground or Rolled Oats	30 pounds
Wheat Bran	20 pounds
Linseed or Soybean Oil Meal	10 pounds
Bone Meal	1 pound
Salt	1 pound

Calf Feeding Notes

In all cases the calf should nurse the cow for the **first three days** in order to receive the colostrum milk.

In **hand feeding** milk to calves make the calf take the milk slowly

or use nipple buckets. All utensils must be strictly clean. Do not over feed. These points help prevent digestive upsets.

In changing from whole milk to skimmilk **change gradually**, taking about a week to make the complete change. Any change in feed must be done gradually.

Roughage. After the second week provide green leafy legume hay, free choice. Keep the supply fresh. Limited amounts of silage may be fed after calves are 16 weeks of age.

Pasture. Calves should not be pastured under 4 to 5 months of age. Pasture should be limited until at least 6 months of age. Calves on pasture need grain until they are a year old.

Mineral. As long as milk or skimmilk is fed, calves ordinarily do not need additional mineral feeds other than salt. One per cent each of salt and feeding bone meal should be added to the grain ration when milk feeding is limited or discontinued.

Water. Provide fresh clean water at all times after calves are two weeks old.

Often **commercial calf meals** or starters may prove more practical than home grain mixtures. This is especially true where only a few calves are raised. Choose a high quality brand and use according to manufacturers directions.

Quarters and Stanchions for Dairy Calves

It is best to keep the calves by themselves for the first two or three weeks. Real young calves should never be bumped and jostled about, and the only way to prevent this is to have small individual pens for them. These pens should always be dry and well bedded. By the time the calf is two or three weeks old it is well to turn it in with other calves in a large pen. These large pens should always have stanchions fixed on one side so that the calves can be shut in and each calf will get its share of the feed.

It is almost impossible to feed calves right where they are kept in a large pen unless they are fastened at feeding time. They are likely to spill the feed and the larger calves will take feed from the smaller ones. Also, to prevent calves from sucking one another, it is well to keep them in these stanchions for a while after feeding them.

A simple calf stanchion can be made from scrap lumber in very little time and with little expense. In the long run, it will save a great deal of time in feeding calves and will produce better calves because all will get just what feed they need and no more.

A "calf cradle" may be constructed where only one calf at a time is to be raised and other satisfactory quarters are not available. It consists of a tight box large enough for the baby calf for the first

two or three weeks. The size will depend on the breed. For small breeds it might be approximately 5 feet long by 2 feet, 8 inches wide and 3 feet, 4 inches high. One end of the box is made as a sliding panel held by cleats and removable by sliding up. On this panel is constructed a miniature manger and feed box to teach the calf to

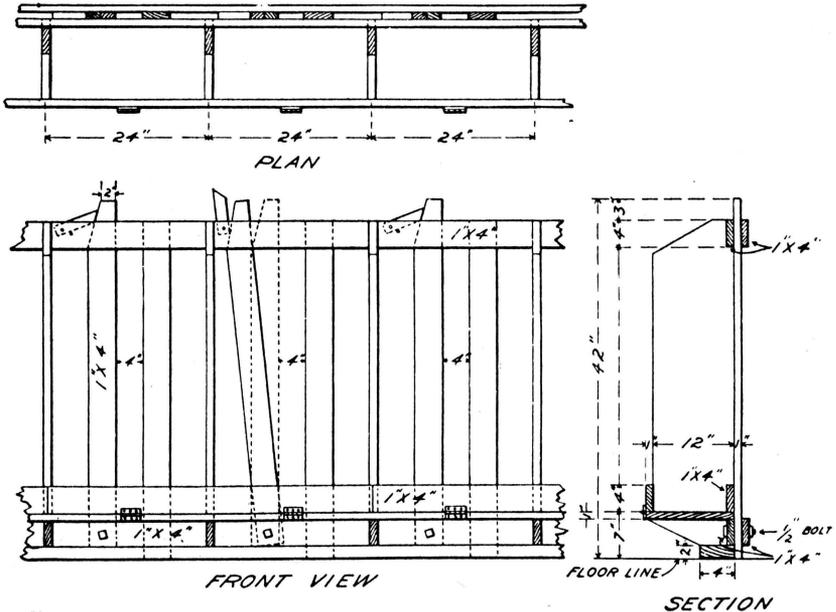


Fig. 7.—Diagram showing how to make a calf stanchion. (Courtesy U. S. Department of Agriculture.)

eat grain and hay. The advantage of the “cradle” is that it is portable, easily cleaned and placed in the sun for airing. The tight sides protect the calf from drafts and the top is open for ample ventilation.

It is of very great importance that the quarters for calves be light and dry. Plenty of bedding should be furnished and changed often enough to keep the pens dry all of the time. After the calves are a few weeks old, they can stand quite a bit of cold if they are dry. Darkness or dampness or both are very likely to lead to any one of numerous calf diseases.

The calves should have a lot to exercise in. They should be turned out at least once every day except on the stormiest days.

Dehorning

Dairy cattle not intended for show may well be dehorned. As a rule calves should be dehorned when one to two weeks old. The most

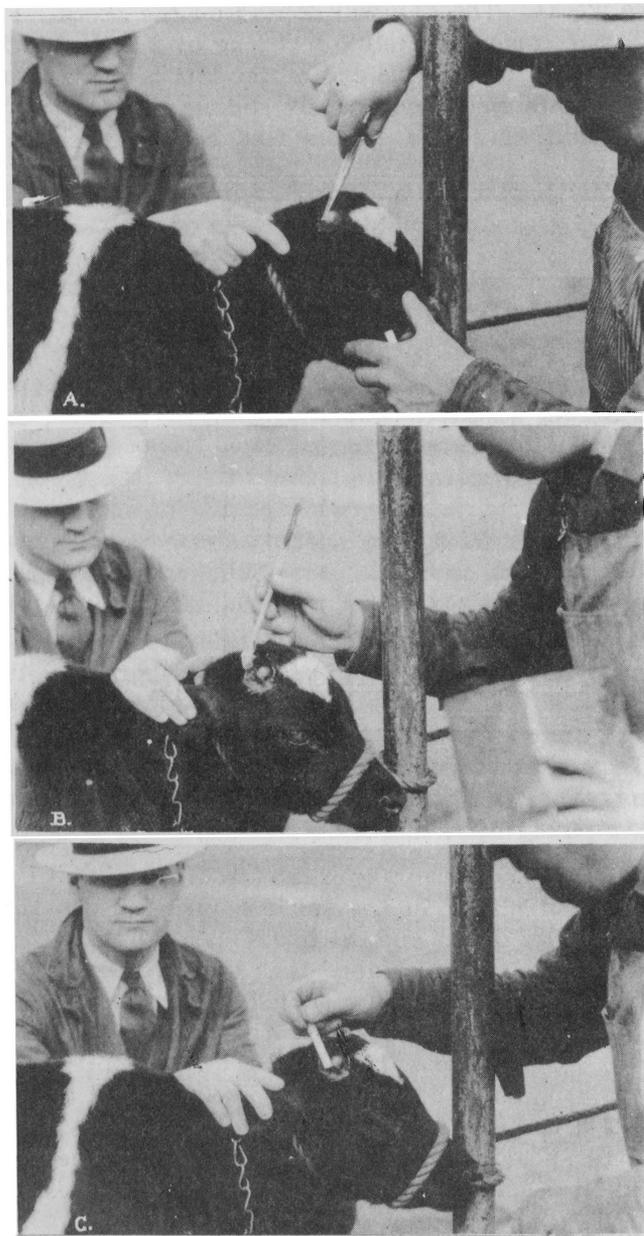


Fig. 8.—Steps in dehorning the dairy calf. A. Clip the hair away from the small horn or "button". B. Apply grease around the horn to prevent the caustic from spreading. C. Apply the caustic directly to the base of the horn.

satisfactory way is to use caustic potash for the purpose, as it kills the growing horn, and cattle breeders who prefer to have their cattle dehorned find it less trouble to prevent the growth of horns than to remove them later.

To prevent the growth of horns, first clip the hair from a small area around the horn button. Next, encircle the clipped area with vaseline or axle grease to confine the action of the caustic potash to the area of the horn. The final step is to rub the horn button with a stick of moist caustic potash until the skin is ruptured and begins to bleed slightly.

Excessive amounts of potash should not be used as the horns of young calves are easily killed. The caustic should not be too moist, for if it runs over on the surrounding skin or into the eyes, much unnecessary pain is caused. Immediately after treatment, calves should be protected from rains, to prevent the caustic from spreading.

Heifer calves a month or more of age may be successfully treated by the caustic potash method, by burning a raw ring in the skin from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch wide about the base of the horny growth. Clipping hair around the base of the horn will facilitate the operation.

Marking Calves for Identification

It is important that each calf be plainly marked within a few days after birth. This is very necessary in purebred herds and should be done in all herds of considerable size, even if made up of grades. Some of the most common marking systems are—leather strap or small chain around the neck, with brass tag attached; ear tag; halter with number plate; tattoo marks in the ears; and diagrams of the color markings. In some herds photographs are used as a means of identification, with excellent results.

In purebred herds it is a good idea to tattoo, diagram, or photograph each calf quite early and make out the necessary registration application and hold this on file until time for registration. In the case of Guernseys where it is the usual custom to file a birth report before the animal is 30 days of age, the diagram of the animal should be made in duplicate and one copy sent to the breed association as a part of the birth report and the other kept as a means of identifying the animal in the herd.

How to Tattoo Calves.—Tattooing of Jersey, Brown Swiss and solid-color Guernsey animals is required for registration. It can be used to identify animals of all breeds. Tattoos can be read even in black animals by the use of a flash light held behind the ear. Tattoo outfits may be secured from breed associations and livestock supply companies. Most purebred breeders have them. The essentials are

a punch with changeable blocks which have needles arranged to outline the letters and numbers, and indelible tattooing ink. The essential steps in tattooing are:

1. Prepare the animal's ear by removing wax on the inside of the ear by washing with soap and water or gasolene or rubbing alcohol.
2. Locate the area where the tattoo is to be placed so that the needles will miss the large blood vessels and the thick ribs of cartilage. Usually there will be a clear area near the center of the ear.
3. Place the proper letters and numbers in the punch securely, and make a trial impression on a piece of heavy cardboard to be sure they are in proper order and legible.
4. Make the impression in the animal's ear with one firm squeeze on the punch. Needles should enter from the inside of the ear. Be sure they are positioned so as to be easily read.
5. Apply paste or liquid ink to the area and rub in thoroughly with the thumb. Thorough rubbing is important.

Most breeders have a system for assigning tattoo numbers to animals in their herds. Some use the initial of their last name followed by a serial number. Others use a letter to indicate the sire of the calf followed by a number. Select a plan that suits your situation and follow it carefully.

Registration.—Purebred heifers should be registered at an early age as this adds to their value. Also it helps prevent mistakes in identity which may occur if registration is delayed. In registering animals tattooing, sketching of body markings, or a photograph of the animal is required as individual identification. The names and registration numbers of the sire and dam are required since an animal cannot be registered unless its sire and dam are registered. Each of the breed associations will furnish blanks and instructions for registering and transferring ownership.

If you were owner of the dam when the animal was born, you will be the one to register it. If you purchased the animal it must be registered by the owner of its dam and transferred to you.

Removing Extra Teats

Rudimentary or extra teats often appear on the udders of heifers. They generally secrete no milk but are unsightly and detract from the appearance of the cow's udder. Occasionally rudimentary teats appear as a part of a main teat, and are a bother in milking. Such teats are hard to remove and at best require a surgical operation

within the scope of only a good veterinarian. The usual type of rudimentary teat is easily removed, however, by any one of several methods. A simple but effective method is to tie a piece of thread or a rubber band tightly around the base of the teat, and within a week or two the extra teat will drop off, leaving a healed wound. The use of scissors is also generally recommended and gives good results. It is best to throw the heifer, apply iodine or any good disinfectant to the teat and cut it off quickly with sharp scissors. The operation is not painful and there is seldom much bleeding. Where bleeding of any consequence occurs the exposed vessels should be cauterized. Care must be used to avoid infection from the scissors. Painting the wound with iodine solution after removal of the teat is recommended.

Free-Martins

If a pair of twin calves consists of a male and a female, the female is called a free-martin. In about 90 per cent of such cases the female is sterile. Occasionally these females breed, but at best it is about a 9 to 1 chance, and it is not worth the expense to raise them except in the case of an animal with very unusual blood lines.

There are many mistaken ideas as to the breeding ability of cattle twins. With opposite sexed twins, even though the female is sterile, the male is not affected and will breed. Twin bulls or twin heifers will breed the same as any singly born calf.

Some Common Ailments of Dairy Calves

Calves, particularly during the first few weeks of life, are subject to a few common ailments. In some cases diseases causing a high mortality are encountered and often the calves surviving are subject to general unthriftiness and poor growth.

Prevention is the best treatment of calf trouble. The general health of calves depends largely upon the feeding, care, management and sanitation measures employed. When disease does make its appearance general "cure-alls" should be avoided. If the herdsman cannot detect or treat the trouble a veterinarian should be called. It is well to keep in mind that many diseases are rapidly spread and any appearance of sickness in the calf herd should be dealt with promptly. Sick calves should be isolated and treated at once. Watch for symptoms of disease. These may include listlessness, general unthriftiness, rough hair, lack of appetite, scours, constipation, coughing, rapid breathing, and high temperature.

Scours.—The causes of common scours are many, but usually they are confined to factors causing indigestion. Symptoms of this disease are a looseness of the bowels and foul smelling droppings. Overfeeding, drinking milk too fast, separator foam on milk, cold

milk, sour milk, dirty feeding pails or troughs, sudden changes of feed, feeding freshly cut or too much legume hay, fresh green grass and spoiled feeds are among the causes of common scours. This form of scours is usually corrected by proper feeding and management and should not be confused with "infectious white scours."

The calf should immediately be isolated.

Treatment for scours:

(a) Reduce the amount of feed immediately, also correct any faults with the milk such as too cold, sour, dirty, or garget affected.

(b) Give the calf about a half teacup of mineral oil to which has been added $\frac{1}{2}$ to 1 tablespoonful of a mixture consisting of two parts bismuth-subnitrate and one part salol. One to four tablespoonfuls of castor oil given in the milk may also be used, but the bismuth-subnitrate and mineral oil is preferable. If the calf does not improve, as in case of severe attack, the bismuth-subnitrate-salol-oil mixture should be repeated every 6 to 12 hours, the amount given varying with the age and size of the calf. In some cases, raw eggs broken into the milk are helpful.

(c) Bring the calf back on feed slowly, feeding one-half the usual amount of milk after the oil treatment, and gradually increasing the allowance of milk as the calf progresses.

(d) Sterilize all pails and utensils used in feeding. The addition of $\frac{1}{2}$ to 1 ounce of limewater per pint of milk fed is often helpful during the time the calf is recovering.

White Scours.—This is a bacterial disease and is very infectious. Most cases occur when the calf is only a few days old, and death often occurs in a few hours. White scours is indicated by dry skin, exhaustion, and whitish droppings with a foul odor. Once it is established on the place it is likely to cause heavy losses among calves for some time. Strict sanitation is important and any treatment must be applied promptly.

Sulfaguanidine is one of the most promising treatments for prevention and control of the disease. It should be given under the direction of a veterinarian. Disinfection of the navel cord at birth aids in controlling the disease.

Grubs.—Grubs or ox warbles are a troublesome pest of cattle. The grubs are the larvae of the heel fly or warble fly. They hatch from eggs laid by the adult fly, usually on the animal's hair just above the hoof. Eggs are laid in the first warm days of spring and hatch in 3 to 5 days. The tiny larvae at once force their way through the skin and into the deeper tissues where they move about and grow for about nine months, finally appearing under the skin along the back where each grub, now about an inch long, makes a hole through

the skin. When mature it works its way out of the animal's back and drops to the ground where it goes through the pupa stage and develops into the adult fly.

Besides annoying the cattle, the grubs damage the hides, as the holes left by the grubs persist for some time.

Control consists in dusting the backs of the cattle with cube or derris powder containing 5% of rotenone mixed with equal weight of wettable sulfur. The powder should be well rubbed into the coat of hair with the hands. The drug may also be mixed with water and applied with a stiff brush.

Treatment in badly infested communities may be futile unless generally done by all cattlemen in the community.

Colds.—Calves frequently have colds. Though seldom fatal in themselves, colds weaken and retard the growth of the calf, and if neglected may bring on pneumonia, or some other serious disease. Plenty of dry bedding, good ventilation without drafts and good nutrition are the conditions desirable for the prevention and cure of colds. Damp, drafty or poorly ventilated quarters are likely to result in colds or more serious ailments.

Lice.—Lice are found on calves and young stock during the winter months in particular and may become so abundant as to cause discomfort, and loss of condition. During cold weather lice may be controlled by dusting powdered sabadilla seed along the backs of the animals. Blanketing the animal for a few hours following treatment and combing out the hair, preferably out-of-doors, makes this treatment more effective. A mixture of 1 part sodium fluoride and 5 parts flour may be used in the same way. In mild weather, infested cattle may be washed or dipped, using one of the many commercial coal-tar compounds as recommended by the manufacturer.

The new insecticide D.D.T. is quite effective in the control of lice on cattle. A 10 per cent mixture of D.D.T. powder in talc is dusted on the calf's back and other parts when lice are found. D.D.T. gives good control for all types of lice.

Ringworm.—This disease is quite common in young calves. It is caused by a fungus or mold affecting the hair and skin, giving the affected areas a crust-like appearance. The crusts usually appear about the eyes and neck of young calves. The affected animals should be isolated and the stalls they occupied should be thoroughly cleaned and disinfected. The "crust" areas should be washed with soap and water. After the areas are dry they should be painted with tincture of iodine. For stubborn cases, equal parts of tincture of iodine and tincture of iron are helpful.

Warts.—Warts appear on the surface of the skin in a rough, horny-like growth, and may be single or multiple. Rubbing the horny projection of each wart with castor oil daily will hasten their disappearance. Where warts are present in large numbers, surgical measures may be advisable.

Bang's Disease or Brucellosis

Bang's disease or brucellosis, sometimes called contagious abortion, is a serious disease of cattle. Not only does it cause cows to lose their calves, but the milk from infected cows can cause undulant fever, a serious disease, in humans. Every dairy farm should have a definite control program which is strictly followed. Such a program should include blood testing of all cattle on the farm twice a year, and in most cases disposal of all reactors. In many cases vaccination of calves at 4 to 8 months of age will be advisable, especially if there have been infected cattle on the farm or nearby. It is suggested that club members discuss this problem with their county agent and veterinarian and follow their suggestions. Vaccination of older animals is not usually recommended.

Vaccination for Bang's disease causes the heifer to react to the blood test for a time. However, probably 90 per cent of them lose this positive reaction before breeding age if they were vaccinated at the proper age, as near 6 months as possible. Heifers usually should not be bred until they are negative to the blood test.

Vaccination in most cases causes the heifer to be relatively immune to Bang's infection for some time. This immunity, however, may be gradually lost in from two to five years. Regular testing should be continued after vaccination.

Many good breeders of dairy cattle prefer to test regularly and dispose of any reactors for slaughter at once, thus maintaining a herd free of the disease.

IV. FEEDING AND CARE OF THE DAIRY CALF FROM SIX MONTHS TO ONE YEAR OF AGE

Feeding and Management

Heifers over six months of age are comparatively easy to care for but should not be neglected. At this age the heifer is growing rapidly and responds to good care and management by very economical gains in body size during this period. Studies at the Missouri Agricultural Experiment Station show very clearly that neglecting the feeding of calves between 6 and 12 months of age results in an increased growing cost. Heifers should not be kept fat but rather growing rapidly so as to be sufficiently developed to be bred for freshening at the normal age for the breed.

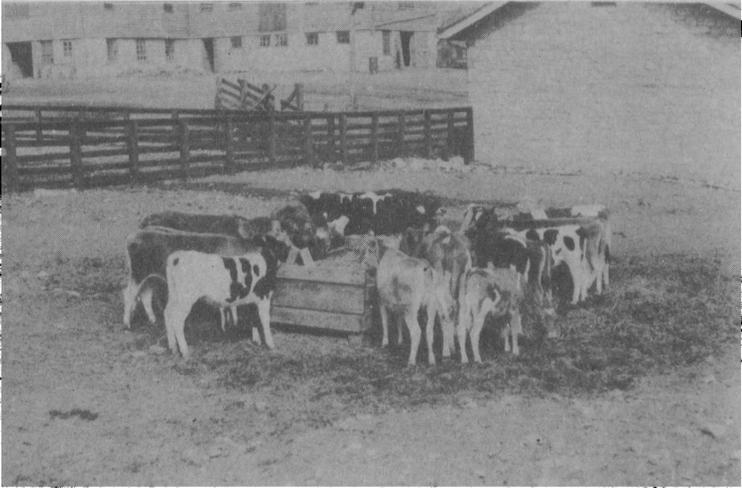


Fig. 9.—Heifers over six months old may be raised principally on good quality roughages.

From 6 months to 1 year of age the heifer may be fed mostly on roughages, including pasture, with a moderate amount of grain. During the summer months green pastures furnish excellent and well balanced feed for growth. Unless the pasture is unusually good, however, a little grain feed is recommended, and this is most important for extremely young calves, 6 to 9 months of age. Early in the spring, during hot, dry weather, and during the fall months when pastures are short, hay and silage in addition to grain should also be provided. Heifers from 6 to 12 months of age will eat from 5 to 10 pounds of hay daily and from 5 to 15 pounds of silage, the silage replacing some of the hay. Legume hays such as alfalfa, clover, soybean and cowpea, or a mixture of these hays and non-legumes, is excellent for growing heifers. This form of roughage is rich in minerals and vitamins necessary for growth. Roughages may very satisfactorily be fed free choice and just enough grain supplied to keep the heifers growing well. Where plenty of legume roughages and silage are available a grain mix consisting mostly of corn and oats is desirable. Suggested mixtures are:

I		II	
Ground corn	300 lbs.	Ground corn	400 lbs.
Ground oats	200 lbs.	Ground oats	200 lbs.
Wheat bran	100 lbs.	Wheat bran	100 lbs.
		Linseed oil meal	100 lbs.

Where only non-legume roughages such as corn stover, timothy hay, straw, etc., are available, a grain mixture higher in protein than

the above should be fed. In such cases one of the following rations will be satisfactory:

I		II	
Ground corn	100 lbs.	Ground corn	200 lbs.
Ground oats	100 lbs.	Ground oats	200 lbs.
Wheat bran	100 lbs.	Wheat bran	100 lbs.
Steamed bone meal	3 lbs.	Linseed oil meal	100 lbs.
		Steamed bone meal	6 lbs.

Water and Salt.—Growing heifers require plenty of water and salt. Salt may be fed as a part of the grain ration and in addition should be available at all times in the pasture or exercise lot.

Table 3 gives normal growth figures for Jersey, Guernsey and Holstein heifers as given by the Missouri Experiment Station. These may be used as a guide in checking the growth of heifers. It has been shown that it is most economical to grow heifers at about the normal rate. With legume hay and pasture as base feeds, the amount of grain given will determine the condition of the heifer to a large extent.

It has been shown that chest measure, taken just behind the shoulders is a good index to body weight. Where scales are not available chest measure may be used to check growth. Growing heifers should be checked frequently and the ration adjusted so as to keep growth about normal and the heifers thrifty, without getting them fat.

Shelter.—Calves over six months of age need a simple shed where they can get out of the cold winds and rain. A tight barn is not necessary, and in fact not as desirable as an open shed that protects from wind and rain but otherwise allows the heifers to be in or out as they please. Plenty of bedding is advisable as it helps keep the heifers clean and warm.

In summer, calves should have shade convenient to the water supply and to pasture.

Table 3.--Normal growth of Dairy Heifers*

Age in Months	Jersey			Guernsey			Holstein		
	Weight lbs.	Chest in.	Height in.	Weight lbs.	Chest in. ^f	Height in.	Weight lbs.	Chest in.	Height in.
Birth	53	27	26	65	28	27	90	31	29
1	67	30	27	77	30	28	112	34	31
2	90	32	29	102	33	30	148	37	32
4	158	38	33	173	39	33	243	43	36
6	243	44	36	260	44	37	355	49	40
8	324	48	39	350	49	40	462	53	42
10	393	51	41	427	52	42	552	56	44
12	490	54	42	490	55	43	632	59	46
16	558	59	44	605	60	45	762	64	48
20	642	62	46	712	63	47	912	67	50
24	733	65	47	818	66	48	1069	71	52

*Adapted from Exp. Sta. Buls. 336 and 354 by Ragsdale, and Ragsdale and Brody.
^fEstimated from averages for each weight.

V. FEEDING AND MANAGEMENT OF THE DAIRY HEIFER FROM ONE TO TWO YEARS OF AGE

Feeding

In feeding heifers from one to two years old, a good ration of roughage will usually be sufficient. Feed them all the corn silage and good legume hay they will clean up and they will thrive on it. A liberal ration of good roughage is desirable at this time for two reasons. First, it is desirable to develop an animal of good size and plenty of capacity for handling food for milk production later. Second, a good, well balanced roughage of this kind is practically as good for the dairy heifer at this age as grain, and the food supplied in the roughage is much cheaper.

As a rule, more harm results from underfeeding in the summer than in the winter. As long as pastures are good in summer, the heifers usually will fare all right, but when the summer droughts come and the pastures begin to get short, the heifers suffer. Always plan to have a little good, green forage to feed the heifers at such times. A little patch of some good forage will prove a money maker.

Sudan grass and lespedeza furnish good summer pasture. Small grain with lespedeza may be used for pasture for heifers from early spring through early fall. Two fields of small grain and sweet clover seeded in alternate years will also furnish excellent supplementary pasture.

It is seldom that the animal will need grain at this age. However, the animal should be kept in reasonably good flesh and in good growing condition. If it becomes necessary to feed grain in order to do this, a mixture of equal parts of crushed corn and crushed oats will be found to be a good economical ration.

Always give the calf free access to plenty of good fresh water and salt. The importance of this point cannot be over-emphasized.

Breeding

The age at which it is best to breed the heifer depends somewhat upon the breed and upon the development of the particular heifer.

As a rule, a Jersey or Guernsey should be bred at 15 to 18 months of age. At this age, she should weigh about 600 pounds. A Holstein should usually be bred at 18 to 19 months of age and should weigh about 800 to 850 pounds at that age. The Guernsey is a little larger than the Jersey and should possibly be bred just a little later. Brown Swiss are the slowest maturing of all breeds and should be bred at about 20 months of age when they should weigh about 800 pounds. Do not get discouraged if the heifer is a little smaller than the average for the breed at this age. Some cows develop more slowly than

others and it is the nature of some cows to be small. That does not mean that they may not show up well and be good producers. Delay of breeding past the recommended age, where a heifer has attained normal growth and development, usually does not pay. On the other hand, a small or unthrifty heifer should not be bred until she has grown to about normal size.

A blood test for Bang's disease just before breeding age is advisable. Heifers that are not negative to the blood test should not be bred. This applies to vaccinated heifers as well as those not vaccinated.

The club member should be especially careful in selecting the bull to which the heifer is to be bred. Do not be satisfied with anything but a registered bull of the same breed as the heifer. Use a bull of that kind if you have to go several miles to him. If possible, breed to a bull with a good pedigree behind him, one whose dam made an official record and whose other ancestors show good breeding. Then you will get a calf from your heifer that will be worth a good many times what a calf from a "scrub" bull would be worth. After you have had your heifer bred, keep her shut up in a boxstall or small lot by herself for the rest of the day.

Make it a practice from the start to keep a record of breeding dates. Then you will know what time the heifer will calve.

Artificial breeding service has many advantages. Formerly boys and girls who perhaps had the only purebred animals on their farms had to go to considerable trouble and expense to get their heifers bred to bulls of the right kind. Some, rather than go to this expense and trouble, have used inferior bulls or bulls of another breed, thus spoiling their chances to develop a herd. But now, with artificial breeding service available in most Missouri counties, breeding to top bulls of the breed is possible, at least in the three most popular breeds. County agents can furnish information on how to get this service in your county.

Handling

In the care of your heifer, kindness pays, no matter what her age. Teach her to lead so that if she is shown at the fair she will follow and will stand in a natural position without the least trouble. It is assumed that an animal owned as a calf by a 4-H member will have been trained to lead and obey long before she is 8 or 10 months old, but if she is taken as a club animal after calthood then no time should be wasted. You should work with her every day to teach her to obey before the showing season arrives.

In preparation for the milking time, many dairymen stanchion

a heifer with the milking herd a month or so before she is due to freshen. If possible give her the stall she is to occupy after calving. Managing her in a quiet, gentle manner at this time does much toward making her an obedient cow a little later. A few days before the calf arrives put her in a well bedded boxstall so that she will have time to get used to her surroundings.

Nervous Heifers.—Some heifers are naturally inclined to be timid and more or less wild. Such heifers, if allowed to follow their natural inclination, will usually become more wild and before long will be jumping fences. On the other hand, with a little special petting now and then they may become the tamest animals on the place. If the heifer seems a little timid at times, give her a little special notice, and an extra handful of grain or something of the sort to make her feel that she is one of the herd.

Abnormal Conditions

Although yearling heifers require little care, they should be closely watched so that if any abnormal condition is found it can be taken care of promptly.

Keep the heifer away from sources of contagion. Particularly if any abortions occur in the farm herd see that the heifers do not have access to the infected animals or to any feed that may have become contaminated by discharges of the infected animals.

Indigestion.—Indigestion in cattle is generally caused by eating damaged feed, or changing quickly from one kind of feed to another. It may also be caused by the animal's not getting enough water or from drinking very cold water. It is indicated by loss of appetite, bad odors or a dull sluggish action. One should immediately take away all feed except good silage or grass and a little bran or similar laxative feed. Then, give one pound of glauber's or epsom salts dissolved in two quarts of warm water. If necessary, repeat the dose in a day or two.

Sore Feet, Cuts, Open Wounds.—The best policy with such troubles is to clean out the sore or wounds, keep them clean and disinfect them. A 3 to 4 per cent solution of carbolic acid makes a good disinfectant. Sore feet are often caused by the heifer's having to stand in a filthy barnyard. In such cases, there is no hope of healing the feet until they are taken out of the filth and kept clean. Clean the feet well and disinfect them and turn the heifer into a clean lot or pasture. Or, if it is winter and impossible to do this, give the heifer a good clean, roomy box-stall in the barn. Keep her there, keep the stall clean and give her plenty of bedding. Clean the sore out and disinfect it every few days until it is well.

In warm weather avoid surgery and take care of any open wounds at once to avoid complications from flies and infections. If wounds occur treat them with a fly killing preparation known as "Smear 62". Be sure to thoroughly disinfect all instruments before and after using on each animal if any surgery is necessary.

VI. HANDLING THE HEIFER OR COW AT CALVING TIME

Feeding

The heifer about to bring her first calf should get careful attention. If she is not in good condition she should receive from 3 to 6 pounds of grain daily. The amount of grain needed will depend on her condition and the quality of the roughage. It is well to stanchion the heifer at this time to get her accustomed to being tied up and handled and so that her condition can be closely observed.

Cows should have a 6 to 8 weeks dry period so that they can rest from the strain of previous lactation. The condition of a cow or heifer at freshening has a great deal to do with her production in the following lactation. She should be provided with good pasture or fed hay and silage at about the same rate as to milking cows.

The same grain ration recommended for the milking herd or the dry cow grain mixture suggested below may be fed in such amounts as required to get or keep cows in good condition until about one week before calving. The amount of grain fed to the mature cow will vary from 2 to 8 pounds per day depending on the condition of the cow.

About one week before calving, or when the udder starts to "spring," one-half, or more, of the grain should be replaced with bran. Many good herdsmen feed only a light feed of bran the last few days before calving and for two days after calving. At this time the cow should have only warm water to drink. Beginning about the third day following calving the grain ration can be changed back gradually to the regular grain mix. The amount of grain fed may then be increased slowly until the cow is on full feed after about three weeks. Avoid heavy feeding during the freshening period.

A Suggested Dry Cow Ration

Ground corn	160 pounds	Soybean meal	15 pounds
Ground oats	120 "	Bone meal	5 "
Wheat bran	80 "	Salt	5 "
Cottonseed meal	15 "		

Linseed meal may be substituted for a portion of the cottonseed meal and the soybean meal when available at similar prices.

Care at Calving Time

Some time before calving, the heifer should be moved to the barn and to the stall where she is to be kept permanently. The cow is very

nervous at the time of calving and will be less excitable than if she has become somewhat accustomed to her permanent quarters. You should have a breeding record so that you will know just when your cow is due to calve. The normal gestation for cows is about 283 days although this may vary considerably. A few days before this date she should be removed to a good large box-stall. Keep the stall clean and supplied with plenty of clean bedding.

Just at this time the cow should be given especial care. If it is cold weather, she should have a good warm stall free from drafts. It is well to warm her water for a few days at least and she should have only a light, palatable ration. A good allowance of bran or beet pulp in the ration is advisable to see that the cow's bowels are in good shape. You should be especially careful not to let the cow become constipated at this time.

Just before the time of calving, the hind quarters of the cow should be cleansed thoroughly with soap and water. Then the rear parts of the cow should be washed with a 1% solution of lysol. This is done to reduce to a minimum the possibility of the new born calf picking up a navel infection. Immediately after the calf is born take a fruit jar lid or some other container that does not have a sharp edge, and preferably one a little larger than a fruit jar lid, fill it with tincture of iodine, such as you would purchase at any drug store, if the navel cord is too long break it off and then press the container of iodine over the navel holding it there for one minute.

A large amount of the loss of calves from white scours and other stomach disorders is due to the calf picking up an infection through the navel at the time it is born or within a few hours afterward. The practices suggested here will help to avert this type of infection.

Just at the time of calving, the cow and especially the heifer may need help. However, do not be in too much of a hurry to help her. Let her have the calf herself if she can. If the front feet and nose of the calf do not appear first, it is best to call a veterinarian at once. However, even though the calf is properly presented, the cow may still be unable to deliver it. The calf should be presented front feet first with the head between the feet.

If the presentation is normal and the heifer or cow is unable to give birth to the calf you may help by pulling the calf. Use no more force than is absolutely necessary and work with the cow, pulling when she works.

When the calf is born it must breathe immediately. If any of the membranes or mucus in the nose interfere with breathing, remove them at once. Then treat the navel cord with iodine as already described. The cow normally will lick the newborn calf until it is dry.

If she does not, give the calf a good rub down with a clean feed sack to dry it and stimulate circulation.

Within 30 minutes after birth the calf normally will stand and suck. See that each quarter of the cow's udder is open by taking a few squirts of milk but do no further milking until the calf has nursed. This first milk or colostrum is very important to the health of the young calf.

Give the cow a warm bran mash consisting of about two quarts of bran, a little salt and warm water. No further feed is required for 12 hours although good clean hay may be provided. Give her plenty of warm water but do not permit her to drink cold water. In cold weather it may be advisable to blanket the cow until her afterbirth is passed. If the cow does not clean in 12 to 24 hours, a veterinarian or an experienced herdsman should be consulted.

After the calf has nursed and the cow has been given the mash and warm water, let her alone for 12 hours.

First-calf heifers may be milked dry 12 hours after calving. If the udder is congested and swollen, frequent milking out, 3 or 4 times a day, may be advisable. In older cows the udder should not be milked dry for 24 to 36 hours. This is important in cows that are high producers and may be subject to milk fever. Avoid heavy grain feeding while any congestion remains in the udder.

If conditions are normal the calf may remain with the cow for the first three days. After that it is usually best to hand feed the calf. (See Part III.) The fresh cow can be then put in the milking herd and gradually and carefully brought to full feed and production.

VII. FEEDING AND MANAGEMENT OF PRODUCING DAIRY COWS

Feed Requirements of the Dairy Cow

In studying the ways to feed cows and the kinds of feeds to give them in order to make the most profit from them, we should remember first that feeds contain a number of different types of constituents. Among these are water, mineral matter, protein, and energy feeds or carbohydrates and fats, and vitamins.

The cow's body is also made up of these same constituents and she must have a certain amount of each to keep her alive. The water is found in the blood and throughout the entire body. The mineral is mostly lime and phosphorus and is found in the bones, hoofs, hair, skin and to some extent in the blood. Protein is found mostly in the muscles, bones, skin and hair, while the fats are found largely in the fatty portions of the body.

Vitamins are chemical substances occurring in very small

amounts, but necessary to growth and health of the animals. There are many different vitamins, each having a different use in the complex regulation of the animal body. Milk also contains a certain amount of each of these constituents, though they are all in solution and we cannot separate them except by chemical analysis.

Now it happens that some feeds are very high in one of these constituents but low in others. Some may contain a large amount of two kinds of constituents but no cow feeds contain just the right amount of all of them. For instance, corn contains a great deal of energy feed like carbohydrates and fats but contains very little mineral and protein. On the other hand, soybean hay contains a great deal of both protein and mineral matter. It is absolutely impossible for the cow to make any one of these take the place of another. If we feed too much of one and not enough of another then the surplus of one will go to waste because we didn't have our feeds balanced and besides we will not get as much production and profit from the cow as we should. Then what we want to learn is which feeds serve each purpose and how much of each to feed. In order to do this, we shall take up each of these constituents as we have named them.

The Water Supply.—It seems strange that it should be necessary to mention this since a liberal supply of pure fresh water is available with little or no effort or cost on the average farm. Yet it is a fact that the profits from cows are very materially reduced on a great many farms simply because cows do not get enough pure water. Since 56 per cent of the cow's body is made up of water and 87 per cent of her milk is water, we should readily see that she needs to consume large quantities of it. An ordinary cow will drink about 12 gallons of water a day and a real high producing cow needs more.

A cow should have all the water she wants and should have it as often as she wants it. This water should be clean from a running stream or spring, or direct from a well. A stagnant pond is not only a source of filth but is likely to be dangerous as a disease spreader at any time.

This water should be at a reasonable temperature. No cow will drink enough ice water to maintain her body and produce a reasonable flow of milk. If the cows are being watered from a tank in the winter time, it will always be found economical to arrange a tank heater or other means of bringing the water up to at least the temperature at which it comes from the well before watering them.

Mineral Feeds for Cows.—As was mentioned in the last discussion, the cow needs feeds that contain mineral matter to keep up her bones, teeth, and muscular tissues as well as to make milk. Milk contains a

great deal of mineral and especially lime. A quart of milk contains as much lime as 30 pounds of beef, or 23 pounds of potatoes, or 11 loaves of white bread. Milk contains a great deal more lime and mineral matter than any other common human food. We need this lime to make teeth, bones and muscles and most people who drink plenty of milk from infancy are strong and have good teeth for this reason.

But the cow must be provided with feeds that contain plenty of mineral matter if she is to have them from which to make milk. The most important mineral is lime.

Table 4.—The Amount of Lime in Different Feeds

Kind of Feed	Pounds of Lime Per Ton of Feed
Alfalfa Hay-----	71 Pounds
Soybean Hay -----	48 Pounds
Red Clover Hay - -----	60 Pounds
Corn Stover-----	23 Pounds
Wheat Straw -----	6 Pounds
Millet -----	15 Pounds
Timothy -----	13 Pounds

From this table we see at a glance the importance of alfalfa, soybeans and clover as a source of mineral matter for the cow. The cows should always have, during the entire feeding season, as much of one of these kinds of hay as she will clean up once a day.

Phosphorus also is sometimes lacking, especially after a drouth. Bone meal, bran and oil meals supply phosphorus.

Salt is another mineral which should be mentioned. A cow should always have all of the salt that she wants. For a cow in milk, this will vary from one to two ounces a day. She may be given free access to it or it may be mixed in the grain ration at the rate of 1 pound of salt to every 100 pounds of grain mixture. We also add 1 to 1½ pounds of bone meal to the ration to be sure she gets plenty of lime and phosphorus.

Protein Feeds.—Protein feeds are mostly used to build up muscles and lean meat. Quite a bit of protein is also found in the bones, hair, skin, and other parts of the body. Milk also contains very large quantities of protein, and that is another reason why it is such a good human food.

A cow must have a liberal supply of feeds that contain protein

in order to be a good milk producer. It takes seven-tenths of a pound of protein a day just to keep a 1,000-pound cow alive. In addition to that, she needs about half-a-pound of protein for each gallon of milk she produces. So we should know just what feeds are highest in protein and should furnish her with enough of them. Some common feeds with the amounts of protein they contain are shown in Table 5.

From this we see very readily that among roughage feeds, alfalfa, lespedeza, soybeans, and clover are our very best sources of protein. Among the concentrated feeds, soybean oil meal, cottonseed meal and linseed oil meal are our best sources of protein.

It is worth while to mention here that protein and mineral matter are the two kinds of feed of which we are short on nearly all Missouri farms. These are feeds that can be supplied very cheaply through home grown soybeans, lespedeza, clover or alfalfa, and if grown and fed will greatly increase the profits from the average herd.

Energy Feeds.—Other constituents to which we previously referred were the carbohydrates and fats or energy feeds. These are usually referred to as energy feeds because they furnish energy and heat for the body. They include feeds which contain plenty of fat, starch and sugar. They are needed to maintain the fatty portions which are found to a greater or less extent throughout the body. Milk also contains a great deal of fat as well as milk sugar. These energy feeds are needed to furnish the fat and the milk sugar in milk.

Vitamins.—What we know about the nature and function of vitamins has been discovered recently, largely in the past 30 years. Investigators are still learning more about these mysterious substances which occur in very small quantities yet which are so important to the animal body as regulators or “spark plugs” for many body processes. Fortunately we do not need to be greatly concerned with many of the vitamins in dairy cattle since they occur in normal feeds in ample supply, or the cow is able to produce them by means of the yeast and bacteria living in the rumen or paunch.

Vitamin A is the only vitamin likely to be deficient in mature dairy cattle and that only after the cows have been away from pasture or green feed for some months. In winter a little green pasture, good green legume hay or silage usually provides sufficient vitamin A for all needs.

Baby calves, because of their undeveloped rumen, are not able to produce vitamins and must have them in the feed. Nature takes care of this need partly in the colostrum milk which is very rich in vitamins. If the cows are on good feed, including pasture or good

Table 5.--Average Composition of Common Feeds for Dairy Cattle
(Given in percent, or pounds in 100 pounds)*

	Digestible Nutrients		Average Total Composition					
	Total	Protein	Protein	Fat	Carbohydrates		Mineral	Total Dry Matter
					Fiber	N-Free Extract		
Roughages:								
Alfalfa Hay	50.3	10.6	14.7	2.0	29.0	36.4	8.3	90.4
Clover Hay	51.9	7.0	11.8	2.6	27.3	40.1	6.4	88.2
Lespedeza Hay	52.2	9.2	12.8	2.3	26.2	42.4	5.4	89.1
Soybean Hay	50.6	11.1	14.8	3.3	28.4	37.0	7.3	90.8
Timothy Hay	46.9	2.9	6.2	2.4	30.1	45.0	5.0	88.7
Prairie Hay	49.2	2.6	5.7	2.4	30.3	44.4	7.6	90.4
Oats Hay	46.3	4.5	8.3	2.7	28.4	41.7	6.9	88.0
Orchard Grass Hay	49.6	4.6	7.7	2.9	30.5	40.7	6.8	88.6
Corn Stover	46.2	2.1	5.7	1.2	27.7	40.9	5.5	81.0
Wheat Straw	35.7	0.8	3.8	1.5	35.7	40.9	8.2	90.1
Corn Silage	18.7	1.3	2.3	0.9	6.9	16.5	1.7	28.3
Concentrates:								
Ground Corn	80.6	7.1	9.4	3.9	2.2	68.4	1.3	85.2
Ground Corn and Cob	75.9	6.0	8.2	3.3	8.2	67.4	1.4	88.5
Ground Oats	71.5	9.4	12.0	4.7	10.6	60.2	3.6	91.1
Ground Barley	78.7	9.3	11.8	2.0	5.7	68.0	2.9	90.4
Ground Wheat	83.6	11.3	13.1	1.7	3.0	70.0	2.0	89.8
Wheat Bran	70.2	13.1	15.8	5.0	9.5	54.3	6.0	90.6
Ground Whole Soybeans	86.2	32.8	36.9	17.2	4.5	26.3	5.3	90.2
Soybean Oil Meal	82.2	37.7	44.3	5.7	5.6	30.3	5.7	91.7
Linseed Oil Meal	78.2	30.6	35.2	6.3	8.0	36.3	5.5	91.3
Cottonseed Meal	75.5	35.0	43.2	7.2	10.6	27.0	5.5	93.5

*From Morrison's "Feeds and Feeding".

green hay, calves usually will require no additional vitamins while getting milk. As they grow older they begin eating legume hay and forage which will take care of their needs.

Table 5 gives the average composition of some of the common feeds used for dairy cattle. For further details on the composition of feeds and the exact requirements of various classes of animals the dairyman is referred to "Feeds and Feeding" by Morrison, a standard text on livestock feeding.

Dairy Rations

The dairy cow renders a great service to mankind by converting rough feeds such as pasture hay and silage, into our most nearly

perfect food—milk. Only the dairy cow can use such a high percentage of rough feed to produce a product of such high value in human nutrition. Milk is not only a valuable food in itself but it has great value in supplementing other human food. It provides energy, proteins, minerals and many “protective” substances such as vitamins and apparently some essential substances as yet unidentified.

In economical dairy production we aim to take full advantage of the cow's ability to convert rough feed into milk.

Feeding on Pasture

Pasture is the natural feed for cattle. It is the cheapest and best basic ration. However for best production, cows that are average or better producers should receive grain as a supplement, even when pasture is good, since grass is bulky and contains much moisture. Good producing cows can hardly hold enough grass to provide all of the feed nutrients required to maintain the body and produce milk. Grass is stimulating to milk production and good cows will often lose weight unless given concentrated feed with the grass. As a result they later go down in milk production too.

Naturally the quality of the pasture as well as the quantity effects the amount of grain required. Fresh fast growing grasses and legumes furnish the most desirable pasture.

When there is sufficient pasture cows are able to fill up in two or three hours and then usually lie down to chew their cud and rest. Under such pasture conditions and with a grain supplement cows should reach their maximum milk production.

Cows of average production probably should receive $\frac{1}{4}$ to $\frac{1}{6}$ of a pound of grain for each pound of milk, however, there are many factors that effect the amount of grain per pound of milk required on pastures as indicated below:

Conditions requiring more grain per pound of milk.	Conditions requiring less grain per pound of milk.
1. Poor pasture. (Poor quality—thin ground—not enough pasture)	1. Excellent pasture.
2. Richer milk.	2. Low testing milk.
3. Milk high in price compared to grain.	3. Milk low in price compared to grain.
4. Cows thin.	4. Cows in good condition.
5. Cows producing above average amounts of milk.	5. Cows producing less than average amounts of milk.

The quality of the pasture also determines to some extent the grain mixture to be used. Fresh, fast growing legume and grass pasture usually furnish ample protein so the grain mixture can be almost any combination of home grown grains which will average 11 to 13 per cent crude protein.

In summer when grass is growing more slowly, when there is less of it and it is more mature, the protein content is less and therefore the protein content of the grain should be increased to about 16 to 18 per cent.

A normal grain mixture for dairy cows for average roughage in winter and average pasture in summer, contains about 16 per cent crude protein. See Table 7.

The economy of good pasture is shown in the following comparison of feed required on pasture and on dry feed.

Feed Requirements on Pasture as Compared to Dry Feed*

	Hay	Silage	Grain
For a 1,000 Lb. Cow Producing 20 lbs. of 5 per cent milk daily:			
On Dry Feed (Pounds)	15	15	7.2
On Good Pasture	0	0	3.7
Daily saving due to pasture	15	15	3.5
Monthly saving	450	450	105
Price	\$20 ton	\$7.00 ton	\$2.50 cwt.
Value of Saving per month	\$ 4.50	\$1.57	\$2.63
Total			\$8.70

*Based on feed schedules in *Feeds and Feeding* by Morrison.

This saving of course varies with the price of feed. This example, however, emphasizes the importance of good pasture and the necessity from the standpoint of economy of providing adequate pasture as much of the year as possible. Ordinarily pasture can be produced or rented for $\frac{1}{3}$ to $\frac{1}{2}$ of the saving indicated above. Furthermore, the labor of harvesting crops is reduced as the cows are on pasture for more months of the year. Less grain and cured hay and silage will be required for the shorter winter feeding period. Therefore less cultivated crops are needed and it is possible to do a better job of soil conservation where pastures are used to the maximum.

In order to have pastures over most of the year it is necessary to provide supplementary pasture crops to fill in when permanent pastures are not at their best. It is possible to have nine months of good pasture in most of Missouri if the cropping system is carefully planned. Dairy farmers readily get eight months of pasture. Such a system will include lespedeza, small grains (rye, barley or wheat), sweet clover, and sudan grass, in addition to permanent grass or grass and legume mixtures.

The following schedule illustrates how a pasture system is used in providing "year round" pasture.

Pasture Schedule

- January— **On Dry Feed.** Cows run on permanent pasture when weather permits.
- February— **On Dry Feed.** Cows run on permanent pasture when weather permits. In South Missouri small grain seeded the previous fall may provide limited grazing in late February.
- March— **Mostly on Dry Feed,** except in South Missouri when small grain pastures should be coming into full use.
- April— **Small Grain Pasture,** second year sweet clover and some permanent pasture.
- May— **Permanent Pastures—Second year Sweet Clover** and Rye or other small grain that is not to be cut for grain.
- June— **Permanent Pasture.** Second year Sweet Clover.
- July— **Lespedeza.** Keep cows off of permanent pasture as much as possible.
- August— **Lespedeza.** Supplemented by Sudan grass. Permanent pastures are dormant. Keep cows off for best fall growth.
- September—**Sudan.** Lespedeza may be grazed in early September only if actively growing. **First-year sweet clover** in late September. Save permanent pasture for late fall.
- October— **First-year Sweet Clover.** Small grain seeded in late August. Feed hay if necessary.
- November—**Permanent pasture.** Small grain as weather permits. Partial dry feed.
- December—**Mainly on Dry Feed.** Permanent pasture as weather permits.

The acres of pasture required per cow vary with the soil fertility, the amount of manure and fertilizer used and other farming methods. In general for average land a total of $3\frac{1}{4}$ acres will be required to furnish pasture for one cow.

All of the following for **each cow**:

Permanent grass or grass-legume mixture	1 to 2 Acres
Small grain	1 Acre
Lespedeza	$\frac{1}{2}$ Acre
Sweet Clover First Year	$\frac{1}{4}$ Acre
Sweet Clover Second Year	$\frac{1}{4}$ Acre
Sudan Grass	$\frac{1}{4}$ Acre

Lespedeza and sweet clover are seeded with the small grain as a rule, so this totals about $3\frac{1}{4}$ acres of land required to pasture one cow.

Columbia, Missouri

January, 1947

DAIRY PRODUCTION 4-H RECORD

To be used with Circular 83

Name _____ Age _____

Address _____ County _____

Name of 4-H Club _____

Dairy Project Leader _____

Club meetings attended during year..... _____

Dairy project meetings attended..... _____

Number of demonstrations you gave at club or project meetings, _____,
county meetings _____, district or state meetings _____

Number of times dairy judging work was done in local club _____,
county _____, district _____, state _____,
interstate _____.

Number of exhibits made in community _____, county _____,
district _____; state _____, interstate _____

Work done on club activities this year _____

Work done on community service activities _____

DAIRY I

THE DAIRY CALF

Project Requirements - Own and care for one or more purebred or high grade dairy heifer calves up to breeding age.

Project Report

Date project started _____
Number of animals in project..... _____
Breed of animal or animals _____
Registry number if registered..... _____
Age of animal or animals at start of project _____
Grain mixtures used _____
Kind of pasture used _____
Kind of roughage fed in winter _____

Growth Record*

Age in Months	Weight lbs.	Chest in.	Height in.

Date project closed _____

Financial Summary**

Cost of animal or animals _____
Value of milk fed _____
Value of grain mixture fed..... _____
Value of roughage and pasture consumed..... _____
Other cash expense _____

Total..... _____

Value of animal or animals at close of project _____
Amount of cash prizes won _____

*Make entry every three months.

** Detailed feed records may be kept on Feed Record Sheet #445 and transferred to this record at close of project.

DAIRY II

THE DAIRY HEIFER

Project Requirements - Own and care for one or more purebred or high grade dairy heifers from time of breeding through the first calving period.

Project Report

Date project started _____
Number of animals in project..... _____
Breed of animals _____
Registry numbers if registered _____
Age of animals at time project started..... _____
Date heifer was bred _____
Name and number of sire to which heifer was bred _____
Kind of pasture used _____
Kinds of roughage fed _____

Growth Record*

Age in Months	Weight lbs.	Chest in.	Height in.

Weight of calf at birth..... _____
Date project closed _____

Financial Summary

Value of animals at start of project..... _____
Value of pastures used..... _____
Value of roughage fed _____
Value of grain fed, if any..... _____
Cash expense _____

Total..... _____

Value of animals at close of project _____
Value of prizes won..... _____

*Make entry every three months.

DAIRY III

THE DAIRY COW

Requirements - Own, feed and care for one or more purebred or high grade dairy cows beginning about freshening time and continuing through a lactation period. The member will be given credit for this project the first year he owns a cow if the project is started before June 1 and continues to the time project reports are called in for the fall. After the first year, the project report should cover the full twelve months.

Project Report

It is assumed that records of cow's milk will be kept on sheets like the one shown in Circular 83. These monthly records need not be submitted unless called for.

Date project started _____
 Number of animals _____ Breed _____

Breeding Record

Registry Name and Number	Date of Calving	Wt. of Calf at Birth	Date Rebred
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____

Production Summary - (Compiled from Monthly Record Sheets)

Name of Cow	Days in Milk	Total lbs. Milk Produced	Av. Test %	Butterfat Produced	Value of Product	Value of Feed Consumed	Value Product Less Feed Cost
1. _____	_____	_____	_____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____	_____	_____	_____

Total _____

Date project closed _____

Financial Summary

Value of herd at start of project _____
 Cost of animals purchased..... _____
 Cost of feed consumed..... _____
 Breeding fees..... _____
 Veterinary fees _____
 Testing fees..... _____
 Other cash expenses..... _____
Total..... _____

Value of herd at close of project..... _____
 Value of products sold _____
 Value of animals sold _____
Total..... _____
Labor Income . _____

Winter Feeding

When pasture is not available or is of poor quality it is necessary to feed dried roughages and silage and more grain for full production. Ordinarily feed nutrients are cheaper in rough feed than in concentrates. A hundred pounds of roughage such as average hay contains about 45 to 50 pounds of digestible nutrients. A hundred pounds of mixed grain feed as usually provided to dairy cows contains about 75 pounds of digestible nutrients. As a general rule, we think of a pound of grain as being worth about 1.75 pounds of good hay.

If grain is worth \$2.50 per cwt. or \$50.00 per ton, good hay is therefore worth about \$1.43 per cwt. or \$28.60 per ton. Usually hay or an equivalent amount of silage can be bought or produced much cheaper than that. Further comparisons are given in the table below:

Table 6.--Comparison of Grain and Hay.

When the Grain Mixture Costs:		Good Legume or mixed hay is worth:	
100 Pounds	Ton	100 Pounds	Ton
\$1.00	\$20.00	\$0.57	\$11.40
1.50	30.00	.86	17.20
2.00	40.00	1.14	22.80
2.50	50.00	1.43	28.60
3.00	60.00	1.71	34.20
3.50	70.00	2.00	40.00
4.00	80.00	2.29	45.80
4.50	90.00	2.57	51.40
5.00	100.00	2.86	57.20

These comparison would hold true only if the hay is of good quality. Hay varies in quality a great deal. Late cut hay that has lost much of its leaves or has been leached out by rain and exposure would not be worth nearly so much.

Silage may replace part of the hay and it is usually considered worth about $\frac{1}{3}$ as much per ton as hay.

These comparisons show that for profitable milk production we need first to think of producing as much pasture as possible. When pasture cannot be provided the cows should get all the hay or hay and silage they will eat. Grain is then used as a supplement in such amounts and in such mixtures as will give the best and most economical results.

The amount of grain required again will depend on the amount of hay and other roughage the cows eat and its quality. Of course the cows usually will eat less of the poorer hay which again increases the amount of grain required.

Normal winter grain feeding for cows of average production is at the rate of $\frac{1}{3}$ of a pound of grain per pound of milk for Jerseys and Guernseys, and $\frac{1}{4}$ of a pound of grain per pound of milk for Holstein, Brown Swiss and Milking Shorthorn. Some of the factors which affect the rate of grain feeding are summarized below:

Conditions that increase grain requirements	Conditions that lower grain requirements
1. Insufficient roughage.	1. All the roughage cows will eat.
2. Unpalatable roughage.	2. Palatable roughage.
3. Poor quality roughage. (Stemmy, too mature, few leaves)	3. Excellent hay and silage.
4. Cows thin.	4. Cows in good condition.
5. Milk price high compared to feed.	5. Milk price low compared to feed.
6. High testing milk.	6. Low testing milk.
7. High producing cows (above average).	7. Cows of low producing ability (below average).

The kind and amount of roughage consumed is of great importance. Normally cows consume 2 to 2½ pounds of dry roughage daily per 100 pounds of body weight. Three pounds of silage equals a pound of hay. If the roughage is poor the amount of grain should be increased and the percentage of protein increased. This is necessary since the poorer hays are usually less palatable, the cows eat less of it and therefore require added nutrients from grain. Poor hay is usually lower in protein and this too must be provided by the grain. (See Table 7.)

While grain can to some extent make up for deficiencies in roughage rations, it cannot fully do so, and it is usually more expensive to substitute grain for hay.

Kinds of Roughage.—Early cut legume hays, cured so as to retain most of the leaves and the green color are among the most desirable roughage feeds for producing dairy cows. Timothy and oats and other grass hays if cut at the proper stage and properly cured are also good. Timothy cut in bloom contains about twice as much protein as timothy cut when the seed is ripe. Hay is also much more palatable when cut early. This is true of practically all hay crops. In general, early cut hays are better for dairy cattle.

Most of the feeding value of hay is in the leaves, therefore hay that has lost its leaves is inferior for milk production.

Vitamin A is associated with green color in roughage. Prolonged curing in the sun or leaching by rain destroys the color and the vitamin A in hay as well as some of the other nutrients. On the other hand, sun curing adds vitamin D which may be important if cows or calves do not get out in the sun very much.

Silage made from growing crops such as corn, sorghum or legumes is an important roughage feed for dairy cattle. They like it very much. Silage is also an important source of vitamin A. An acre of ground will usually produce more nutrients in a silage crop than by any other method of handling. Silage may be used to replace from $\frac{1}{4}$ to $\frac{1}{2}$ of the hay. It will require about 3 tons of silage to replace a ton of hay.

Most dairymen like to feed a mixed roughage. Preferably, half of the wintert roughage should be good quality legume hay, the balance might be silage or grass hays. Cows seem to like to eat some oats straw or wheat straw during the winter, even when on the best of rations, so it is a common practice to allow cows to run to a straw stack during the day.

The Grain Ration

If we think of grain as a supplement to roughage, then the grain ration will be determined by the kind of roughage available. The grain ration should make up for any deficiencies in the roughage ration.

Ration		Analysis
Corn	500 lbs.	Total Dig. Nutrients75.5
Oats	300 "	Dig. Prot.14.6
Soybean Oil Meal ...	200 "	Crude Protein17.8
Steamed Bone Meal .	15 "	Fat 4.5
Salt	15 "	Carbohydrate: (Fiber .. 4.9
		+ N. Free Extract)55.0
		Mineral 4.7
		Total Dry Matter 87.0

The following table (Table 7) gives three simple grain mixtures which meet most of the needs for dairy cattle feeding in Missouri. On farms where most of the grain must be purchased, it may be found practical to buy the dairy rations as a mixed feed. Usually such mixed feeds are made up with 16 to 18 per cent crude protein content, which is satisfactory for a good all around dairy feed. In purchasing mixed feed, however, attention should be given to other constituents of the feed in addition to protein. Total digestible nutrients is one of the best single indicators of the value of a mixed feed. Although this figure is seldom given on the tag. A home mixed ration such as No. 2 in Table 7 will have the average analysis

shown above. (See also Table 5 for percentages in various feeds). These may be compared with the guaranteed analysis given on mixed feed.

Table 7.--In Feeding Dairy Cattle Let Your Roughage Be Your Guide

	Low Protein Roughage (Often less palatable & less digestible)	Medium Protein Roughage	High Protein Roughage (Usually more palatable & more digestible)
With this kind of roughage or pasture, → feed ↓	Corn silage, corn stover, oat hay, cane, timothy, soybean straw, sudan or other non- legumes; or fair to poor pasture	Alfalfa, clovers, soy- beans or cowpeas; with corn silage, stover, cane, oat hay, timothy, or other non-legumes, or good to medium pasture	Alfalfa, clover, cow- peas, or soybeans, or excellent pasture
This mixture of grain →	(1) Lbs. Ground corn.....400 Wheat bran.....300 Soybean oil meal 300 Steamed bone meal..... 20 Salt..... 15	(2) Lbs. Ground corn.....500 Wheat bran or oats.300 Soybean oil meal ...200 Steamed bone meal..... 15 Salt..... 15	(3) Lbs. Ground corn..... 600 Ground oats.....200 Wheat bran.....200 Steamed bone meal..... 10 Salt..... 15
Approximate protein content	Crude 20.0% Digestible 16.5 #	Crude 17.5% Digestible 14.5 #	Crude 11.0% Digestible 8.5 #
Amount to feed:-	Feed average Jersey or Guernsey cows 1 lb. of grain for each 3 pounds of milk; Holsteins, Brown Swiss or Shorthorns 1 lb. of grain for each 4 lbs. of milk. High producing cows need more grain, low producing cows need less. <u>When on good pasture feed</u> at about one half to two-thirds this rate.		
Substitutes for: Corn.....	Corn and cob meal, barley, hominy feed, pound for pound. Up to 50% of the corn may be replaced by an equal weight of ground wheat or sorghum grains.		
Bran.....	Ground oats, alfalfa meal, or wheat middlings, pound for pound.		
Soybean oil meal.....	Cotton seed meal, linseed oil meal, gluten meal, crushed soybeans, pound for pound.		
When home grown feeds are not available a high quality commercial mixed feed of the same crude protein content may be used.			

Getting Cows on Full Feed

Cows use feed for maintaining their bodies first, the additional feed they get above the amount needed for maintenance goes toward milk production. It is usually profitable then to feed a full ration. For example, suppose that in addition to the roughage ration two pounds of grain are required for body maintenance and we give the cow three pounds. Only one pound is left for milk production. However, if we give the cow ten pounds of grain, eight pounds will be left for milk.

Actually on a restricted ration a cow may continue to give a good quantity of milk for a while but eventually she will either lose flesh or go down in production or both, if feed is inadequate for both body maintenance and milk production.

There may be times, however, when it will not pay to feed grain

heavily. If prices of milk are low compared to prices of grain it may be that we can afford to sacrifice some production in order to get cheaper production.

In practice, when a cow freshens we feed her lightly on grain for a while, gradually increasing the feed until after about 3 weeks she is getting $\frac{1}{4}$ to $\frac{1}{3}$ of a pound of grain for each pound of milk, depending on the fat content of the milk. If the cow continues to increase milk production we may continue to increase grain as long as the increase in milk will pay for the added grain, or until we reach the limit of her appetite or capacity. If a cow begins to show any signs of refusing the increased ration it is time to back up enough to keep her appetite good. All increases should be made very gradually, and when we get over 15 pounds of grain a day we must watch the cow very closely for signs of failing appetite or digestive disturbance. Practical dairymen very seldom feed more than 15 pounds of grain even to the best cows. Then, too, we must always keep an eye on costs.

We cannot follow rules too closely in feeding grain to dairy cattle. Each cow is different. Skill in feeding is largely one of watching the cows constantly, keeping in mind the cow's condition, her appetite, the amount of milk produced, the amount of feed given as well as economy.

It has been said "The eye of the master fattens his cattle". It is also true of the master dairyman, his watchful eye is responsible for milk production.

Efficient Milking

The dairyman should give thought and planning to the actual job of milking. Whether milking is by hand or machine he should take advantage of the help the cow gives, if we understand her and work with her. He should protect her udder from injury and her product from contamination.

Regularity. Milking at the same hour with very few minutes variation is of vital importance for full and complete production.

Order of Milking. The order of milking cows in the barn should be mapped out carefully. Cows that let their milk down first should be milked first. Those that are not inclined to let down their milk on slight stimulation can be milked later or last.

Quick Milking. When the milking is begun it must progress rapidly to completion. If a machine is used not more than 3 to 5 minutes should be required. Slow milking results in decreased production.

Completion. When the milking is completed, or if the cow stops

secreting, it is time to stop milking. Too much stripping or prolonged manipulation develops strippers.

Temperament. The temperament of the milker and the handler of the cows, which enables him to "get along" with them is important. In no way should suspicion, fear, or excitement be aroused in the cows.

Distraction. Nothing should appear in the barn before milking or during milking to detract the cow's attention from the feed she is eating or the milking that is being done.

Rough Milking. Strong arm methods, painful pinching of the teats, the use of an ill fitting or irritating milking machine, or any procedure that causes unpleasant sensations to the teats or udder will result in incomplete milking.

Stimulants. It is of vital importance that nothing be done that stimulates milk "let down" any considerable time in advance of milking, otherwise the hormone that has been secreted into the blood stream will be dissipated, and the edge will be gone from the cow's ability to force down her milk. No more than one minute before milking should such things as washing the udder or using a strip cup for checking the milk be done. Otherwise the cow's complete production will not be secured.

Controlled Milking

In order to take full advantage of the cow's "let down", or what is actually the pressure generated in the udder by a hormone that causes the muscles around the milk cells to contract, a milking routine, called "Fast Milking" or "Controlled Milking" has been devised. In practice this procedure has been found to have several advantages.

It gets more milk—by taking the milk quickly while pressure is on.

It helps control mastitis—by sanitation and by preventing udder injury from leaving the milking machine on too long.

It produces clean milk—by a strict sanitary routine.

It saves time—because each step is planned for efficiency.

Briefly the steps in controlled milking are as follows:

1. Prepare the cow by thoroughly washing or wiping the udder and teats, using warm chlorine water, 200 to 250 parts per million of available chlorine. Start out by having a clean cloth for each cow in a pail or pan of chlorine solution. After each cloth is used once it is dropped into another pail to be washed and sterilized later.
2. Take one or two full hand squeezes from each teat in a strip cup. This preparation aids in producing clean milk and spots cows giving abnormal milk. It also assists in stimulating the "letting down" process, which is all important in this fast milking program. Some operators massage the udder briefly at this point.

3. The milker begins milking at once or if machines are used the operator applies the milking unit immediately and leaves it on for three minutes. A three minute egg timer can be used in timing this operation. Some prefer a 4-minute period. Near the end of the milking period the operator pulls down on the teat cups to keep them from crawling too high.
4. At the end of period the unit is removed and the teat cups are dipped in clean water, then into warm chlorine solution, 250 parts per million. Then the unit is applied to the next cow which has been prepared as above. In hand milking wash the hands after milking each cow.
5. Strip each cow just as soon as the milker is removed. This is done with full hand squeezes and should not be prolonged.
6. As soon as the stripping is completed each teat is dipped into a dipper of chlorine water, 250 parts per million, which is discarded after use on each cow.
7. Milk last any cows that are suspected or known to be infected with mastitis.
8. The change to rapid milking may be made abruptly. Most cows respond to the new system within a few days.
9. Move any cows that fail to respond to this system in a position last or next to the mastitis cows in the milking row. Cows with mastitis should always be milked last.

VIII. DAIRY RECORDS

Records are essential in the successful conduct of any business. This is especially true in dairy farming. Records give us the facts with which we can proceed to improve the efficiency of the herd by proper feeding, culling, breeding herd replacements and management. It is important to feed cows well so that they will have every chance to demonstrate their abilities in production. Then "boarders" or low producers can be removed and heifers from the cows with high production and long producing life raised for herd replacements.

It is not safe to guess at the production of dairy cows. Testing is the only way to determine accurately what a cow produces.

Records from dairy herd improvement associations covering thousands of cows in the United States have proven again and again that high producing cows are more efficient, returning more for each dollar's worth of feed given them. This is illustrated in the following table.*

Table 8.--High Production Means Greater Efficiency

	Cows Averaging 200# of B'Fat	Cows Averaging 400# of B'Fat
Production, Pounds of Butterfat	200	400
Value of the Product	\$104	\$211
Cost of Feeding	\$ 56	\$ 81
Returns above Feed Cost	\$ 48	\$130

*From Farmers Bulletin No. 1974, U. S. Department of Agriculture.

Thus we see that 10 cows of the higher production class return as much income above feed cost as 27 cows in the lower class. It costs \$810.00 to feed the 10 cows while to feed the 27 lower producing cows would cost \$1512.00. Much less labor is required in the case of the small higher producing herd.

Production Records

One of the best ways to get production records on your cows is to join a dairy herd improvement association. If that is not possible or practical it is suggested that you weigh the milk from each cow for a 24 hour period, the first time about 10 days after freshening and the same day each month thereafter. Take a small sample from each milking and test the mixed or composite sample. For the milk sample use a clean 2 to 4 oz. jar or a half-pint milk bottle. Before taking the sample, stir the milk well or mix by pouring it into another bucket. With a dipper fill the jar $\frac{1}{3}$ full. At the second milking repeat, filling the jar to about $\frac{2}{3}$ full. Mark each jar carefully with the name or number of the cow and keep the samples cold until the test is made, as sour milk cannot be accurately tested. Sometimes arrangements can be made to have your dairy plant do the testing for you. With milk weights and a butterfat test covering a 24 hour period it is easy to figure the monthly production of the cow. Essentially this same method is followed in all D.H.I.A. testing and in official testing conducted by the dairy cattle breed associations.

Directions for Running the Babcock Test for Butterfat in Whole Milk*.—From a thoroughly mixed sample 17.6 cc. of milk is taken with a pipette graduated for that amount. This milk is then transferred from the pipette to the milk test bottle. The temperature of the milk at the time of testing should be between 60° and 70° F. and the acid to be added should be at about the same temperature. With the acid measure, 17.5 cc. of standard commercial sulfuric acid is then poured down the inside of the test bottle in such a way that it will wash down any particles of milk adhering to the inside of the neck of the bottle. Having a specific gravity much greater than that of the milk, the acid collects at the bottom of the test bottle. Next the test bottle is rotated and gently shaken until the milk and acid are thoroughly mixed.

Next the test bottles are placed in the sockets of the Babcock tester, which is set in motion and whirled for 5 minutes at a rapid rate. The proper speed varies from 1,000 revolutions per minute for a centrifuge having a diameter of 12 inches to 800 per minute for

*More complete instructions for making the Babcock test may be found in Circular 189, "Testing Milk and Cream," Mo. College of Agriculture.

one having a diameter of 18 inches. In cold weather the centrifuge should be placed in a warm room for 2 or 3 hours before being used.

After the first whirling, hot water is added to each bottle until the contents reach the lower part of the neck. The whirling is then repeated for 2 minutes. More water is added until the fat reaches a point in the neck of the bottle where the percentage of fat may be read from the graduation marks. The whirling is then repeated for another minute in order to clarify the upper and lower meniscus of the fat column. The hot water used should be hot enough to maintain the bottles at a temperature between 130° and 140° F. Soft water gives best results. After the final whirling, the test bottles should be set into a water bath so that the entire butterfat column is surrounded and read after a temperature of 135° to 140° F. has been maintained for not less than 3 minutes.

The percentage of fat is read by measuring the length of the fat column from the lowest point to the highest point of the column with an ordinary pair of dividers. One point of the dividers is then placed on the zero point and the other on the scale and the point of the scale indicates the percentage of fat in the milk.

In order to run a Babcock test for butterfat the following equipment is required:

- (1) Sample jars
- (2) Centrifuge machine
- (3) Milk Test Bottles
- (4) Pipette (17.6 cc.)
- (5) Acid measure (17.5 cc.)
- (6) Concentrated Sulphuric Acid
- (7) Dividers
- (8) Water bath or deep flat bottomed vessel in which test bottles may be brought to the proper temperature for reading.
- (9) Thermometer.

Feed Records

At the same time that milk production weights are taken the feed consumed by each cow should be weighed so that the value of the month's feed can be determined. Subtracting the monthly feed cost from the market value of the milk gives you the cow's income above feed cost for the month.

The form (p. 46) is suggested as a convenient way to keep production records. It may be used as a month's record for a small herd or a 12-month record on one cow.

every 18 to 24 days with the average about 21 days. Cows normally calve 283 days after breeding. Although there may be a variation of several days either way.

The best way to keep breeding records is on a card tacked on the stable wall so that entries can be made before they are forgotten. Such a card for keeping breeding records is given on page 48.

IX. PRODUCING QUALITY MILK AND CREAM

The public is demanding that milk and milk products be of the highest quality. High quality dairy products cannot be made from milk that is unclean and carelessly handled. When milk is scarce it is easy to sell milk or cream but when dairy products are plentiful the producers who have a reputation for producing good milk have a great advantage in the market. Below are listed some of the more important factors in producing high quality milk.

The Desire To Improve

If you make up your mind to produce high quality milk and dairy products that will be the most important step in getting it done. An attitude of desiring to improve the quality of your product to the fullest as compared with one of merely meeting minimum requirements of your market, will be reflected in personal cleanliness and care in other details which make for clean milk.

Milk is a food. It must be handled at all times in such a way as to keep dirt out; all surfaces it contacts must be sterile; and such bacteria as do get in the milk must be kept from multiplying by prompt cooling and by keeping it cool until it reaches the market or the consumer. All persons connected with the production and handling of milk, of course, must be healthy and free from communicable diseases.

You will be proud of your high quality products. You can produce them. Talk it over with your market field man, health inspector, or County Agent. These folks can help you.

Good Buildings and Equipment

Elaborate and expensive buildings and equipment are not necessary. However they can be designed so as to make it easy to follow a quality program.

Barns should be clean, well ventilated, well lighted and comfortable. Concrete floors and other improvements in the milking barn make cleaning easier. Arrange the feeding program to avoid stirring up dust just before milking. Tight ceilings over the milking barn will prevent dust contamination from above.

The milk room may also be designed for ease in taking care of the milk and equipment. Plenty of clean water is important. These points also should be checked. (1) Concrete floor and drain for ease in cleaning, (2) Screening to keep out flies, (3) Double doors between barn and milk room to keep out flies, dust and stable odors, (4) Provision for washing, sterilizing and storing equipment, (5) Provision for heating water, (6) Equipment for cooling of milk with water, ice, or refrigeration.

Equipment of good design is important. Seamless pails, small top buckets, well designed strainers which are easy to use, clean and sterilize, make the routine jobs easier.

Clean Healthy Cows

A herd health program that will insure cows free from disease is one of the first essentials in producing wholesome milk. Test for tuberculosis and Bang's disease regularly. Watch for signs of mastitis or any other conditions which may produce undesirable or unhealthy milk.

Much dirty milk can be prevented by clipping cows' flanks and udders regularly and by brushing and wiping the sides and udders before milking. Experiments have shown a bacterial count eleven times greater in fresh milk from dirty cows as compared to milk from cows with washed udders and teats. It is best to use a clean cloth for each cow.

Small mouth milk pails should be used. See that milkers hands are washed with soap and water and dried just before milking.

A well bedded barn or loafing shed, and lots that are well drained and kept reasonably clean also aid in keeping cows clean. Store manure inaccessible to the cows. During summer months spread it on the fields at less than weekly intervals to prevent breeding of flies.

Clean Equipment and Utensils

Wash and sterilize all utensils after each usage. Unclean utensils are a major source of bacteria in milk. Arrangements for prompt, thorough and easy washing should be a part of every quality program. Follow this procedure:

Rinse utensils, milking machines and cream separators promptly after using, with clean cool water.

Wash in warm water to which a dairy washing powder or a wetting agent has been added. Do not use soap. Use a brush for washing, not a rag.

Sterilize with hot water at 180° or over, or with a chlorine solution. Many dairymen use hot water to sterilize and rinse just after

washing and then rinse in chlorine solution just before using. The same solution may then be used to wash the cows udders.

After washing have a rack for storing utensils that will insure prompt drying away from dust and dirt. Milking machine cups should be kept filled with a disinfecting solution between milkings and rinsed with clean water or chlorine solution before using.

Quick Thorough Cooling

It is best to strain milk as soon as drawn, using a single service filter pad; and to cool it as quickly as possible using water, ice or electric refrigeration. Be sure that the cooling water comes up to the neck of the cans. If well water is used add fresh water to the tank while the milk is cooling, or preferably use running water. Cool to 50° or as cool as possible. Milk will cool much more quickly in water than in air.

Running well water (47 degrees) will cool milk to 58° in one hour, without stirring, while cold air at 10° below zero will reduce the temperature only 8° in one hour (90° to 82°).

Keep milk at a low temperature until it reaches the market or the consumer. Protect cans from direct heat or freezing while enroute to market. A moistened can jacket or clean sack will aid materially in keeping temperatures right.

Do not pour warm milk or cream into cooled milk or cream of a previous milking, as this revives bacterial growth. Market cream at least twice weekly in warm weather.

X. DAIRY CATTLE SELECTION AND JUDGING

A dairyman will do well to develop skill in the selection and judging of dairy animals because he will find use for such skill practically every day. Whenever animals are purchased, the herd culled, heifers selected or a new herd sire chosen, the dairyman who is a good judge of dairy animals will have a distinct advantage.

Good dairy type is about the same in all breeds of dairy cattle, although there are certain characteristics peculiar to each breed. This desirable dairy type is described in the uniform score card which has been adopted by all the major dairy breeds. The uniform score card is reproduced on the following pages.

The numerical score of the various parts of the animal indicates their relative importance. The student in dairy judging will do well to study the score card and become thoroughly familiar with it by study and use in scoring animals. Actually in judging or in selecting animals the score card is not used directly at all, but the good judge has it in mind all the time.

In learning to judge it is essential that one become familiar with all the different parts of the animal. From the score card learn the names of the different parts and the descriptive terms that apply to them. Study the live animals and note the differences. Decide which is more desirable according to the score card. Gradually you will build up in your mind a picture of desirable dairy type. Then without the score card, compare two animals and place them. It is well at first to write down your reasons for the placings to help you organize them. Reasons should also be given orally to develop ability to talk about the animals and to make decisions.

You will note that the score card is divided into four main divisions

1. General Appearance
2. Dairy Character
3. Body Capacity
4. Mammary System

AYRSHIRE CHARACTERISTICS

COLOR—Red of any shade, mahogany, brown or these with white, or white, each color clearly defined. Distinctive, red and white markings preferable; black or brindle markings strongly objectionable.

SIZE—A mature cow in milk should weigh about 1150 lbs.

HORNS—Inclining upward, small at base, refined, medium length and tapering toward tips.

BROWN SWISS CHARACTERISTICS

Strong and vigorous. Size and ruggedness with quality desired. Extreme refinement undesirable.

COLOR—A shade of brown varying from a silver to a dark brown. Hair inside ears is a lighter color than body. Nose and tongue black, with a light colored band around nose. Color markings which bar registry are: white switch, white on sides, top, head or neck and legs above knees or hocks. White on belly or lower legs objectionable.

SIZE—A mature cow in milk should weigh about 1400 lbs.

HORNS—Inclining forward and slightly up. Moderately small at base, medium length, tapering toward black tips.

GUERNSEY CHARACTERISTICS

COLOR—A shade of fawn with white markings clearly defined, black or brindle markings objectionable. Skin should show golden yellow pigmentation. When other points are equal, a clear or buff muzzle will be favored over a smoky or black muzzle.

SIZE—A mature cow in milk should weigh about 1100 lbs.

HORNS—Inclining forward, small and yellow at base, refined, medium in length and tapering toward tips.

HOLSTEIN CHARACTERISTICS

COLOR—Black and white markings clearly defined.

Color markings which bar registry are solid black, solid white, black in switch, black belly, black encircling leg touching hoof, black from hoof to knee or hock, black and white intermixed to give color other than distinct black and white.

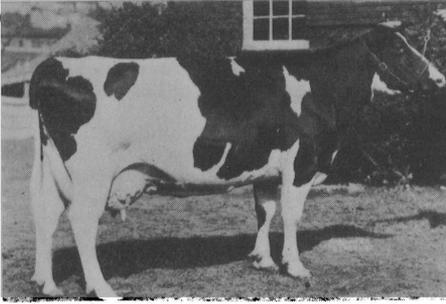
SIZE—A mature cow in milk should weigh about 1500 lbs.

HORNS—Inclining forward, incurving, small at base, refined, medium length and tapering toward tips.

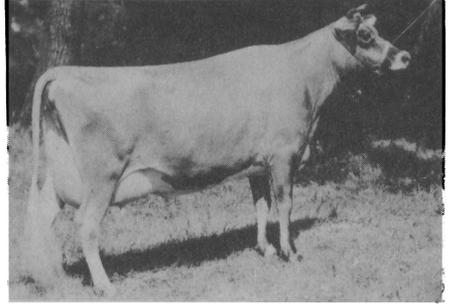
DAIRY COW SCORE CARD

Ideals of type and breed characteristics must be considered in the application of the terminology of this score card.

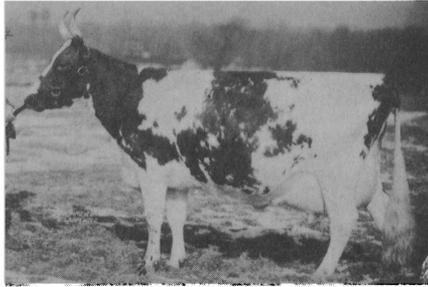
Based on Order of Observation		Perfect Score
1. GENERAL APPEARANCE		30
<i>Attractive individuality, revealing vigor, femininity with a harmonious blending and correlation of parts. Impressive style and attractive carriage with a graceful walk.</i>		
BREED CHARACTERISTICS (see below)		12
HEAD—medium in length, clean-cut; broad muzzle with large open nostrils; lean, strong jaw; full, bright eyes; forehead broad between the eyes and moderately dishd; bridge of nose straight; ears medium size and alertly carried.		
SHOULDER BLADES set smoothly against chest wall and withers, forming neat junction with the body.		
NECK strong and appearing straight with vertebrae well defined.		
LOIN broad, strong and nearly level.		
RUMP long, wide; top-line level from loin to and including tail head.		10
HIPS wide, approximately level laterally with back, free from excess tissue.		
THURLS wide apart.		
PIN BONES wide apart and slightly lower than hips, well defined.		
TAIL HEAD slightly above and neatly set between pin bones.		
TAIL long and tapering with nicely balanced switch.		
LEGS wide apart, squarely set, clean-cut and strong with fore legs straight.		
HIND LEGS nearly perpendicular from hock to pastern. When viewed from behind, legs wide apart and nearly straight. Bone, flat and flinty, tendons well defined.		8
Pasterns, of medium length, strong and springy. Hocks cleanly moulded.		
FEET short and well rounded, with deep heel and level sole.		
2. DAIRY CHARACTER		20
<i>Animation, angularity, general openness, and freedom from excess tissue, giving due regard to period of lactation.</i>		
NECK long and lean; blending smoothly into shoulders and brisket; clean-cut throat and dewlap.		
WITHERS well defined and wedge-shaped with the dorsal processes of the vertebrae rising slightly above the shoulder blades.		20
RIBS wide apart. Rib bone wide, flat and long.		
FLANK deep, arched and refined.		
THIGHS incurving to flat from the side; wide apart when viewed from the rear, providing sufficient room for the udder and its attachment.		
SKIN of medium thickness, loose, and pliable. Hair fine.		
3. BODY CAPACITY		20
<i>Relatively large in proportion to size of animal, providing ample digestive capacity, strength and vigor.</i>		
BARREL deep, strongly supported, ribs wide apart and well sprung; depth and width tending to increase toward rear of barrel.		12
HEART GIRTH large, resulting from long, well sprung foreribs, wide chest floor between front legs, and fullness at the point of elbow.		8
4. MAMMARY SYSTEM		30
<i>A capacious, strongly attached, well carried udder of good quality, indicating heavy production and a long period of usefulness.</i>		
UDDER—CAPACITY and SHAPE, long, wide and of moderate depth. Extending well forward, strongly attached, reasonably level floor. Rear attachment, high and wide. Quarters evenly balanced and symmetrical.		25
TEXTURE soft, pliable and elastic. Well collapsed after milking.		
TEATS uniform, of convenient length and size, cylindrical in shape, free from obstructions, well apart and squarely placed, plumb.		
MAMMARY VEINS long, tortuous, prominent and branching, with numerous large wells.		5
Veins on udder numerous and clearly defined.		
TOTAL		100



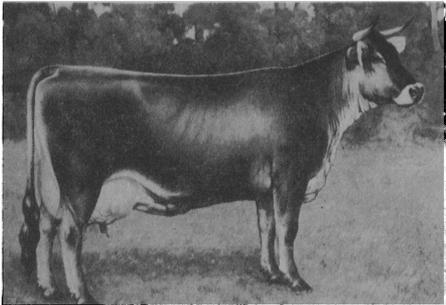
Holstein



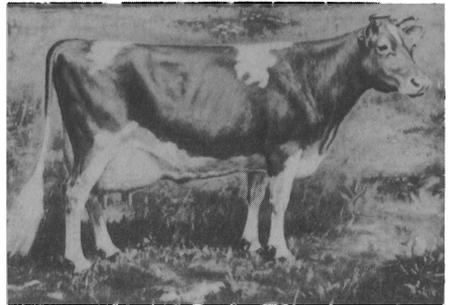
Jersey



Ayrshire



Brown Swiss



Guernsey

Fig. 10.—Ideal type cows of the five leading breeds of dairy cattle.

JERSEY CHARACTERISTICS

COLOR—A shade of fawn, with or without white markings.

SIZE—A mature cow in milk should weigh about 1000 lbs.

HORNS—Inclining forward, incurving, small at base, refined, medium length and tapering toward tips.

General appearance has to do with the general lines of the animal, how typical it is of the breed and sex it represents, its symmetry and balance, the straightness of topline, strength and quality of bone and the style and vigor of the animal. All parts should be blended into an attractive balanced animal.

EVALUATION OF DEFECTS

In a show ring, disqualification means that the animal is not eligible to win a prize. Any disqualified animal is not eligible to be shown in the group classes. In slight to serious discrimination, the degree of seriousness shall be determined by the judge.

EYES

1. Total blindness: *Disqualification.*
2. Blindness in one eye: *Slight discrimination.*

WRY FACE

Serious discrimination.

PARROT JAW

Slight to serious discrimination.

SHOULDERS

Winged: *Slight to serious discrimination.*

CAPPED HIP

Slight discrimination.

TAIL SETTING

Wry tail or other abnormal tail settings: *Slight to serious discrimination.*

LEGS AND FEET

1. Lameness — apparently permanent and interfering with normal function: *Disqualification.*
— apparently temporary and not affecting normal function: *Slight discrimination.*

2. Bucked Knees, blemished hocks, crooked hind legs, weak pasterns: *Serious discrimination.*
3. Evidence of arthritis, crampy hind leg: *Serious discrimination.*
4. Enlarged Knees: *Slight discrimination.*

ABSENCE OF HORNS

No discrimination.

LACK OF SIZE

Slight to serious discrimination.

UDDER

1. One or more blind quarters: *Disqualification.*
2. Abnormal milk (bloody, clotted, watery): *Possibly disqualification. A slight to serious defect.*
3. Udder definitely broken away in attachment: *Serious discrimination.*
4. A weak udder attachment: *Slight to serious discrimination.*
5. One or more light quarters, hard spots in udder, side leak or obstruction in teat (spider): *Slight to serious discrimination.*

DRY COWS

In case of cows of apparently equal merit: *Give preference to cows in milk.*

OVERCONDITIONED

Serious discrimination.

TEMPORARY OR MINOR INJURIES

Blemishes or injuries of a temporary character not affecting animal's usefulness: *Slight discrimination.*

EVIDENCE OF SHARP PRACTICE

1. Animals showing signs of having been operated upon or tampered with for the purpose of concealing faults in conformation, or with intent to deceive relative to the animal's soundness: *Disqualification.*
2. Heifer calves showing evidence of having been milked, in an attempt to deceive regarding natural form of udder: *Serious discrimination.*

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Approved—The American Dairy Science Association, 1943

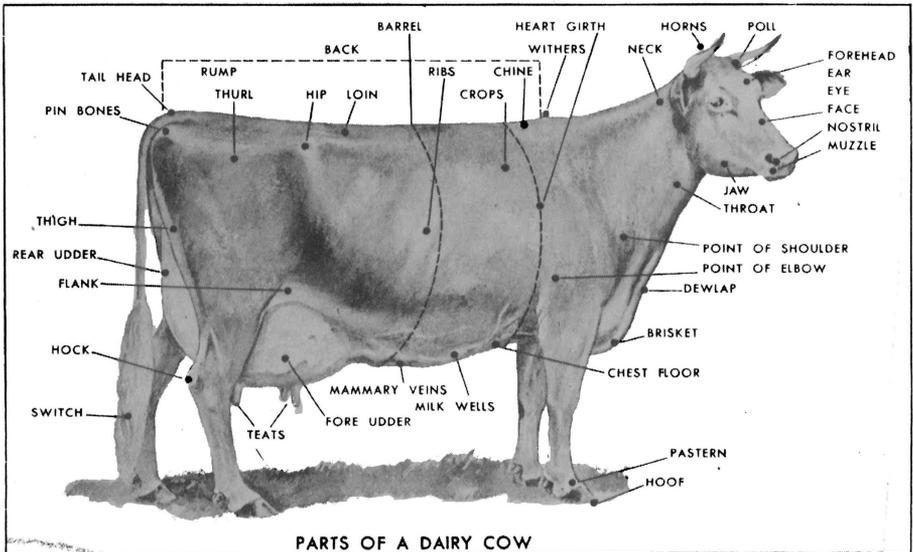


Fig. 11.—The parts of a dairy cow that are noted in the score card. (Approved by the Purebred Dairy Cattle Association, 1942.)

The animal should have an alert clean cut head typical of its breed, with full bright eyes, wide muzzle and large nostrils.

Shoulders should be smooth, the withers sharp and the crops smooth and well filled.

The back must be straight, the loin strong and wide, the rump long and wide and level from hips to pin bones.

Legs should be straight, wide apart, clean cut and strong.

Dairy character has to do with the characteristics that go with the production of milk from the feed eaten in contrast to those that indicate an inclination to take on flesh. Angularity, leanness, fine quality of skin, and hair, alertness and refinement (particularly in females) characterize the good dairy cow.

Good dairy character has been acquired through long years of selection from the original wild cattle. In the original animals only enough milk was produced to feed their calves. Since then cattle have in the main been selected either for the production of milk or for the production of beef. The two types are quite different. Beef animals are characterized by thick covering of flesh, compact, squarely built, while dairy cattle have longer thinner necks and thighs, are less compact and show the typical wedge shape.

The contrast between dairy and beef type is shown in the accompanying illustrations. (Courtesy Cornell University.)

Dairy animals are sharp at the withers and wide in the floor of

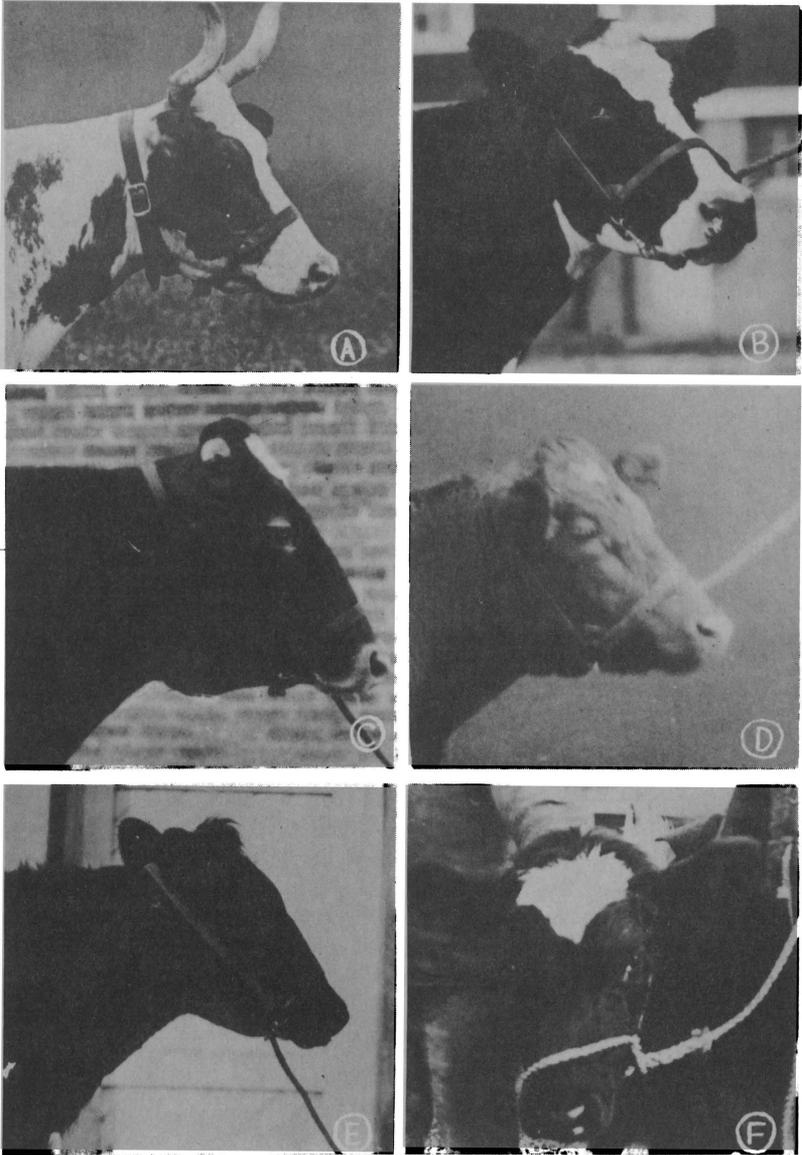


Fig. 12.—Types of heads. (A) Excellent head and neck. Note the alertness, carriage, and refinement of the head and the long slender neck. (B) Good dairy head with a large, alert, and prominent eye, width between the eyes, dished forehead, large nostrils and muzzle, and a strong jaw. (C) Plain head. Note the Roman nose and heaviness in the throat. (D) Poor head and neck. The neck is too thick and the head is plain and lacks refinement. Note the dull eye and the plain forehead. This head is not typical of a good dairy cow. (E) Poor head with a dull eye, a small nostril, and a weak muzzle and jaw. This head indicates a weak constitution and a sluggish disposition. (F) Plain head with a small dull eye, small nostrils, and narrow muzzle.

the chest giving a wedge shape when viewed from above and in front.

The sharp withers and wide hips form the top triangle or wedge.

From the side view the dairy animal is deep in the rear with a thin refined neck. Lines drawn along the top line and along the underline of the animal would meet in front of the head, giving a characteristic side wedge.

Body Capacity.—A good dairy cow should be able to consume large quantities of bulky feed. This requires large feed capacity and plenty of room for heart, lungs and other organs. The cow's barrel, between the front and hind legs, should be deep and long. The ribs should be long, well sprung and wide apart. Associated with good capacity we usually find a wide strong loin, a large muzzle and a strong jaw. The cow's barrel develops in size with maturity so we do not expect calves and heifers to have the width and depth found in mature cows. Wide muzzles, strong jaws and wide strong loins, however, are desirable in heifers.

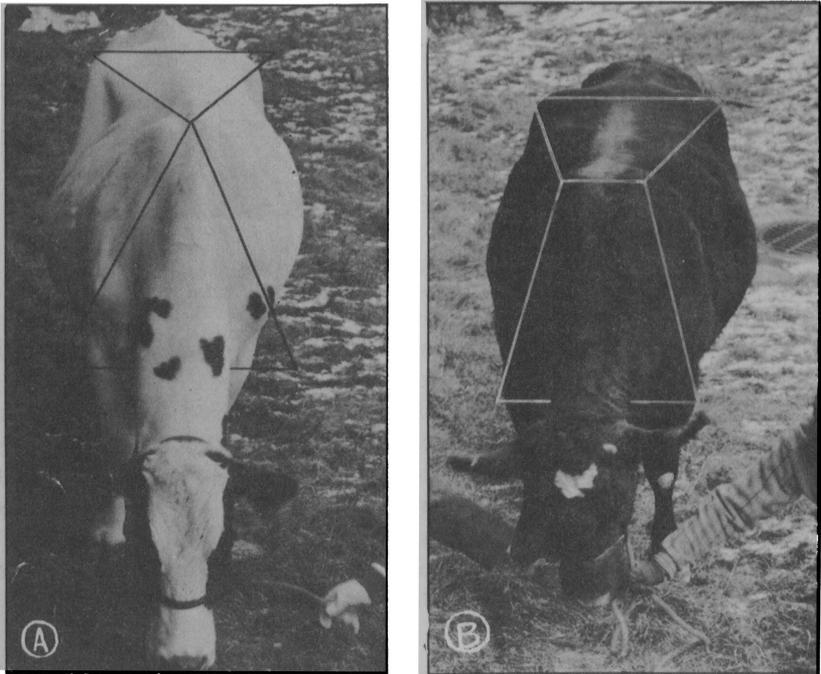


Fig. 13.—Top and front wedges. (A) The wedges of a dairy cow. (B) Top and front view of a cow that is inclined to be beefy. A's withers are freer from fleshiness than B's. Width between the points of the shoulders indicates constitution. Width of loin indicates feeding capacity.

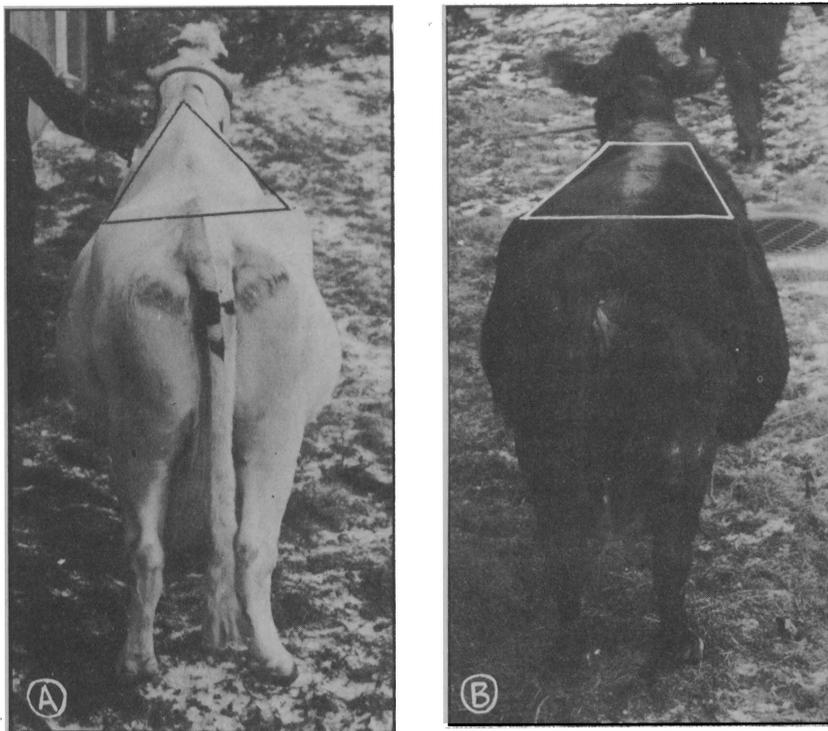


Fig. 14.—The top wedge. (A) Top wedge of a good dairy cow. A triangular-shaped back is an indication of dairy temperament and milk production. (B) Back that is characteristic of beef cattle or dairy cows lacking in dairy temperament.

Large cows are preferable, other things being equal but we should not sacrifice too much quality for size.

A large heart girth, good width in the floor of the chest, large nostrils and a wide forehead indicate ruggedness and a strong constitution. A cow lacking in constitution is apt to break down from heavy production early in life. Such cows are not so profitable as cows that have a longer production life.

Straight top lines, strong straight legs and a soft pliable hide are further indications of good constitution and good health.

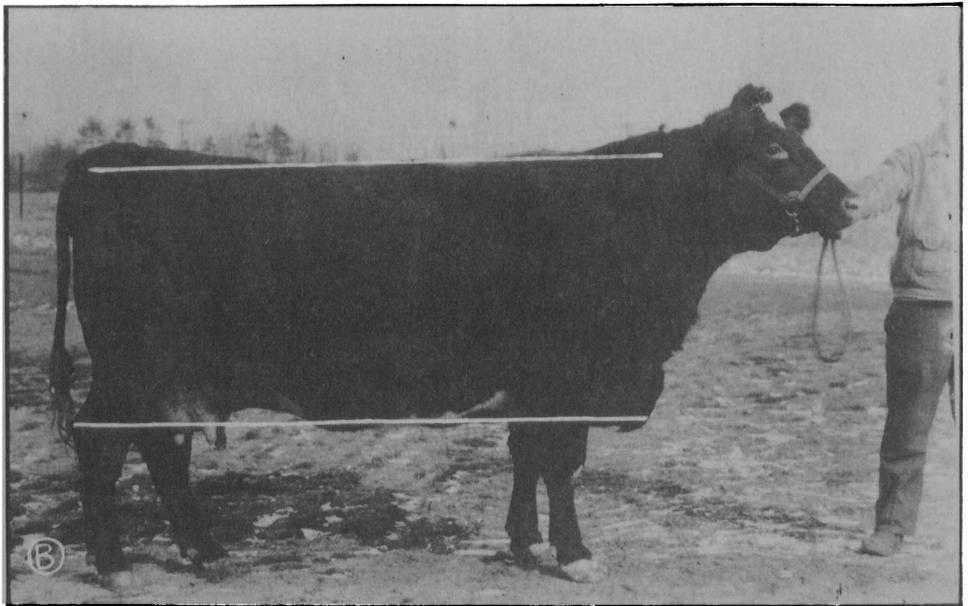


Fig. 15.—The side wedge. (A) The wedge that is characteristic of good dairy cows. If these lines were extended, they would meet beyond the cow's head. (B) Top and bottom lines of a beef are nearly parallel and do not form a wedge.

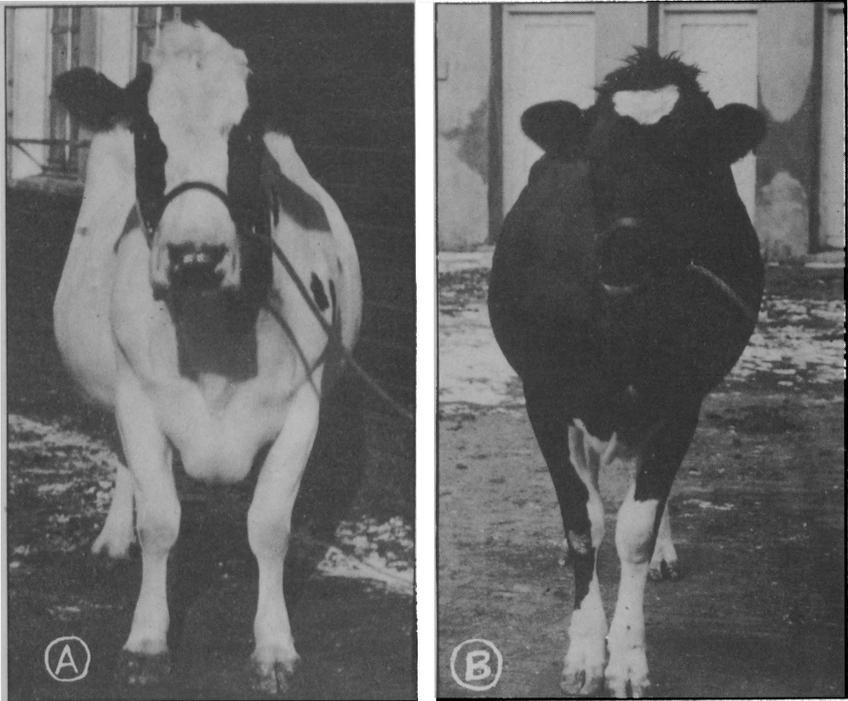


Fig. 16.—A study of constitution. (A) Cow that has width between the eyes, which usually indicates width throughout the body. The large nostril and the width in the floor of the chest indicates constitution. Notice that this cow has good spring of rib and a large barrel together with a wide muzzle. (B) Cow that is narrow in the floor of the chest and lacks spring of rib and width of middle. She lacks in constitution and feeding capacity.

Mammary System.—In the mammary system we include the teats, the udder, the milk veins and milk wells. We like an udder of large size as well as of good quality, that is, one that is soft and pliable and free from hard lumps. Udders that are symmetrical with even quarters and teats evenly placed have greater capacity than when they are unbalanced. Milk secreting tissue is soft and pliable, especially when the udder is milked out. An udder that is solid or meaty has less room for milk.

The udder must be well attached. The rear attachment should be high and wide. See Figure 21. The front udder should extend well forward and be smoothly and firmly joined to the body.

Udders that are not well attached may break away from the body as the cow comes in heavy production and become pendulous or loose. In such cases the producing ability of the cow is often seriously impaired.

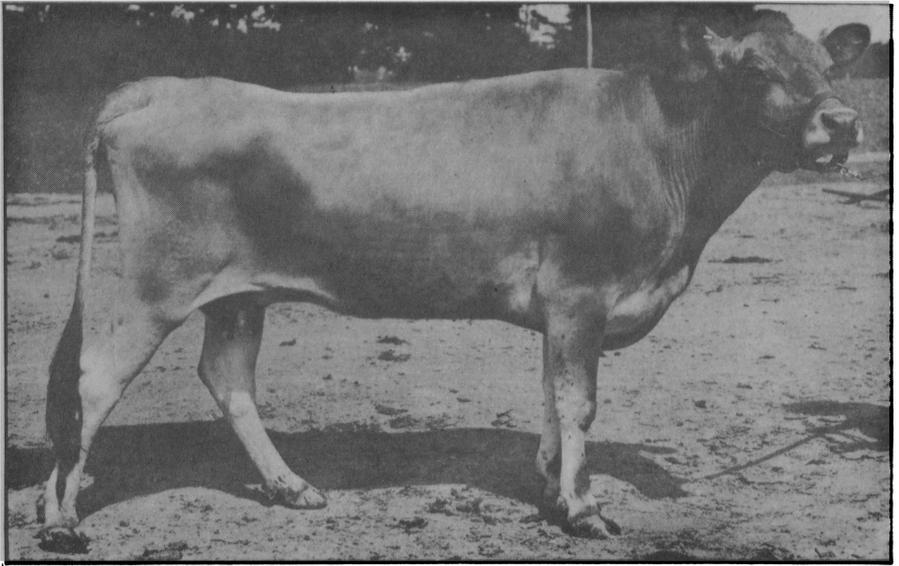


Fig. 17.—Lack of feeding capacity. This cow lacks in depth of middle, and the teats are placed too close together. Compare with Figure 18.

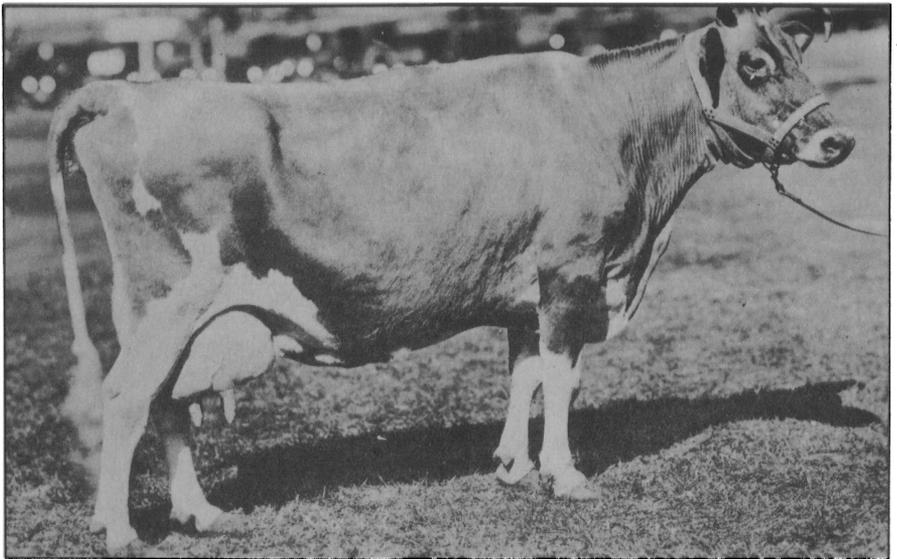


Fig. 18.—A cow that made a world's record after she was 16 years of age. Notice the dairy temperament, constitution, and vigor, the good feeding capacity, and the well-preserved udder. She has a very good top line and good legs for a cow of her age. Notice the excellent heart girth.

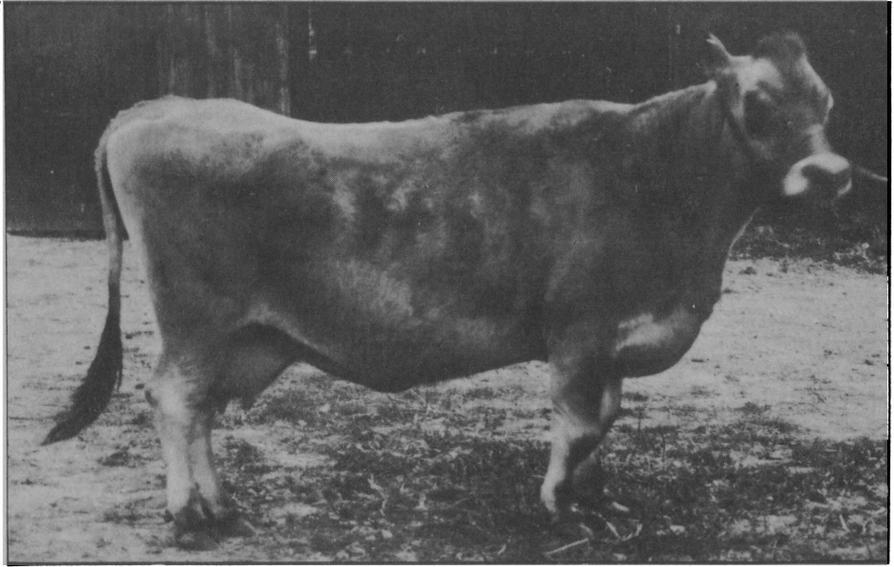


Fig. 19.—The weak loin. This condition is often found in old cows.



Fig. 20.—Crooked hind legs (sickle hocked). Crooked legs sometimes indicate poor constitution. When the hind legs are set too close together, they restrict the room for the udder and crowd the udder forward.

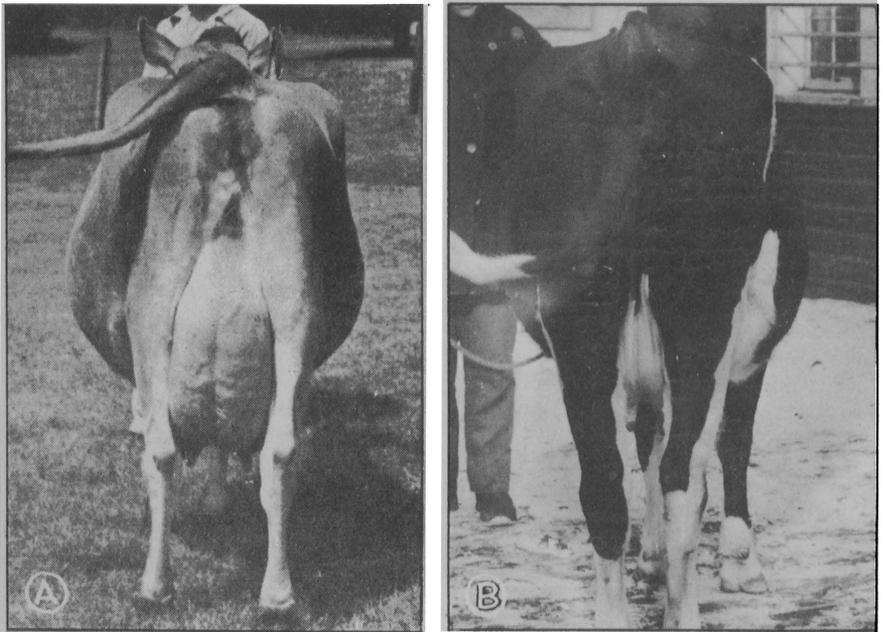


Fig. 21.—Types of udders. (A) High and wide rear-udder attachment. The legs are far apart and the thighs are incurving. Note the width between the pin bones. (B) The legs are too close together and the thighs are thick, leaving no room for the udder. Note the narrow pin bones and the narrow rear-udder attachment.

The floor of the udder should be relatively level with some suggestion of a cleft between the halves, indicating a strong central attachment, but it should not be deeply divided between the halves and it should not be cut up between the quarters on the side.

Teats should be of convenient size, evenly spaced, well apart and hanging plumb. Teats that are close together, that are uneven in size and that do not hang straight are undesirable.

Milk veins are large veins that carry part of the blood supply from the udder back to the heart. Other veins are located inside the body and cannot be seen. High producing cows usually have well developed milk veins and large "milk wells". These wells are the openings into the abdomen through which the milk veins pass. Milk veins should be large, long, crooked and branching with large milk wells, indicating a well developed blood supply to the udder.

It requires some time with study and practice to become proficient in judging dairy cattle. One must be able to "see" the animals and remember the differences noted. A great deal can be learned from books and from studying pictures but it also requires plenty

of practical experience. One should take advantage of every opportunity to watch judges work and to participate in judging contests.

In judging contests or in judging at shows the following procedure is suggested to organize your work.

Procedure in Judging

1. Get breed type firmly fixed in mind. Try to visualize the ideal type animal when placing a ring of animals.
2. Be systematic in inspecting a class.
 - a. Make good use of the few minutes spent in comparing the animals at a distance or while moving. That is the best time to compare breed type, general lines, blending of parts, balance, symmetry, and carriage; also length and depth of barrel, body size, and squareness and levelness of udder.
 - b. After classes are lined up, first pass along behind the class observing:
 - (1) Spring of rib and capacity of barrel.
 - (2) Width between hip points and between pin bones and width of loin.
 - (3) General clean-cutness and degree of refinement.
 - (4) Sharpness at withers and fullness of crops.



Fig. 22.—Undesirable types of udders. (A) Pendulous udder. This type of udder interferes with the cow's walking, becomes soiled easily, is often stepped on or injured when the cow is in the barn, and is usually difficult to milk. This type of udder is more common in old cows. (B) Cut up between the quarters. This udder is shallow in the forequarters, has a poor placement of teats, and is cut up between the quarters. Notice the deep groove down through the middle of the udder.

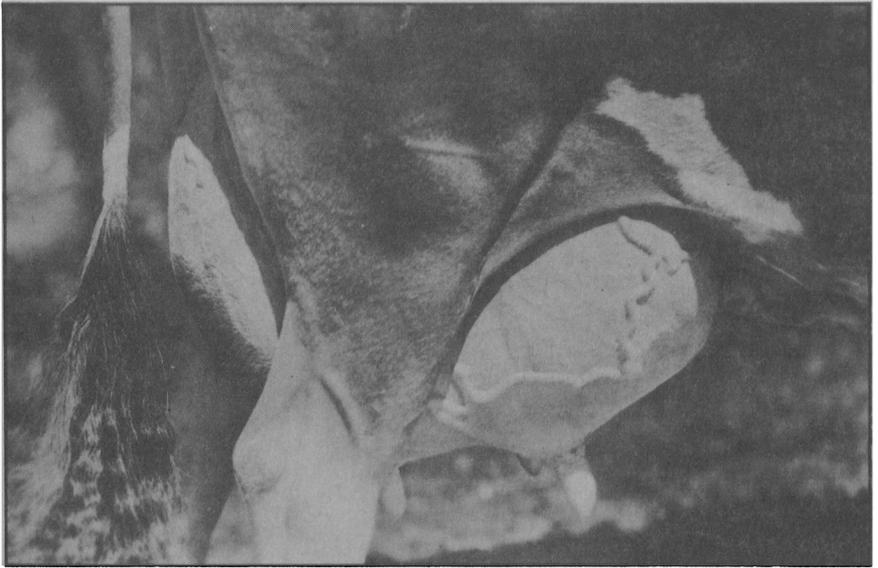


Fig. 23.—Milk and udder veins. Milk veins, long, large, crooked, and branching. Such veins are an indication of a cow's ability to produce milk. Heavy producers usually have large milk veins. A high development of the circulatory system within the udder is indicated by a network of veins on the surface of the udder.

- (5) Height of rear udder attachment and uniformity of development between teats.
- c. Move along in front of ring observing:
 - (1) Heads and necks—breed type and character—constitution.
 - (2) Width of chest floor.
 - (3) Spring of fore ribs.
 - (4) Fineness of withers and general blending of body parts throughout.
 - (5) Clean-cutness and degree of refinement.
- d. Spend enough time in close inspection and handling to determine:
 - (1) Handling quality or texture of udder, and size and spacing of teats.
 - (2) Size of milk veins and milk wells.
 - (3) Quality of skin and hair.
 - (4) Openness of ribs and backbone.
 - (5) General dairy temperament.
3. In drawing conclusions and making your placings *keep in mind* the following:

The approximate value given to different parts on the score

card and balance the points to the best of your judgment, remembering for example, that a cow having a badly tilted or ill-shaped udder would place below a cow having desirable udder, even though the first mentioned cow is superior in fineness of withers and quality of hide, other things being equal. On the other hand, remember that there are many different degrees of any fault and that for example, in the case mentioned above, the first cow might have a slightly tilted udder and yet place above the cow having a good udder because the first mentioned cow has a much neater wither and greater quality of hide.

Judging Young Dairy Stock.—In judging immature classes, the same things are looked for as in mature animals, but as some of the most important points are not developed in the young animals, the indications of future development must be taken into consideration. This is particularly true of the mammary development. The younger the animal, the less development of udder and veins is to be expected, but several things may indicate future development.

In young heifers, the udder should be examined carefully for uniformity of quarters and teats, length and width of udder, rear and fore attachments and quality of udder. Close examination will also reveal the length and tortuousness of the milk veins.

In dairy conformation, the same refinement is looked for as in older animals, although care must be taken to differentiate between animal in good condition and a tendency toward beefiness, as young animals are generally in good condition. Springing heifers that have been properly fed usually carry much fat and are sometimes said to be coarse over the withers when this is due to accumulation of fat that will come off when they freshen.

Judging Dairy Bulls.—In judging dairy bulls, the same essentials are looked for as in judging dairy cows; namely, general appearance and style, dairy conformation, capacity for feed and constitution, and development of rudimentary mammary system. In addition to this, it is important that the bull possess masculinity.

Masculinity is indicated by a broader head with thicker and straighter horns than those of the cow. The neck is wider with a well developed crest on top and the shoulders are more prominent than those of the cow. Care must be taken to differentiate between coarseness and masculinity in development of these parts.

Giving Reasons

In a judging contest reasons for the placings made are often as important as the placings. It is customary to give equal weight to

placings and reasons. In giving oral reasons try to observe these points:

1. Be able to visualize a class well before attempting to give reasons. A set of accurate notes for study in organizing reasons is indispensable.
2. Have reasons well organized in your mind before attempting to give them orally.
3. In a general statement give the main points which have decided your placing, preferably giving them in the order of their importance. Then in a few brief, concise sentences, elaborate on the points in the same order as named. Make all reasons comparative. Use specific descriptive terms, avoiding general terms as much as possible.
4. Ordinarily begin reasons by telling why first animal was placed over the second one, and so on down the line. In case of some outstanding blemish or defect which would disqualify an animal or unquestionably place her at the bottom of the class, it is well to make a statement to this effect in beginning your reasons.
5. Remember that the judge who takes reasons has listened to reasons on this same class from perhaps fifty others, so that to attract and hold his attention your reasons must be:
 - a. Truthful (be sure of the points you make. Your reasons had better be one minute long and exact than two or three minutes long, but doubtful).
 - b. Forceful (get some expression and emphasis into your speech).
 - c. Concise and specific.Avoid (1) repetition; (2) vague or general statements; (3) minute descriptions which have little bearing on your placing; (4) points on which you are doubtful; and (5) a monotonous monotone in your delivery.
6. It is also true that the impression which the judge forms when you make your first appearance carries weight. Above all other things, try to be natural in your walk, your poise before the judge, and your tone of voice. When you approach the judge and stand before him, be at ease, yet stand erect with hands in an easy natural position. When he indicates that he is ready for your reasons, give them in as convincing a manner as possible. Talk to the judge, not to the floor, the window, or the ceiling. In case of questions from the judge, try to visualize the class and see the points which he asks about. If you cannot remember, however, it is not a crime to give an "I don't know." Better do that than to guess.

See the score cards for descriptive terms used in comparing dairy animals and further details on each part.

XI. FITTING AND SHOWING DAIRY CATTLE

The dairy cattle show has for its main object the development of better types of cattle. In the show ring the club member or young breeder has an opportunity to study breed type and to compare his own animals with those of other breeders. By watching and participating in the show he may become a better judge of cattle and the defects in his own cattle would be pointed out. He not only should be able to breed better cattle but he would become better known as a breeder.

The average club member or breeder does not want to become a professional showman, yet there are times when it will be to his advantage to show his animals. Animals for showing should be carefully selected. It seldom pays to show inferior animals. There are a few simple rules to observe in getting animals ready for a show.

1. The animals to be shown should be started at least two months before the first show. It is very difficult, if not impossible, to take animals out of a pasture a few days before show time and have them look their best. Time is required to teach the animals to lead readily. Dairy animals cannot be gotten into the proper physical condition for showing unless they have had the proper feed, care, and attention for a considerable period before they are to be shown.

2. After the animals have been selected, they should not be out of doors during the heat of the day in the hot sun. Keep them in comfortable stalls and, if possible, darken the barn and keep out the flies. Keep them tied at least part of the time to accustom them to the halter. They may be allowed pasture at night.

3. A satisfactory grain mixture for fitting is 5 parts of bran, 5 parts of oats, 2 parts of corn, and 2 parts of oil meal. Add 30 pounds of salt to each ton of mixture. Feed from 10 to 15 pounds daily to the cows. The young stock may be fed according to their size and condition. Mixed hay is usually preferred for the show animals as it is not as laxative as alfalfa hay. Beet pulp may be used for succulent feed. When the animals are in transit reduce the feed allowances. Give them plenty of water from your own containers. Animals have more "bloom" if they are gaining in weight slightly at show time, but do not have them too fat.

4. The showman and his animals should become well acquainted. Begin early to teach them to lead and to stand squarely on their feet

so they show to best advantage. Frequent handling is necessary to properly train the animals.

5. Calves and heifers should show a large body capacity without being "pot bellied". To accomplish this they should be fed all the roughage they will consume particularly after they are six months of age.

6. In order that the animals will be sleek and show good quality of skin and hair, one should start to blanket them heavily a month before the show. After the skin becomes mellow, lighter blankets may be used. Daily grooming with a soft brush helps to get the hair and skin in good condition. Plenty of hand rubbing with a little sweet oil on the hands helps to give gloss to the hair. A little extra laxative feed such as oil meal or bran in the grain ration may be desirable.

7. It may be necessary to give some attention to the horns and hoofs some time ahead of the show.

If the horns are long and coarse they may usually be improved by taking an inch or more off of the end and rasping them down to a point. If it is desired to change the direction of horn growth rasp the end of the horn so it points in the direction desired. In smoothing the horns first use a rasp to remove the rough scaly outside. Next scrape with a steel scraper or a piece of broken glass. Follow with sandpaper to give a smooth surface. As show time approaches the horns may be finished and polished with fine emery cloth followed by strips of cloth moistened with a pumice stone and sweet oil mixture and finally by strips of dry cloth. Continue until a fine polish is obtained.

One of the first things to be done after the show animals are put up for fitting is to give some attention to the feet. Poorly shaped feet or long hoofs make crooked legs worse, or on the other hand, help them materially if properly trimmed. The main requirement is to have the foot square and level at the bottom with the most weight on the outside wall. Trim the feet much like horses feet are trimmed. The toes can be cut back with a chisel or hoof trimmer. Smooth the edges with a rasp to prevent breaking back. At show time clean and smooth the hoofs and polish with a little oil.

8. To give the animal a clean cut appearance clipping of the head and tail is advisable. Also clip long hair along the top line. A little clipping makes a wonderful difference in the appearance of the animal. It is very seldom that an animal needs clipping all over. Cows are usually clipped on the udder and enough on the belly to show the milk veins.

The tail should be clipped from just above the switch to the tail

head. At the tail setting the hair should be carefully blended off to give a smooth appearance. Clip enough along the top of the rump to give it a smooth top line.

Animals usually look best about a week after clipping.

9. Washing the animals is advisable soon after the fitting begins. Do a good job using plenty of tar soap. Some coal tar dip in the wash water is a good idea but be careful not to get it too strong. Rinse off the soap and dip thoroughly.

Do not wash too often as this removes too much of the natural oil from the skin and leaves it dry and harsh. About every two weeks is often enough unless they have to be washed just before showing to clean them. Avoid washing the day of the show if possible.

After the first good washing, use only mild soap or tar soap. Tincture of green soap may be used if desired. Rinse soap off well. After washing, blanket the animal for several hours.

10. When transporting animals cut down on their feed. Feed mostly on hay and give plenty of water.

After the cattle are unloaded see that they have plenty of bedding and a comfortable stall. Give them a chance to rest if possible.

11. The day before the show cut down on the feed somewhat and let them have a little salt. Some may need to be washed and all should be groomed and final fitting done. Tails should be washed and braided while wet. Leave the braids in until just before going into the ring. Keep the cattle clean.

12. On show day feed early, giving plenty of grain and hay. A full feed is desirable. Give them water just before going into the showing but too much water, especially cold water may give them an abnormal appearance. Before going into the ring see that the cattle are clean, brushing them thoroughly with a soft brush followed by a good hand rub. The tail should then be unbraided and brushed out. Finally show halters are put on as the class is called.

Keep the stalls neat and clean and well bedded, and have the cattle neat at all times at the show. Have some one with the animals at all times to answer questions.

13. In the show ring keep the animals moving slowly most of the time unless otherwise instructed by the judge. When standing in position the animals top line should be straight, its head should be up and its feet should be squarely placed. Watch the judge and the animal. Do not allow the animal to slouch and by all means do not slouch yourself or lean on the animal. Keep it showing all the time.

Do your best with your animals and try to win but if you do not, try to find out the faults in your animals and bring better ones next time. If you win do not brag and if you lose do not complain.

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE AND THE UNITED
STATES DEPARTMENT OF AGRICULTURE COOPERATING

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Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914