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H. P. Davis

M. N. Lawritson

R. F. Morgan

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Dairy Calf FEEDING AND MANAGEMENT

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Extension Service of the University of Nebraska College of Agriculture
United States Department of Agriculture Cooperating

W. H. Brokaw, Director, Agricultural Extension Service
Lincoln, Nebraska

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Dairy Calf Feeding and Management

H. P. DAVIS, M. N. LAWRITSON, and R. F. MORGAN

CALF RAISING begins before the calf is born. If a healthy cow in good physical condition is allowed to calve in a good environment, she will in all probability give birth to a strong healthy calf.

A cow should have a rest period, during which she is dry, for at least a month and preferably for six weeks. If she is properly fed and cared for, it is possible for her to prepare for the coming milking period by resting, so that her body organs can recuperate from the hard work of producing milk, and so that she can put on surplus weight.

Feeding Prior to and During the Calving Period

During the dry period it is desirable for the cow to have access to good pasture, for there is no other feed so satisfactory as natural pasture. If pasture is not available, grass silage or legume hay is necessary. While she is dry, a good milk cow should receive grain as well as roughage. If the cow is in moderate to poor condition, one pound of grain should be fed daily for each 200 to 300 pounds of live weight. As phosphorus and lime are needed during this period, such feeds as wheat bran should have a prominent place in the grain mixture. In general a grain mixture that contains at least 12 per cent digestible protein is desirable, although if legume hay does not constitute part of the roughage it is well to feed a mixture containing 14 or 15 per cent digestible protein.

About two weeks before the calving, the grain mixture may be changed to one containing 100 pounds of ground oats and 100 pounds of wheat bran, to which is added 3 pounds of iodized salt and 3 pounds of steamed bone meal. This feed has a laxative effect, but if for any reason the cow is constipated, use a pint of raw linseed oil as a drench. Immediately after the cow has calved, she should be given 4 pounds of a mixture of equal parts of whole oats and wheat bran soaked in hot water for half an hour and fed in a warm, sloppy condition. This procedure has been found very helpful in toning up the cow's system and in bringing about the rapid passage of the fetal membranes or afterbirth. Plenty of clean drinking water of moderate temperature should be available at all times.

For a week after calving, the grain fed may be bran and ground oats. Change the feed gradually to the regular grain mixture, depending upon the condition of the cow. During this time the cow is given all the good hay she will eat and a limited amount of silage in the winter time, and of course in the summer time she should have access to pasture. In order to prevent too much swelling in the udder it is necessary to limit the amount of silage if there is a considerable quantity of grain in it.

Care of the Udder

As parturition (calving) approaches, the udder of the cow tends to swell, often attaining an enormous size, and sometimes becomes very hard and congested. To relieve a large swelling, the cow may be milked prior to calving.

If this is done, the first milk (colostrum) should be saved to feed to the calf at birth. If facilities permit, the colostrum may be preserved by being placed in a clean container, such as a covered pail, and frozen solid, then kept at a temperature below freezing as in a freezer locker. For mild cases of udder swelling, rubbing the udder and manipulating it thoroughly with the hands is helpful, as is applying sweet oil, camphorated oil, or turpentine and lard.[1] Plenty of dry bedding in the stall, particularly in the winter time, prevents the udder from becoming chilled, a condition which may cause trouble.

Housing

In the winter time or in stormy weather a stall should be prepared for the use of the cow while calving. Eight by 10 feet is adequate for a small cow, but for a large one the stall should be at least 10 by 12 feet. Before each calving clean the stall thoroughly, scrub it with hot water to which lye has been added, and spray the walls and floors with a disinfectant solution. One quart of disinfectant added to about 5 gallons of water will usually be satisfactory. Fill the stall with plenty of clean, dry straw or other bedding using enough to keep the bedding dry and clean at all times. It is desirable for the calf to be born in a clean place where its chances of becoming infected from the surroundings are reduced to a minimum. In the summer it is often possible to have the cow calve in a shady, secluded spot in the pasture. Whether in the summer or winter, the cow should have plenty of exercise and should be turned out for a period each day except in the most severe weather.

Management of Cow and Calf During the First Few Days

Usually within a few hours after calving, the cow will pass the fetal membranes or afterbirth. If this does not happen within a day, it will probably be necessary to call a veterinarian to remove them. No one else should attempt to remove these membranes, because carelessness may cause great harm to the cow.

Milk fever is a condition which sometimes develops shortly after calving. The evidences are dullness, lack of appetite, and lack of control of the hind legs. In the more advanced stages the cow reclines with her head doubled back upon her side. There are two forms of treatment: the older one consists of inflating the udder with sterile air, while the newer is an intravenous injection of from 300 to 600 cc. of a 24-per-cent solution of calcium gluconate.

If the calf is born in a stall, the attendant should see that the fetal membranes are removed from the nose of the calf and that it is breathing normally. Sometimes a calf's mouth is clogged with phlegm, which should be removed with the hand. If at first the calf does not breathe normally, slapping it briskly and rubbing a dry towel against the hair will help to start the circulation and bring about normal respiration.

In order to prevent infection, apply an antiseptic to the navel as soon as possible after the calf is born. A common method is to soak a pad of absorbent cotton with tincture of iodine and apply it. The cow usually licks off the first application; therefore, another should be made the following day. Several days later when the navel cord is dry, pull it off and make another application of iodine to the navel.

[1] One tablespoonful of spirits of turpentine mixed with 5 tablespoonfuls of lard.

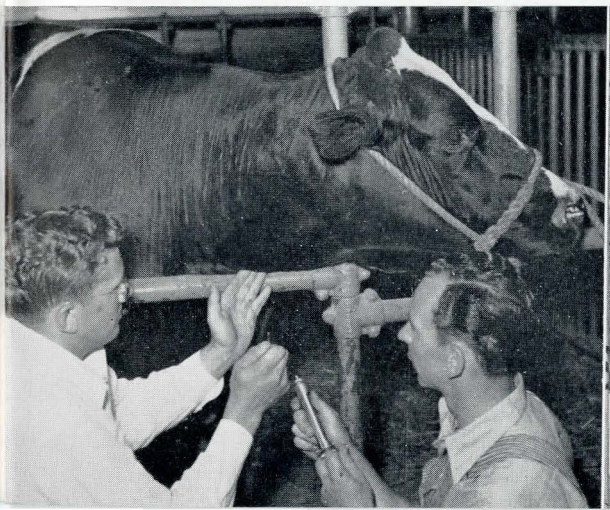
Many calves are weak and lack vitality at birth; as a result they either die within a few days or gain strength slowly. Experience has demonstrated that it is a good practice to give the weak calf an injection of blood from its dam within a few hours after birth. To do this, wash off a spot on the jugular vein of the mother with an antiseptic, insert a sterilized hypodermic needle into the vein, and by means of a sterilized syringe withdraw 80 cc. of blood. Wipe an area of the calf's neck with an antiseptic and immediately insert another sterlized hypodermic needle, delivering 20 cc. of blood from the syringe. Follow the same procedure immediately for three other insertions, delivering not more than 20 cc. at each insertion of the needle. These transfers should be made quickly in order to prevent the blood from clotting. To prevent any congestion or swelling, introduce only a limited amount of blood into the calf's neck at one spot.

Frequently a calf may have a hoof doubled back so that it cannot stand normally on its feet. This condition, which is due to short tendons, is ordinarily not serious and will usually right itself within a few weeks.

In the case of twins, if both are males or both females, there is no reason to believe that they will not be entirely normal; but if the twins are of opposite sexes, the female is called a "freemartin," and only about one in ten is normal and will breed.

Heifer calves should be examined to see if they have extra teats. If so, they should be removed when the animal reaches six months of age. Lay the animal on its back with one attendant holding it. Apply an antiseptic to the area around the extra teat. Then stretch tight the whole area around the teat with

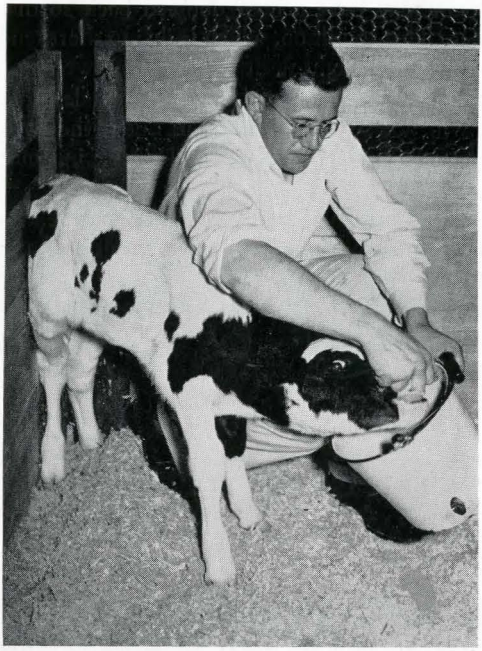
Injecting blood from mother in newborn calf.



one hand and cut off the teat with a sterilized pair of sharp scissors. Soak the entire area with tincture of iodine applied with a pad.

Feeding the Newborn Dairy Calf

As soon as possible after birth the calf should nurse in order to get the colostrum which is so necessary for its proper start in life. It is a good practice to wash the cow's udder with clean warm water, drying it thoroughly, before the calf is allowed to nurse. This will tend to prevent the calf from getting any bacterial infection which the cow may have picked up while lying on dirty straw. If the cow has been milked before freshening, it will be necessary to give the calf a tablespoonful of castor oil unless frozen colostrum has been stored that can be thawed, warmed to 100° F., and fed in small quantities from a bottle or a pail.

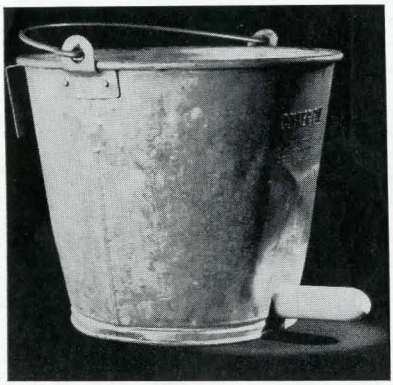


Teaching the calf to drink. Note fingers in the calf's mouth.

Colostrum contains nearly six times the amount of protein and twice as much minerals for bone building as does ordinary milk, besides being rich in vitamin A. It is nature's concentrated baby food, slightly laxative and ideally mixed to start the calf off to a fine growth and development. If a cow has mastitis, it may be dangerous for the young calf to nurse its mother. If colostrum is not available from another cow, castor oil should be given. However, it is difficult to raise calves without colostrum.

Care During the First Two Weeks

Ordinarily the calf is allowed to nurse its dam for about three days. By the time the calf is weaned, the milk is normal and ready to go into the regular milk supply. The usual practice is to teach the calf to drink from a pail. Be sure that it does not draw milk into its lungs for doing so may result in pneumonia. Some calves make better growth when fed by a nipple on a pail or bottle, which prevents gulping the milk. Nature's way is for the young calf to receive a small amount of food many times a day. For the first week, a calf should be fed at least three times daily.



Bucket equipped with nipple for feeding calves.

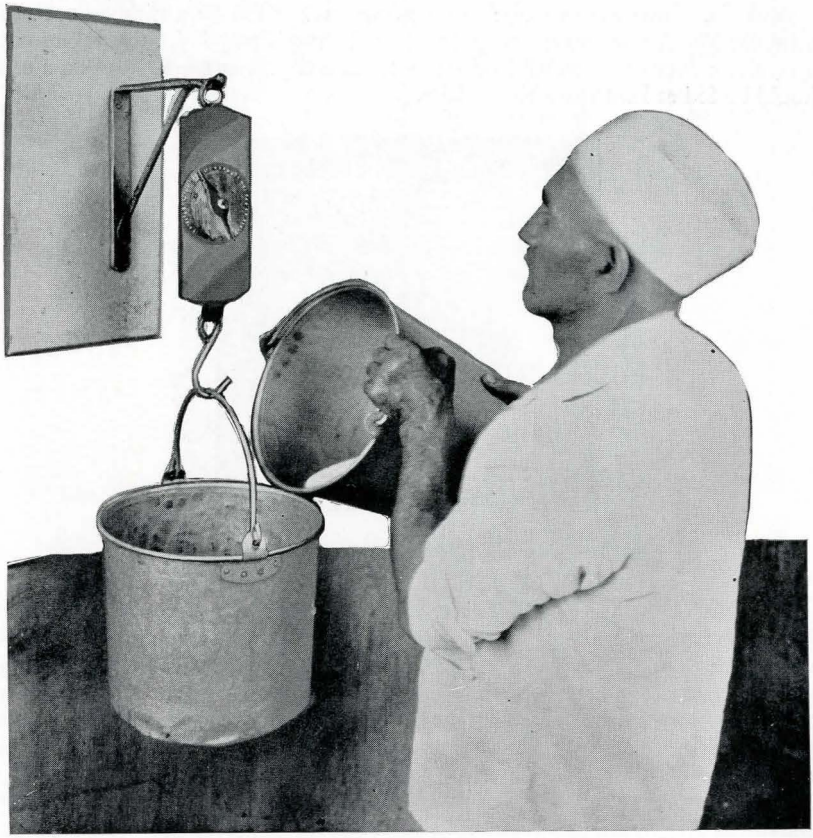
Milk for calf feeding should be of uniform temperature day after day. When the calf is very young, it is essential that this temperature be no lower than 90°F., and it has been demonstrated that warm milk is more easily digested by the young calf. The ideal procedure is to use the dam's milk to feed her own calf immediately after milking. If the milk has cooled, it should be warmed by placing the pail of milk in a container of hot water, testing the temperature with a thermometer.

If for any reason the dam's milk is not available for her calf, it is well to select milk from a cow that has recently calved rather than from one that is toward the end of her lactation. The quantity of milk which a calf should receive depends upon its breed and weight as well as its general strength and condition. It is always better to underfeed than overfeed the calf in the early stages of its growth, and a good rule is for the calf to be a little hungry when it finishes its feed. *All milk utensils should be thoroughly washed and scrubbed and, if possible, sterilized between feedings.* The milk should be weighed in order to insure the proper quantity, and the temperature should be determined with a thermometer.

Schedule for Milk and Grain Feeding

Table 1 indicates the quantities of whole milk, skim milk, grain, and hay which are suggested for feeding from birth to 24 months for calves of various

breeds. The practice suggested in the table is weaning from whole milk during the fourth week with skim milk feeding continued until the calf is six months old. If available and not too expensive, whole milk feeding for a longer period is desirable for all calves and particularly for those that are somewhat weak and do not grow well. If it is cheap and abundant, somewhat larger quantities

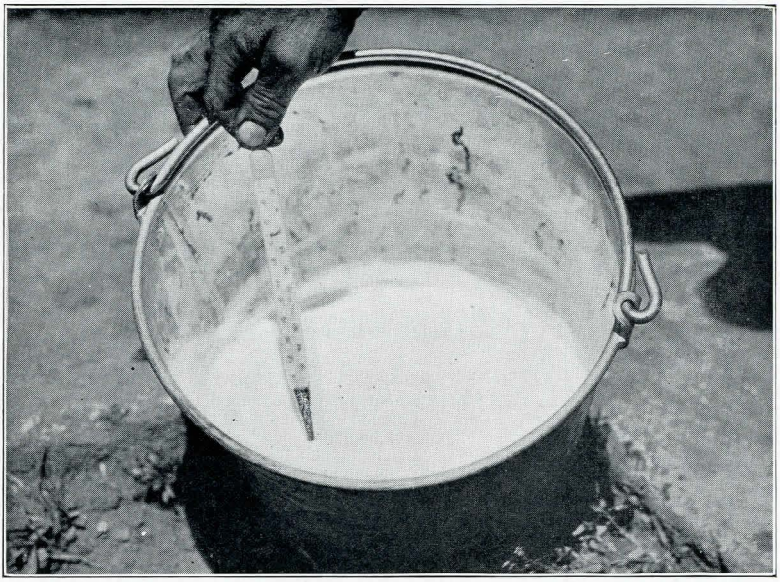


Milk for calves should be weighed.

of skim milk may be fed after the calves are three months old. Usually it is undesirable to feed more than 20 pounds of skim milk daily. If skim milk is not abundant, the feeding program should follow the one outlined under the use of calf meals (Table 2).

Stanchions placed along one side of the pen facilitate milk feeding. A convenient practice is to construct in front of the stanchions a manger covered with a flat lid upon which the pails of milk may be set. After the calves have consumed the milk, remove the pails and lift the lid so that they can eat the

grain in the manger. Such a system tends to prevent the calves from sucking each other, thus causing ill-shaped udders.



Taking temperature of milk for calf feeding.

The substitution of skim milk for whole milk should take a week, being made gradually. If a calf is to receive 10 pounds of milk daily the fourth week, a program of change might be worked out as follows:

Day	Pounds Whole Milk	Pounds Skim Milk
1	9	1
2	8	2
3	6	4
4	5	5
5	4	6
6	2	8
7	1	9
8	0	10

All skim milk used should be of good quality, fresh and sweet, and should be heated to 90°F. if it is not fed warm from the separator. Skim milk has had the fat removed, and with it the greater part, if not all, of the vitamin A. Vitamin A is necessary for growth and development of young calves and when present in adequate quantities tends to prevent respiratory troubles. Therefore, if the calf is fed skim milk, it must obtain its vitamin A from other feeds. Carrots, yellow corn, and bright green hay are all vitamin-A rich, but in practice hay is the main source. In winter adding cod-liver oil or a cod-liver oil con-

TABLE 1.—*Feed requirements for normal growth of dairy heifers—milk, grain, hay.*[1]

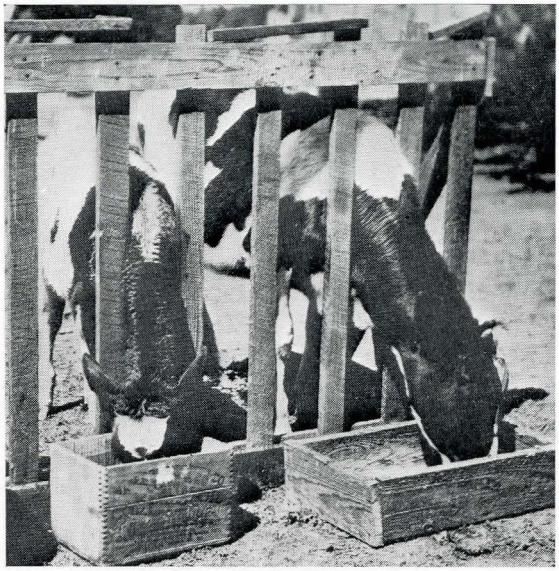
Age of calf	Ayrshire and Shorthorn				Holstein and Brown Swiss				Guernsey				Jersey			
	Whole milk	Skim milk	Grain	Good hay equiv-alent	Whole milk	Skim milk	Grain	Good hay equiv-alent	Whole milk	Skim milk	Grain	Good hay equiv-alent	Whole milk	Skim milk	Grain	Good hay equiv-alent
	Pounds of feed needed daily															
1st week	7	..	..	..	8	..	..	..	6	..	..	..	5	..	..	..
2nd week	8	..	..	..	9	..	..	..	7	..	..	..	6	..	..	..
3rd week	9	..	0.1	0.1	10	..	0.2	0.1	8	..	0.1	0.1	7	..	0.1	0.1
4th week	5	5	0.2	0.2	5	6	0.5	0.3	5	4	0.2	0.2	4	4	0.2	0.2
5th week	..	11	0.5	0.4	..	12	0.8	0.5	..	10	0.5	0.3	..	9	0.4	0.3
6th week	..	12	0.8	0.6	..	13	1.0	0.7	..	11	0.8	0.4	..	10	0.5	0.4
7th week	..	13	1.0	0.8	..	14	1.5	1.0	..	13	1.0	0.6	..	12	0.8	0.6
8th week	..	13	1.0	0.8	..	14	1.5	1.0	..	13	1.0	0.6	..	12	0.8	0.6
3rd month	..	13	1.5	1.5	..	14	2.0	2.0	..	13	1.5	1.2	..	12	1.2	1.2
4th month	..	13	2.0	3.0	..	14	2.5	3.5	..	13	2.0	2.5	..	12	1.8	2.5
5th month	..	13	2.5	4.0	..	14	3.0	4.5	..	13	2.5	3.5	..	12	2.5	3.5
6th month	..	13	3.0	5.0	..	14	3.0	5.5	..	13	3.0	4.5	..	12	3.0	4.5
7th month	..	..	3.0	7.2	..	..	3.0	9.6	..	..	3.0	6.9	..	..	3.0	6.8
8th month	..	..	3.0	7.8	..	..	3.0	10.5	..	..	3.0	7.6	..	..	3.0	7.4
9th month	..	..	3.0	8.6	..	..	3.0	11.3	..	..	3.0	8.4	..	..	3.0	8.0
10th month	..	..	3.0	9.4	..	..	3.0	11.9	..	..	3.0	9.1	..	..	3.0	8.6
11th month	..	..	3.0	9.9	..	..	3.0	12.5	..	..	3.0	9.7	..	..	3.0	9.0
12th month	..	..	3.0	10.5	..	..	3.0	13.1	..	..	3.0	10.1	..	..	3.0	9.4
Total birth to 6 months	189	2063	305	434	224	2191	367	504	182	2008	305	376	154	1853	284	376
6 months to 12 months			547	1621			547	2081			547	1572			547	1493
Total birth to 12 months	189	2063	852	2055	224	2191	914	2585	182	2008	852	1948	154	1853	831	1869

[1]Modified from *Food and Life*, Yearbook of the U. S. Department of Agriculture, 1939, page 599.

TABLE 1.—*Continued.*

Age of calf	Ayrshire and Shorthorn				Holstein and Brown Swiss				Guernsey				Jersey			
	Whole milk	Skim milk	Grain	Good hay equivalent	Whole milk	Skim milk	Grain	Good hay equivalent	Whole milk	Skim milk	Grain	Good hay equivalent	Whole milk	Skim milk	Grain	Good hay equivalent
	Pounds of feed needed daily															
13th month	..	..	3.0	11.0	..	..	3.0	13.4	..	..	3.0	10.5	..	..	3.0	9.8
14th month	..	..	3.0	11.5	..	..	3.0	13.8	..	..	3.0	10.9	..	..	3.0	10.0
15th month	..	..	3.0	11.9	..	..	3.0	14.1	..	..	3.0	11.1	..	..	3.0	10.3
16th month	..	..	3.0	12.2	..	..	3.0	14.4	..	..	3.0	11.3	..	..	3.0	10.5
17th month	..	..	3.0	12.4	..	..	3.0	14.7	..	..	3.0	11.6	..	..	3.0	10.7
18th month	..	..	3.0	12.8	..	..	3.0	15.1	..	..	3.0	11.9	..	..	3.0	11.0
19th month	..	..	3.0	13.1	..	..	3.0	15.4	..	..	3.0	12.2	..	..	3.0	11.4
20th month	..	..	3.0	13.6	..	..	3.0	15.6	..	..	3.0	12.5	..	..	3.0	11.7
21st month	..	..	3.0	13.9	..	..	3.0	16.1	..	..	3.0	12.8	..	..	3.0	12.1
22nd month	..	..	3.0	14.5	..	..	3.0	16.5	..	..	3.0	13.4	..	..	3.0	12.7
23rd month	..	..	3.0	15.3	..	..	3.0	17.1	..	..	3.0	14.2	..	..	3.0	13.3
24th month	..	..	3.0	15.8	..	..	3.0	17.6	..	..	3.0	14.7	..	..	3.0	13.9
12 months to 18 months			547	2197			547	2608			547	2052			547	1935
18 months to 24 months			547	2616			547	2983			547	2422			547	2279
Total 12 months to 24 months			1094	4813			1094	5591			1094	4474			1094	4214
Total birth to 24 months	189	2063	1946	6868	224	2191	2008	8176	182	2008	1946	6422	154	1853	1925	6083

centrate to the feed for young calves is a good practice. A suggested dosage is four teaspoonfuls of cod-liver oil or the proportionate quantity of the concentrate daily for each calf. When the calves are changed to skim milk, the quantity of cod-liver oil should be doubled. Usually the oil is added to the milk, although it may be fed on the grain. Where pasture or good green leafy hay is not available for calves, it may be desirable to continue feeding the cod-liver oil until the calf is five or six months old.



Wooden calf stanchions.

Feeding Limited Quantities of Milk--Milk Substitutes--Calf Meals

When whole or skim milk is limited in quantity or high in price, milk substitutes may be fed. Table 2 presents schedules for the use of whey, buttermilk of various kinds, and calf meals with a limited use of both whole and skim milk. The schedule designed for a Holstein calf may be modified in quantities according to the ratios in Table 1 for calves of other breeds. Feeding whey or buttermilk, with limited quantities of whole milk, is a rather drastic departure from nature's plan of nutrition, and these should be fed only to calves that are strong and vigorous with no digestive troubles. Should digestive disturbances occur while the plan is in operation, probably the best procedure is to return to a regular milk-feeding practice. Whey or fresh buttermilk should be pasteurized before using. Feed all milk at a temperature between 90° and 100°F. Prepare semi-solid or condensed buttermilk for feeding by mixing 3 parts of buttermilk with 7 parts of warm water. To prepare dried skim milk

and dried buttermilk for use, mix 1 part of the dried material into a paste with an equal volume of warm water, being careful to break up all the lumps. Add 8 parts of water (temperature 90°-100° F.) and stir thoroughly. Mix only enough for one feed at any one time. Dried or condensed buttermilk is laxative in its effect. If the calves tend to scour, add a half pint of lime water to each feed until the condition disappears. Lime water is prepared by placing a lump of unslaked lime in a pail of water. After it is slaked, stir vigorously and allow the lime to settle, using only the clear solution.

With a healthy, vigorous calf good results can be obtained with limited quantities of milk supplemented with calf meal. Usually the early growth is not quite so rapid, but if the calf keeps well, the entire growth during a year may equal that obtained from a liberal milk ration. Calf meal should be fed dry to calves in stanchions. The calf must be old enough to be able to consume a reasonable quantity of the meal or its feeding will not be successful in producing good growth.

Probably the most important single ingredient of a calf meal or starter is dried skim milk, which need not exceed 20 per cent of the mixture. Blood flour, fish meal, and other proteins of animal sources are useful but are rather unpalatable and consequently can be used only in small amounts. A calf meal or starter suggested by the Bureau of Dairy Industry, U. S. Department of Agriculture, is as follows:

	Per Cent
Yellow corn (ground)	30
Oats, either rolled or crushed	30
Wheat bran	10
Linseed meal	10
Skim milk (dried)	20
	100

Oatmeal without the hulls is preferred, and ground or rolled barley may replace part of the corn. Soybean meal or cottonseed meal (best grades) can be substituted for part of the linseed meal, and dried blood flour or fish meal may replace part of the dried skim milk.

Another calf meal tested out and found to give good results at the New York (Cornell) Agricultural Experiment Station has the following composition:

	Per Cent
Yellow corn (ground)	32.25
Oats (rolled)	28.00
Wheat bran	10.00
Linseed meal	5.00
Whitefish meal	3.00
Skim milk (dried)	20.00
Salt	0.50
Ground limestone (flour)	0.50
Steamed bone meal	0.50
Fortified cod-liver oil	0.25
	100.0

If ordinary cod-liver oil is used in this formula it should comprise from 0.5 to 1 per cent.

TABLE 2.—*Calf feeding—use of substitutes and the limited use of milk—Holstein calf.*[1]

Age of calf	Fresh whey or buttermilk or condensed buttermilk				Reconstituted dried skim milk or buttermilk				Limited whole milk plus calf meal					Limited whole milk and skim milk plus calf meal				
	Whole milk	Whey or butter milk	Grain	Hay equiv-alent	Whole milk	Recon-stituted skim milk or butter-milk	Grain	Hay equiv-alent	Whole milk	Warm water	Calf meal	Grain	Hay equiv-alent	Whole milk	Skim milk	Calf meal	Grain	Hay equiv-alent
	Pounds of feed needed daily																	
1st week	8	..	..	..	8	..	..	..	8	..	..	..	..	8	..	..	..	..
2nd week	9	..	..	..	9	..	..	..	9	..	..	..	..	9	..	..	..	..
3rd week	10	..	0.2	0.1	10	..	0.2	0.1	10	..	0.2	..	0.1	10	..	0.2	..	0.1
4th week	8	3	0.5	0.3	5	6	0.5	0.3	8	2	0.6	..	0.3	5	6	0.6	..	0.3
5th week	4	8	0.8	0.5	..	12	0.8	0.5	6	4	0 8	..	0.5	..	12	0.8	..	0.5
6th week	..	13	1.0	0.7	..	13	1.0	0.7	4	6	1.0	.	0.7	..	12	1.0	..	0.7
7th week	..	13	1.5	1.0	..	13	1.5	1.0	2	8	1.5	..	1.0	..	10	1.5	..	1.0
8th week	..	14	1.5	1.0	..	14	1.5	1.0	..	..	2.0	..	1.0	..	8	1.0	0.5	1.0
3rd month	..	14	2.0	2.0	..	14	2.0	2.0	..	..	3.0	..	2.0	..	..	0.5	2.5	2.0
4th month	..	14	2.5	3.5	..	14	2.5	3.5	..	..	3.5	..	3.5	..	..	0.5	3.0	3.5
5th month	..	14	3.0	4.5	..	14	3.0	4.5	..	..	4 0	..	4.5	..	..	..	4.0	4.5
6th month	..	14	3.0	5.5	..	14	3.0	5.5	..	..	4.0	..	5.5	..	..	..	4.0	5.5
7th month	..	..	3.0	9.6	..	..	3.0	9.6	..	..	..	3.0	9.6	..	..	..	3.0	9.6
8th month	..	..	3.0	10.5	..	..	3.0	10.5	..	..	.	3 0	10.5	..	..	..	3.0	10.5
9th month	..	..	3.0	11.3	..	..	3.0	11.3	..	..	..	3 0	11.3	..	..	..	3.0	11.3
10th month	..	..	3.0	11.9	..	..	3.0	11.6	..	..	..	3 0	11.6	..	..	..	3.0	11.6
11th month	..	..	3 0	12.5	..	..	3.0	12.5	.	..	..	3 0	12.5	..	..	..	3.0	12.5
12th month	..	..	3.0	13.1	..	..	3.0	13.1	..	..	..	3.0	13.1	..	..	..	3.0	13.1
Total one year	273	2142	914	2585	224	2191	914	2585	329		443	549	2585	224	336	65.7	962.5	2585

[1] Adapted from *Food and Life*, Yearbook of the U. S. Department of Agriculture, 1939, page 612.

Grain Mixtures for Calves

A distinction is made between calf meals or starters and ordinary grain mixtures. Calf meals are used as a partial or entire substitute for milk for the young calf and as such must contain feeds that can be readily digested. Grain mixtures for calves are composed of common grains and are considered only from the standpoint of furnishing nutrients, not as a substitute for milk. The character of the grain mixture will depend upon the general feeding plan as illustrated in Table 3.

If 1 per cent of iodized salt and 1 per cent of steamed bone meal are added to each of these grain mixtures, the mineral needs of the calves will be better served. The various grain sorghums or barley may replace part of the corn if necessary, although some yellow corn is advisable because of its vitamin A content. Soybean meal or cottonseed meal may replace one-half or even more of the linseed meal. Any of the grain mixtures should be thoroughly mixed before using.

The calf should be encouraged to eat all the grain that it will consume. When only two weeks old, it will eat a small handful of grain, especially if fed in a manger immediately after the milk feeding. By the time it is a month old, it will eat a half-pound daily. Keep the feeding boxes or mangers clean and use fresh grain daily, removing the unconsumed feed. After the calf is six months old, the grain mixture will depend upon the roughage; it will contain less protein if a legume hay is fed than if a nonlegume roughage is used.

Hay and Roughage

Encourage the calf to eat hay as early as possible. For young calves hay should be fine, clean, leafy, and bright green. Alfalfa and clover hay are excellent, although the former sometimes causes scouring in young calves. Prairie hay mixed with alfalfa has proved to be satisfactory.

Fodders are not suitable for use until the calf is three or four months old, but may be used then if convenient. Remember that since the protein content of fodder is low, the grain mixture should be adjusted to provide adequate protein. Do not feed silage until the calf is four months old. From that time until the calf is six months old, silage may supply from one-fourth to one-third of the roughage or hay equivalent.

Pasture is an excellent feed for growing calves after they are about four months old. Young calves should have the very best pasture available, which means young growing grasses. Such pasture furnishes an abundance of digestible nutrients and vitamins. If they are well fed on milk, the calves will eat only a limited quantity of pasture grasses; however, these may be so laxative as to cause scouring. If scouring occurs, put the calves on the pasture for a shorter period. The fact that young calves do not stand extreme heat well must be considered in connection with pasture in the middle of the summer.

Feeding Young Dairy Stock—Six Months to Two Years

When the calf is six months old milk and calf meals are usually discontinued, as the calf can then make satisfactory growth on a ration composed largely of roughage with a minimum amount of grain. The suggested plan

is to feed about three pounds of grain daily, making up the remainder of the ration with roughage (Table 1). For feeding with good pasture, use a grain mixture from Group 1, Table 3. If pastures are not the best, supply additional roughage by feeding adequate quantities of silage and hay. If pasture and roughage are poor in quality, feed up to five pounds more grain daily, depending upon the breed and condition of the calf.

TABLE 3.—*Grain mixtures for calves up to six months of age.*[1]

Kind of Feed	Group 1—Liberal milk feeding					Group 2—Limited milk feeding—milk products except whey				Group 3—Whey or milk substitutes			
	Per cent					*Per cent*				*Per cent*			
Corn (yellow, ground)	100	...	50	75	40	40	60	50	30	25	50	25	30
Oats (ground)	...	100	50	25	40	40	..	15	30	50	10	25	30
Wheat bran	...	...	...	...	20	..	20	20	30	..	20	25	10
Linseed meal	...	...	...	...	...	20	20	15	10	25	20	25	30
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100

[1] Modified from *Food and Life,* Yearbook of the U. S. Department of Agriculture, 1939, page 614.

During the winter or the nonpasture season, the ideal roughage for the six-to-nine-months-old heifer is alfalfa or other legume hay that is fine, bright in color, and has plenty of leaves. Two pounds daily per 100 pounds of live weight for each heifer is adequate when fed with 3 pounds of a grain mixture from Group 1, Table 3. Two pounds of silage daily may be used to replace 0.5 pound of hay—that is, with 2 pounds of silage daily, 1.5 pounds of hay makes a good proportion. The proportion of silage may be increased to 2.5 or 3 pounds daily per 100 pounds of live weight, but in such a case it is desirable to add another pound of grain since the ration will likely be deficient in protein even though alfalfa is fed as the other roughage. For these roughages the grain mixtures should be from Group 2, Table 3. Grass silage, when fed in the larger quantities, probably would not require more than 3 pounds of grain daily from a mixture in Group 2. Sorghum and corn fodders and nonlegume hays such as timothy, prairie, and oat hay may well be used for feeding growing heifers of this age. If all the roughage consists of fodder or fodder and silage, add another pound, or two preferably, of grain daily per animal. For such roughages the grain mixtures should be of Group 3, Table 3. These quantities are adequate to keep the heifer growing steadily without causing her to become unduly fat.

Between the ages of nine months and two years, the heifer can, with the addition of about 3 pounds of grain daily, consume enough roughage, if of good quality, to make normal growth. With the best legume hay available, heifers have made satisfactory but slightly slower growth with hay alone, but a minimum of one-half pound daily of grain mixtures from Group 1 is advised. With corn or sorghum silage furnishing half or more of the roughage and legume hay, the remainder, 3 pounds of grain daily per head, of mixtures from Group 2 should be adequate. If corn or sorghum silage and corn or sorghum fodder make up the roughage, at least 4 pounds of grain daily is suggested, which should be from mixtures in Group 3, Table 3. The animals

should be allowed to consume all the roughage that they will eat clean. Under most circumstances the heifer can consume enough carbohydrates, and the limitations will come in protein, minerals, and vitamins. With bright legume hay of good quality these are well taken care of with limited amounts of grain, but with other roughage, especially corn and sorghum silages and corn and sorghum fodders, there will be a deficiency in protein, minerals, and vitamins unless a larger quantity of grain is fed. A basis of comparing the different roughages is that 1 pound of good hay is equal to 0.7 pound of grain, 3 pounds of silage, 7 pounds of roots, 2 pounds of dry fodder, or 1.5 pounds of fair-quality hay.

If alfalfa hay is the sole roughage for feeding, the grain mixture need not exceed 10 to 12 per cent digestible protein (Table 3). If alfalfa hay furnishes one-half the roughage, the grain mixture should contain 13 to 15 per cent of digestible protein (Group 3, Table 3). With nonlegume roughages the digestible protein content of the grain mixture should be from 15 to 17 per cent (Group 2, Table 3) and should contain concentrates which are high in phosphorus, calcium, and vitamin A. The mixtures in Table 3 are merely suggestive combinations. For example, soybean meal and cottonseed meal may be used interchangeably, and barley, sorghum, oats, and corn may be exchanged on an approximately equal basis except that yellow corn is much higher in vitamin A.

If the heifer has been making good growth and is in good condition, the ration need not be altered. But if she is not growing well or is thin, or if the roughage is of poor quality, about three or four months before calving increase the grain to 4 to 8 pounds daily, depending on the physical condition of the heifer and the character of the feed available.

Nutritional Requirements

The suggested quantities of feed mentioned and illustrated in the tables are those which will produce normal growth and development. Studies at the Missouri and the Kansas Agricultural Experiment Stations indicate that heifers poorly fed up to two years are likely to be distinctly undersized at first calving. If liberally fed on a balanced ration thereafter, by the time the animals are five years old they may have attained normal size. It is apparent that this system is uneconomical because the cheapest growth can be obtained when animals are young and growing rapidly. Proper feeding will insure that the heifers are of good size when they calve at 24 to 28 months of age. Heifers calving at such ages on the average have produced more butterfat by the time they were seven years old than those calving at other stages.

Protein is the term used to describe a large number of complex compounds, some of which are more necessary than others. Because of the necessity of supplying all these essential compounds in the ration, it is desirable to have several grains and concentrates in the grain mixture. This is why feed from a single plant source is usually not satisfactory. Although adequate protein is needed, there is no good reason for feeding large excesses.

Total digestible nutrients, which include carbohydrates and fat as well as protein, are needed to furnish energy for maintenance and growth. Much

energy is needed to perform the functions of digestion and other forms of body metabolism, such as exercise, and to furnish nutrients for growth.

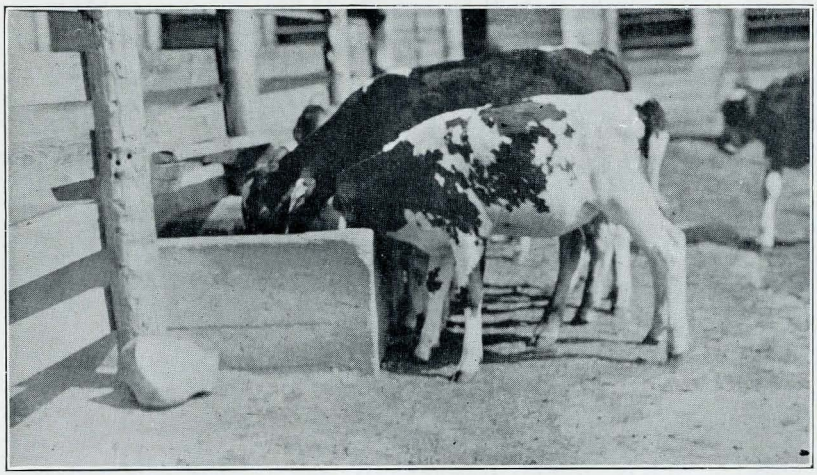
Minerals needed by growing heifers include calcium, phosphorus, sodium, potassium, chlorine, magnesium, iron, sulfur, iodine, manganese, copper, zinc, and possibly cobalt. Under ordinary circumstances the normal ration will supply most of these minerals, with the possible exceptions of salt, iodine, calcium, and phosphorus. Common salt (sodium chloride) is essential to the proper carrying on of body processes. Green pasture grasses are good sources of this compound, but it is well to insure an adequate quantity to the growing animal. The addition of from 0.5 to 1 per cent of salt to the grain mixture is a desirable practice, and boxes containing salt should be placed in protected places so that the animals can consume such quantities as they desire. Salt blocks, while useful, sometimes cause sore tongues before the animals have satisfied their appetites.

Iodine, although needed only in limited quantities, is essential to the proper maintenance of life. In many parts of the country the water contains enough iodine to supply the body needs. In other sections "big neck" or goiter is common. To avoid such a difficulty, use an iodized salt which contains 0.02 per cent of potassium iodide.

Calcium (often referred to as lime because that is a common compound containing calcium) and phosphorus are essential minerals for proper growth, development, and well being in dairy calves. Since the bones are largely formed from combinations of calcium and phosphorus, the importance of an adequate supply of these minerals is apparent. With plenty of milk supplemented with fine legume hay and a properly balanced grain ration, and with a well fertilized pasture available, there is no need of considering a shortage of either mineral. Not only must they be adequate, but it is essential that they be present in the ration in the proper relationship to each other, namely, about 1 to 1.5 parts of calcium to 1 part of phosphorus. If that relationship is not maintained, a deficiency develops. Approximately ⅓ ounce of calcium and an equal quantity of phosphorus are needed daily for a growing heifer. Certain concentrates such as wheat bran, linseed meal, cottonseed meal, and soybean meal contain considerable quantities of phosphorus. Tankage and fish meals also are fine sources. If they are grown on ground that contains plenty of lime, legume hays are good sources of calcium. An easy way to supply both phosphorus and calcium in proper proportions is to add 1 per cent of steamed bone meal to the grain ration. Another method is mixing salt with steamed bone meal, 3 or 4 parts of salt to 1 part of bone meal. This mixture can be placed in convenient boxes where the growing heifers have access to it.

Vitamins are essential dietary factors which must be considered in raising calves. If cows have been fed on a diet deficient in vitamin A, calves may be born dead, weak, or blind. Since calves at birth have a very limited quantity of stored vitamin A, the ration must contain adequate amounts if the calf is to grow and develop properly. Whole milk is a good source of vitamin A, and that is one important reason why it is desirable to start a calf in life with

whole milk. Pasture and good-quality (green) legume hay are particularly important. Failure to provide such feeds requires feeding cod-liver oil or some other rich source of vitamin A.



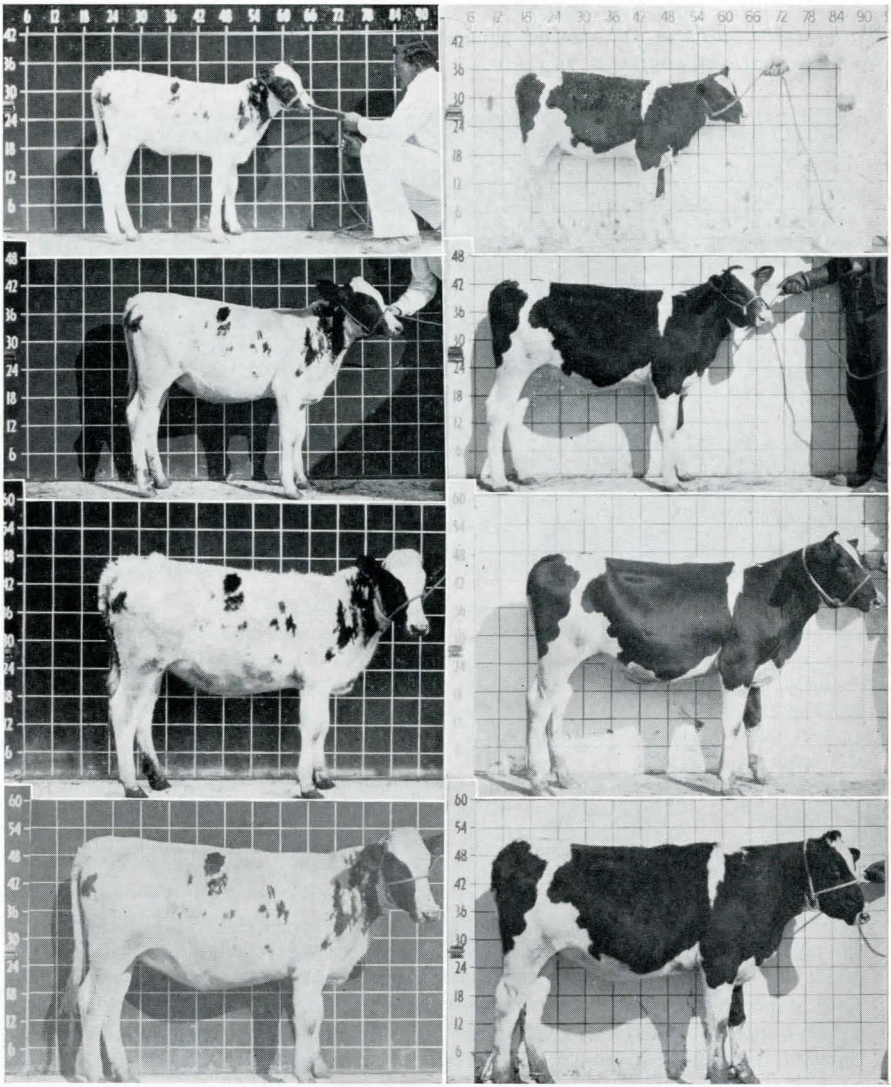
A convenient-sized water tank.

Evidences of the lack of vitamin D are a reduced rate of growth, abnormal bone development, swollen joints, slight paralysis of the hind quarters and a bowed back. Usually animals that have plenty of sunlight are not affected, although occasionally they will show one or more of the above-mentioned symptoms of rickets. If such indications appear, the daily feeding of from 4 to 6 teaspoonfuls of cod-liver oil will usually effect a cure in a few months.

Water is an important constituent of the calf's body, amounting to about two-fifths of the total weight and composing more than three-fourths of the body tissues that result from growth. Since water is used for digestion, assimilation, removing wastes, and regulating body temperature, it is important for the growing animal to have an adequate amount of clean fresh water available at all times. The quantity of water that calves or growing heifers will consume depends primarily upon their weight and the quantity in the feed. The total consumption of water from all sources will amount to about one gallon a day for a three-weeks-old Holstein calf, most of which is furnished by milk. As the calf gets older, the daily water consumption increases until about 1.5 gallons are needed at eight weeks, 2.5 gallons at twelve weeks, and 5 gallons at twenty-four weeks. It is very important for a growing calf to have enough water, especially if its ration contains little or no milk.

Standards of Growth for Dairy Heifers

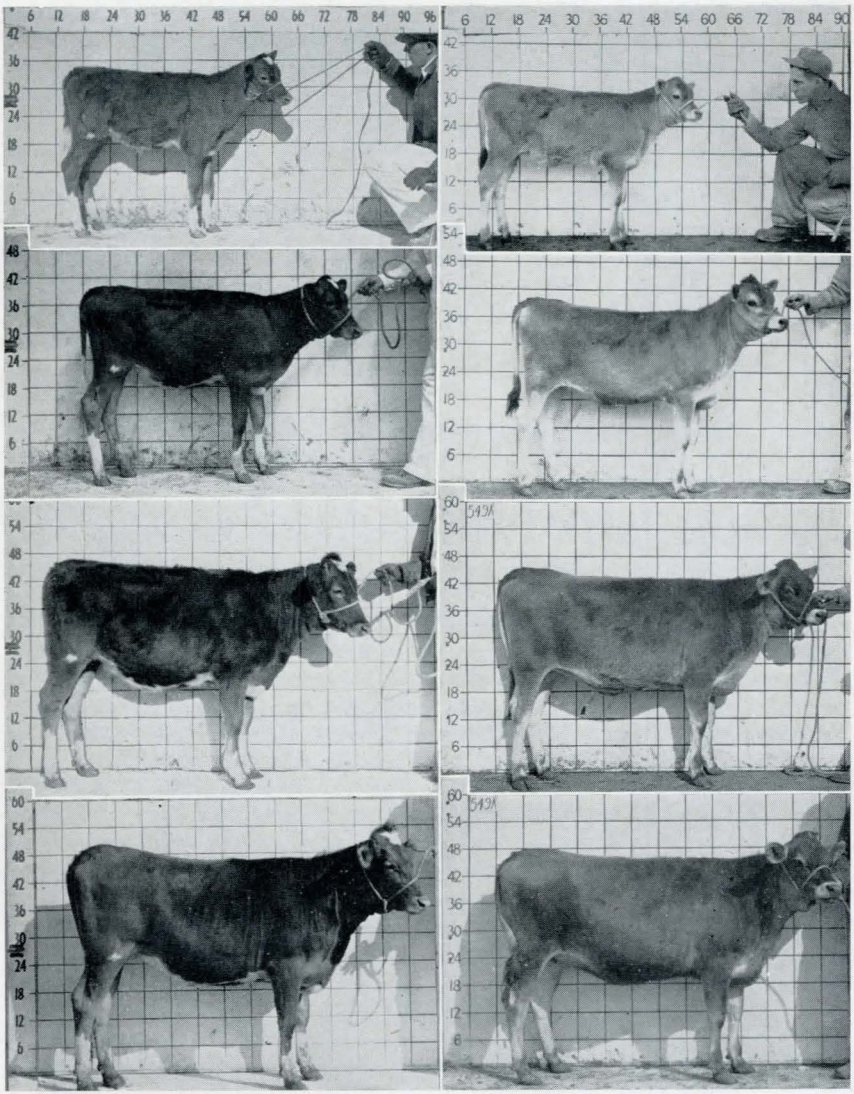
Experience has shown that it is most economical to keep the dairy heifer growing steadily for two years after birth. The simplest method to determine



Standard of Growth

Ayrshire Female
TOP TO BOTTOM:
Three months
Six months
One year
Eighteen months

Holstein Female
TOP TO BOTTOM:
Three months
Six months
One year
Eighteen months



Standard of Growth

Guernsey Female
TOP TO BOTTOM:
Three months
Six months
One year
Eighteen months

Jersey Female
TOP TO BOTTOM:
Three months
Six months
One year
Eighteen months

TABLE 4.—*Age, weight, height, and chest girth standards for growing dairy heifers.*

Age	Holstein females			Ayrshire females			Guernsey females			Jersey females		
	Weight	Height at withers	Chest girth	Weight	Height at withers	Chest girth	Weight	Height at withers	Chest girth	Weight	Height at withers	Chest girth
	Lbs.	*In.*	*In.*	*Lbs.*	*In.*	*In.*	*Lbs.*	*In.*	*In.*	*Lbs.*	*In.*	*In.*
Birth	92	29.5	30.0	72	27.5	29.0	67	27.5	29.0	54	25.5	26.0
1st month	102	30.0	32.0	82	28.0	31.0	76	28.5	30.0	66	26.5	28.0
2nd month	138	32.0	35.0	114	30.5	35.0	98	30.0	33.0	92	29.0	31.0
3rd month	186	34.0	38.0	157	32.5	38.0	138	32.0	37.0	130	31.0	35.0
4th month	251	36.5	43.0	218	35.0	42.0	182	34.0	40.0	181	33.5	39.0
5th month	307	38.5	46.0	280	37.0	46.0	234	35.5	43.0	230	35.5	42.0
6th month	369	40.5	49.0	328	38.5	48.0	289	37.5	46.0	274	36.5	44.0
7th month	429	41.5	52.0	389	40.0	51.0	338	39.0	49.0	324	38.0	47.0
8th month	492	43.0	54.0	441	41.0	53.0	390	40.0	51.0	365	39.0	49.0
9th month	553	44.5	57.0	486	42.0	55.0	437	41.0	53.0	407	40.5	51.0
10th month	613	45.5	59.0	512	42.5	56.0	468	42.0	54.0	447	41.5	53.0
11th month	645	46.0	60.0	556	43.5	58.0	513	43.0	56.0	491	42.5	55.0
12th month	701	47.0	62.0	587	44.0	59.0	566	44.0	58.0	515	43.0	56.0
13th month, 14th month	762	48.0	64.0	643	45.0	61.0	592	44.5	59.0	560	43.5	58.0
15th month, 16th month	829	49.0	66.0	700	46.0	63.0	667	46.0	62.0	613	44.5	60.0
17th month, 18th month	898	50.0	68.0	754	47.0	65.0	727	46.5	64.0	667	45.5	62.0
19th month, 20th month	968	51.0	70.0	824	48.0	67.0	761	47.0	65.0	703	46.5	63.0
21st month, 22nd month	1044	52.0	72.0	871	48.5	68.0	827	48.0	67.0	763	48.0	65.0
23rd month, 24th month	1122	53.0	74.0	930	49.5	70.0	901	49.0	69.0	801	48.5	66.0

growth is to weigh the animal. Weight increase is due partly to growth and partly to fatness. Probably the best single measure of growth is the height at withers. Table 4 presents average measurements for growing heifers of the Holstein, Ayrshire, Guernsey, and Jersey breeds which have been obtained from many hundreds of measurements taken in the University of Nebraska dairy herd. This table may prove useful as a guide to growth of young females.

Management of Calf—Birth to Six Months

Sanitation.—A calf must receive careful attention during the first few months of its life. Sanitation, which is merely applied cleanliness, is essential. The pens where the calves are kept should be cleaned often. The feed boxes should be brushed out and cleaned frequently. Milk utensils should be rinsed with cold water and then scrubbed with hot water and washing powder after each use.

Housing.—A young calf must be protected against severe weather. While calves can stand considerable cold if they are kept dry, most of them are affected by drafts. As soon as a calf is weaned, it should be placed in an individual pen at least 4 by 6 feet. If the sides of this pen are from 30 to 36 inches high, they will do much to prevent drafts. A rack for hay can be attached to one side of the pen with a little manger below to catch fine leaves and for grain feeding. If running water in individual water troughs is not available, a pail of water may be held in place with a clamp.

The floor of the pen should be of concrete so that it can be cleaned easily. Some calf raisers have adopted the plan of using a false floor for the calf pen. This is made of heavy expanded metal lath placed in the pen about 4 to 6 inches above the floor. The bedding is placed on the false metal floor and the claim is made that this arrangement saves bedding, keeps the calves cleaner, and tends to prevent the development of respiratory troubles. A concrete pen partition is cold and therefore undesirable; a wooden partition, while inexpensive, is difficult to keep clean. Sheet-steel partitions probably are more satisfactory than either of the others for small pens.

After the animal reaches the age of two months, it may be placed in a larger pen with several other calves. This pen should have a concrete floor also, but the partitions can be of pipe or boards since there is not so great a need of preventing drafts. Along one side arrange stanchions to confine the calves at feeding time. Milk pails can be fastened in front of the calves with clamps. A wooden feed trough with a hinged cover may be placed in front of the line of stanchions as described previously.

A good arrangement is to have a yard sloping to the south of the calf pen with proper drainage. On pleasant days the calves can be out in the sun, although some shade should be available.

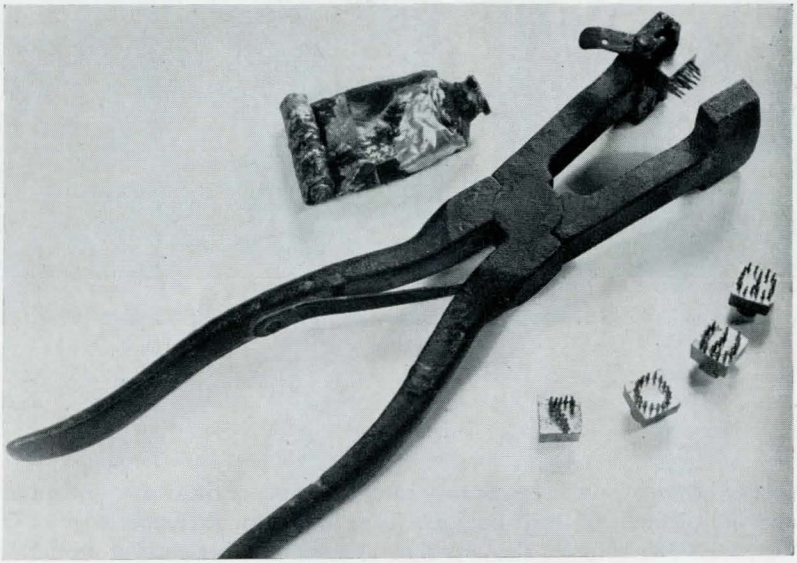
Dehorning.—With the possible exception of the show ring, there is no need or use for horns on dairy cattle. Cattle with horns may injure others and require more housing and yard space. Horns can be removed from older animals either by clipping or by sawing. The easiest and simplest plan is to prevent horn growth by treating the hornbuttons (little knobs on top of the

Applying caustic to calf's head to prevent the growth of horns.

head) on the young calf. Before the calf is a week old, clip the hair from around each hornbutton. Then just inside the outer edge of the clipped area make a thick ridge of vaseline or petroleum jelly. Next wrap a small stick of caustic potash or caustic soda with paper, leaving only the end exposed. Moisten this exposed end and rub it with a circular motion directly over the hornbutton until the skin is burned through and the knob destroyed. Usually the stick is applied alternately to each button so as to allow time for the caustic to take effect. When properly done, there should be a spot the size of a dime above each hornbutton where the skin is completely burned through. When using the caustic, see that it is not moistened too much, as drops from the caustic stick will burn the hands of the operator and the hide of the calf. After the operation is completed, sprinkle powdered boric acid or powdered alum over the burned spot to prevent bleeding. There is a tendency for a calf to rub its head against the side of the pen after treatment. To prevent this, keep the calf tied from above for an hour or more. Keeping it separate and tied as described also prevents other calves from licking its head and burning both animals. Exercise particular precaution to prevent a recently treated calf from going out into the rain.

Marking for identification.—Marking for identification is important in all herds, but particularly if the breed is of solid color or has similar markings. It is necessary to mark for identification at an early age if the true identity of each calf is to be maintained. Animals that are to be registered must be sketched, photographed, or tattooed according to the breed regulation.

For animals that are of broken color, a photograph is a certain method of identification, as the color pattern will not change throughout the life of the



Equipment for tattooing calf's ears, including ink and numbers.

animal. A picture taken broadside of each side of the animal with a small inexpensive camera is satisfactory, but be sure to keep the camera the same distance from the calf in taking each picture.

For solid-color light-skinned animals such as the Jerseys, tattooing in the ear is satisfactory. If this system is used, follow carefully the directions enclosed with the tattooing outfit.

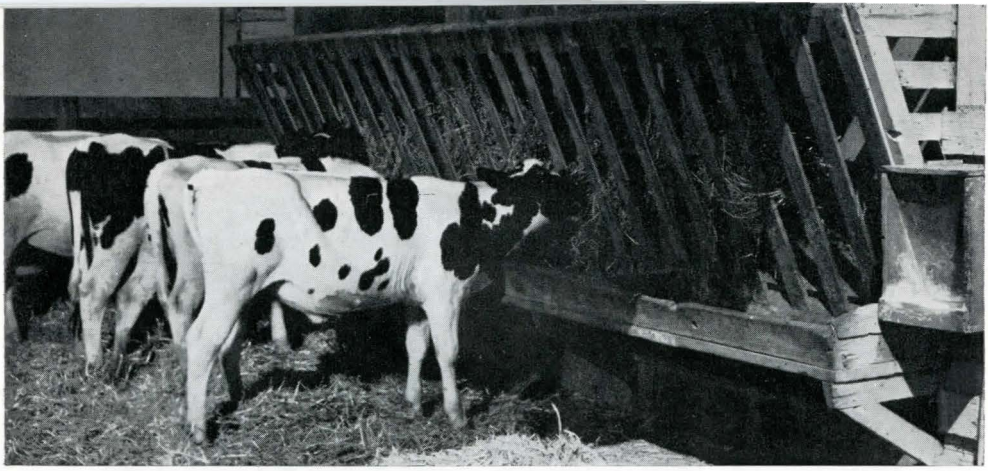
Notching or punching holes in the ears is a satisfactory method of marking animals but is objectionable because it tends to disfigure the ear. A punch is used for this purpose, and usually a numbering system such as the following is used:

Notch in upper edge of left ear	1
Notch in lower edge of left ear	3
Notch in upper edge of right ear	10
Notch in lower edge of right ear	30
Hole in left ear	100
Hole in right ear	200

Branding with a hot iron on the flank is used in some parts of the country. A disadvantage, which may affect its sale value, is that the animal is disfigured to some extent.

Often straps with numbered plates or tags attached are placed around the animals' necks; however, this identification system is expensive, and frequently the straps get caught in fences and are lost. A variation of this practice is a metal tag attached around the neck or the horns by a chain.

Ear tags are probably the most common method of marking cattle. The tags inserted into the ear are either a button, a metal loop, or a circular disk



Heifers in open shed with hay rack, silage and grain manger, and mineral box.

suspended from a ring. The tag may carry the name of the owner or the farm name and the animal's herd number. Tags in or near the upper edge of the ear are less easily torn out than are those inserted in other parts of the ear. A disk tag of either metal or composition attached to the upper edge of the ear with a fish-hook copper hog ring is simple, inexpensive, and quite easily read.

Management of the Heifer—Six Months to Two Years

Housing.—In summer a six-months-old heifer can be turned into pasture without housing. For late fall and winter she should have some shelter, if only a straw shed. At six months, the heifer can be transferred to an open shed, but it is not wise to make such a change in the middle of winter. While an open shed may be of any size or construction, an inside height of about 8 feet and a depth of not less than 24 feet is advised. In such a shed the animals can get protection even from severe storms. For proper housing without overcrowding, 40 square feet of floor space is needed for a six-months-old heifer; 50 square feet for a yearling; and 60 square feet for a two-year-old. If animals are to retain their horns, increase these areas by at least 10 per cent.

Sometimes mangers and hay racks are placed along the sides or back of the open shed. These require more bedding. Feed racks can be placed in the yards away from the sheds either on a concrete platform or on high ground. If possible the floors of the sheds should be of concrete to prevent the development of mud holes and to keep the bedding in better condition.

Keep an adequate supply of clean fresh water available at all times. In winter, insulating the tank with straw will do much to prevent the water from freezing. Freezing can also be prevented by using a water heater set in the tank, or a soil cable and a transformer connected with the electric lighting system.

Age to breed.—One of the most important periods in a heifer's life begins

at the time she is to be bred. As a general rule, fall calving is more desirable than spring calving since calves dropped in the fall are ready to go on pasture in the spring about the time that they have been weaned. The grass is appetizing and nutritious, and usually there is no setback in gain or growth at that time. Other advantages of fall-dropped calves are that there is usually more time on the farm in the winter to care for them, calves dropped in the fall can be bred to freshen in the fall or winter at the proper age, there is a tendency for fall-freshening cows to produce slightly larger quantities of milk, and milk is usually higher priced in the fall and winter than in the spring. Spring-born calves may be on pasture while they are still receiving milk, and their weaning comes when they must go on a dry ration which sometimes checks growth.

The age to breed heifers depends upon the breed, growth, and development of the individual animal. To determine the growth that has been made, check measurements or weights of heifers with the schedule in Table 4. For well grown and well developed animals, the following ages are suggested: Holsteins, Ayrshires, and Shorthorns, 17 months; Guernseys, 16 months; Jerseys, 15 months; and Brown Swiss, 19 months. For animals that are not well grown out, it will be better to delay breeding a month or two. Breeding heifers to freshen at less than two years is likely to stunt the animal's growth, even though a longer period elapses before the second calf.

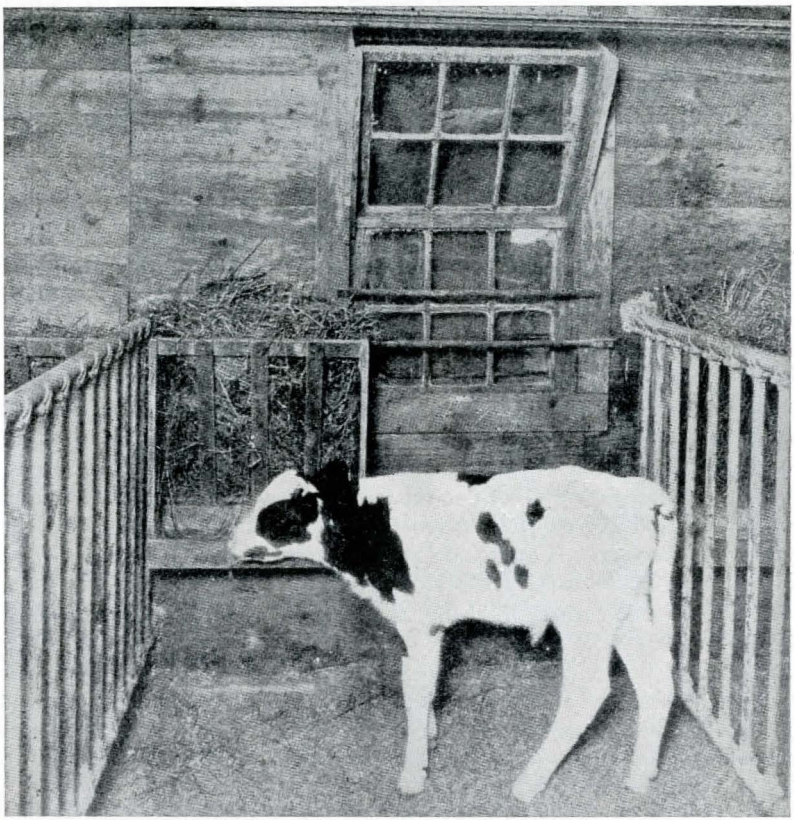
The gestation period of cattle varies but is generally considered to range between 282 and 285 days. On that basis, any calving before 265 days after breeding is abnormal. A gestation table or cattle breeder's perpetual calendar will be found on the back of this circular.

A month or two before the heifer is due to calve, bring her into the barn with the milking cows and place her in a stall or stanchion so she will become accustomed to the new surroundings. During this time pet her occasionally, handle her udder, and in every way possible teach her the routine of the milking herd. If she does not already know how to lead, teach her at this time. Usually the easiest method is to keep her tied, leading her to water twice a day.

Management of Young Bulls

Bull calves are handled with the heifer calves until they are about three months old. At that time put them in separate pens in the calf barn and later in separate open sheds. During the first year there is little difference between the feeding of bulls and heifers except that the former, being heavier and larger, need a little more feed. From one year to two years of age, young males need much more feed if they are to grow out into well developed bulls. While roughage can be fed liberally, the growing bulls need an abundance of a well balanced grain ration, and the quantity fed may well be twice that fed to heifers of the same age. Plenty of oats is recommended, along with sufficient bran and high-protein concentrates to make up a mixture that contains at least 13 per cent of digestible crude protein. Pasture is particularly good for young growing bulls.

Housing.—Keep young bulls together in pens or in sheds for the first nine months. From that time on, better results are obtained by keeping them separate. Long narrow lots or pasture paddocks with water at the far end are ideal for young bulls.



Clean, well-lighted, well-ventilated pen with hay rack.

Management.—Do not use a bull for service until he is at least 12 months old, and from that time until he is two years old do not permit more than two services a week. A little care at this time will prove to be worthwhile, because overuse leads to exhaustion. Do not allow the bull to run with the herd, and if possible train him to use a breeding rack. Every bull should be taught to lead with a halter by the time he is six months old. If this is not done, he may cause great difficulty and even danger later on. When he is nine months old, place a small metal ring in the bull's nose, replacing this with a heavy ring nine months later. Insert the ring in a hole punched through the thick tissue with a special instrument or with a trocar. As soon as the nose is healed a little,

teach the bull to lead with a rope or strap through the ring. From 18 months on, the bull always should be led with a staff. The safest method of handling a bull is by such a staff fastened in the nose ring. *Never take chances when handling a bull.*

Calf Ailments

Scours from indigestion.—Scours or diarrhea is one of the most common ailments of calves, and it usually hinders growth and reduces or stops the daily gain in weight. Among the many causes of scours are irregular feeding time, unequal quantities of milk at different feedings, overfeeding, cold milk, dirty or sour milk, milk from cows with diseased udders, sudden change of feed, fermented feeds, dirty feeding utensils, or damp dirty stables. When scours occur, make a careful check upon the calf's environment and particularly upon the feed and methods of feeding. In the case of small calves, reduce the quantity of milk at least one-half and make a general clean-up of utensils and pens. Home remedies sometimes effective are feeding colostrum milk, two raw eggs, a teaspoonful of blood meal at a feed, or a half cupful of lime water in the milk at a feed. Three tablespoonfuls of castor oil given as a drench is a useful treatment, which may be followed the next day with a teaspoonful of a mixture of 1 part salol and 2 parts subnitrate of bismuth.

Scours from infection.—White scours or infectious dysentery appears shortly after birth and is recognized by light-colored, very offensive droppings. In the usual course of the disease, the calf weakens quickly and dies within a few days. As the disease is contagious, clean thoroughly by scrubbing with hot lye water any pens or premises that have been infected. Burn carefully all straw and litter. Careful attention to the navel at birth will help prevent the disease, but for treatment of white scours consult a veterinarian.

Pneumonia.—Pneumonia in calves is often quite common, especially in the late fall, winter, and early spring. The disease is ordinarily due to a bacterial infection, and the best method of coping with it is to prevent its occurrence. The symptoms are coughing, rapid and difficult breathing, a temperature rise to as high as 105°F., rapid pulse, running at the nose, and general listlessness and weakness. Keeping the calf in a dry pen with an even temperature and free from draft is helpful. Special care and a slightly increased quantity of feed are advised, and a raw egg at each feeding has been found useful in keeping up the calf's strength to combat the disease. Cod-liver oil or other material high in vitamin A is helpful as a preventive of respiratory trouble. Good results have been obtained by the use of hypodermic injections in the neck, consisting of from 8 to 10 cc. of a mixture of 800 cc. of olive oil, 200 grams of gum camphor, and 1.5 ounces of beechwood creosote, at intervals of once or even twice a day in severe cases.

Bloat.—Bloat is caused by indigestion as the result of fermentation in the digestive tract. The symptom is a very much distended paunch, especially on the left side. Tying a stick in the animal's mouth and walking are helpful in mild cases. A drench of 4 cc. of formalin in a quart of warm water will aid in relieving the condition. Another treatment is 1 ounce of kerosene to 1 pint of milk given every 15 minutes for an hour or two as a drench. In severe cases the rumen may have to be tapped to relieve the pressure of gas. In general,

"tapping" should not be resorted to except in an emergency, and then it is best done by a veterinarian.

Ringworm.—Ringworm is a parasite which affects the hair and the top layer of skin, causing circular bare spots in the hide that are covered with crusts. A suggested treatment consists of washing the affected parts with soap and water and applying a mixture of 40 parts phenol, 20 parts glycerine, and 40 parts tincture of iodine with a swab daily. If this mixture produces too much swelling or blisters, dilute it with a small quantity of water.

Lice.—Clean pens and bedding help to prevent infestations of lice. In general lice are likely to be found on the backs and necks of infested animals in spots which cannot be reached readily. There are different varieties of lice and the treatment varies with the type present. One effective method is to dip in a solution of a coal-tar disinfectant made up according to directions. Repeat the process in 14 days. When this is impossible or the weather conditions make the procedure undesirable, scrub the back, neck, and infected parts with a dry brush after dusting thoroughly with powdered derris root or powdered sapadilla seed. This dusting should also be repeated at the end of 14 days.

Warts.—For small warts or those which are closely attached to the body, soak daily with castor oil or olive oil. For longer ones, tie a white silk thread around the base of the wart, which will cause the end to slough off. Then touch the scar with a stick of caustic potash.

Black leg.—Calves should be vaccinated during the first three months with black leg aggressin. Repeat the vaccination when the animals are a year old.