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Raising Dairy Calves



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RAISING DAIRY CALVES

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The average age at which the dairy cow in the United States either dies, is butchered, becomes a non-breeder, or for some other reason ceases to be a producer, is six years. To many this figure may appear low, for cows are sometimes productive at ten or twelve years and even at fifteen or sixteen years and older. These cases of exceptional longevity are notable and they appear to be numerous, but the number of cows which die previous to their sixth year is far greater. Studies of many herds, of both grades and purebreds, under all conditions, thruout the country, confirm the statement that the productive life of the average cow terminates when she is six years old. Dairy heifers become producers when two years old and thus their average production period continues for four years. There are in this country approximately 24,000,000 dairy cows; one-fourth, or 6,000,000, drop out of production each year and must be replaced. It is safe to assume that 18,000,000 calves are born annually; probably one-half of them are bulls and from the remaining 9,000,000 heifer calves must come the two-year old heifers to replace the 6,000,000 discarded cows.

All in all this country for years has raised enough heifers to maintain this replacement and make a slight gain so far as numbers alone are concerned. This has been done in spite of the vealing of heifer calves or of losses previous to first freshening, and the replacement has been ample even tho there have been times when a shortage of producing cows was apparent and their cost was exceedingly great.

A great many dairymen are confronted with the problem whether to raise any of their heifer calves or to veal them at just as early an age as possible. At present prices it costs about \$75.00 to raise a heifer to two years of age. The breeder of purebreds is very seldom puzzled by this question. He plans to raise all his heifers and can usually realize something on his expense, provided it is not too great and the heifers can be sold profitably or retained in the herd to advantage. Neither does the average small dairyman who sells cream question the advisability of raising heifers. He has skim milk for the calves and his feeds are generally cheap.

It is the man who sells whole milk who has difficulty with this question, especially if he has grade cattle. Fifty-four percent of the dairy calves born in the United States come in herds from which whole milk is sold. Undoubtedly a very high percent of these calves are grades and the whole milk from these herds is nearly always too valuable to feed to the average grade calf. Moreover, skim milk is not easily made available for feeding, for separating the milk reduces the cash returns considerably.

The owner of a grade herd has two courses from which to choose. On the one hand, he may veal his heifer calves, buy springers to keep up the numbers in his herd, take his chances on selecting good cows free from disease, and be content with the same grade of cows year after year. On the other hand, he may choose to raise all his heifers or a large percent of the best ones. This will necessitate keeping some whole milk at home to feed these calves at first; later he can separate enough for the necessary skim milk and sell the cream, or, instead of separating, he can use calf meals.

The plan of raising the calves entails considerable expense and the calves may suffer because of attempted economy in limiting their milk allowance, but if the calves be fairly creditable the plan is



Fig. 1. The desirable herd sire brings profits on dairy farms. Daughters from bulls such as this give promise of success and justify the cost of raising them.

safe and profitable. At any rate the man who raises his calves has some prospect of greater success in each succeeding year for he has an opportunity to improve and enlarge his herd by the only sure and safe method yet devised, namely, thru the use of a good purebred dairy sire and the careful rearing of the calves.

CALVES TO BE RAISED

The man who follows the plan of raising his heifers usually gives very little concern to selecting which calves he will raise. He tries to raise all of them. This is one of the misfortunes of the dairy industry in the United States and is due to the great demand for dairy females and the utter disregard of the average farmer of the relative merits of his individual cows. Obviously a large percent of the cows of the country are inferior and they should not be permitted to propagate their kind. This does not necessarily preclude their use as breeding cows, but it does mean that when they are bred they should not be bred to inferior bulls, for then their calves will be of the same or less caliber.

No dairy calf is worthy of being raised unless it is sired by a well selected purebred dairy bull. It does not necessarily follow that all grade calves by purebred bulls are creditable. Some purebred bulls are not capable of begetting high production in their daughters, but such bulls are rare. If a bull be selected from ancestry that has demonstrated its productive ability and if he be of a type that gives assurance of his ability as a dairy sire, little fear need be felt as to the outcome. There is a woeful lack of good sires in the dairy herds of the country. Only one herd out of every 28 milking herds in Iowa is headed by a purebred dairy sire. The other 27 of these herds are using undesirable bulls and are producing and rearing calves that can give no promise of dairy qualities. Such calves are liabilities at birth and the liability increases with every cent expended upon them.

TABLE I. INFLUENCE OF PUREBRED SIRES UPON THE PRODUCTION OF THEIR GRADE DAUGHTERS.

	Scrub Dams		First generation Daughters		Second generation Granddaughters	
	Milk pounds	Fat pounds	Milk pounds	Fat pounds	Milk pounds	Fat pounds
Guernsey	4364	197	4981	245	6993	359
Holstein	3631	176	6698	278	10222	397
Jersey	4047	194	4934	266	6544	345
Average of all	4034	188	5810	264	8125	371

No demonstration of the value of purebred sires has ever been more forceful than an experiment reported in Bulletin No. 188 of the Iowa Agricultural Experiment Station. Some recent material from this work shows what improvement may be expected from using a well selected purebred dairy sire on scrub cows. In table I are shown the yearly records of the scrub cows used in this experiment and the records of their daughters and granddaughters sired by dairy bulls. The records are as they appeared June 30, 1923.

The value of purebred sires is further emphasized when the material of table I is presented as percentage increases.

TABLE II. PERCENTAGE INCREASE IN THE PRODUCTION OF DAUGHTERS AND GRANDDAUGHTERS OVER THE SCRUBS.

	Percentage increase of daughters over scrubs		Percentage increase of granddaughters over scrubs	
	Milk	Fat	Milk	Fat
Guernsey	14	24	60	82
Holstein	84	58	182	126
Jersey	22	37	62	78
Average of all	44	40	101	96

From these tables, I and II, it may be concluded that the use of dairy sires on scrub cows for one generation will increase the productivity of the daughters more than 40 percent. The further use of dairy sires on these grades approximately doubled the production of the granddaughters over the scrubs.

Increased production is not the sole aim in dairy farming. It is but an initial step. Increased economy follows greater production and the two attain the end for which cows are kept—enlarged profits.

That enlarged incomes follow the use of these dairy sires is well attested in the experiments reported in Bulletin No. 188 and presented in table III.

In the case of the scrubs \$23.32 above the feed cost is left to pay for labor and other charges which must be met in milking. This

TABLE III. ANNUAL FINANCIAL SUMMARY PER COW.

	Milk production pounds	Income from milk valued at \$2.50 per cwt.	Feed cost including the dry period	Net income over feed cost	Percent increased net income over scrubs
Scrubs	3660	\$ 91.50	\$ 68.18	\$23.32	...
First generation daughters	5998	149.95	95.28	54.65	134
Second generation granddaughters	8401	210.02	117.00	93.02	299

amount invariably falls short and the scrubs constitute an actual expense to their owner. When \$54.65 becomes available above feed cost, as in the case of the first generation daughters, some money can be made from milking, and when \$93.02 represents the income over feed cost per cow, the operation becomes profitable.

The granddaughters are three times more profitable than the scrubs because of their increased production, even tho their feed cost is nearly twice as great. Obviously it is not profitable even to attempt to raise inferior calves. Those calves sired by good purebred bulls can be made to pay and every effort must be made to raise them properly.

SECURING HEALTHY CALVES AT BIRTH

If a calf be healthy and vigorous at birth the danger of its becoming a weakling is greatly reduced. Contagious abortion is the most serious threat to all herds. This disease especially affects the cow and generally results in premature, dead calves. Sometimes the premature calf lives, but in such cases it is invariably stunted and can be raised only with extreme care and good fortune. Cows affected with abortion disease do frequently carry calves to maturity, but these calves are not vigorous at birth; they have not been properly nourished in their prenatal development and they are more subject to disease than calves from healthy cows.

Whether or not the bull has an influence in infecting a cow at service is a disputed question. Regardless of the facts of the matter and the probability of danger, it is a good plan to disinfect the bull's sheath before and after each service. For this purpose a large syringe can be used, one with a hard rubber tube being preferable to one of metal. The metal tube is likely to become rough and may cause an injury. A solution of lysol, carbolic acid, iodine or any other standard disinfectant is satisfactory care being exercised to have the solution properly diluted. A solution too strong may cause soreness and difficulty in getting the bull to serve. It is a good plan to change from one solution to another from time to time.

In addition to observing this precaution with the bull, every care should be taken to exclude abortion from the herd by avoiding the purchase of suspicious cows, by isolating aborters from the rest of the herd, by employing competent veterinarians and by every possible sanitary measure.

Tuberculosis is another problem but this disease does not affect calves so seriously as does abortion. Tuberculosis is not inherited and except in extreme cases of emaciation and weakness a tubercular cow will drop just as healthy a calf as will a healthy cow. The only necessary precaution is that against allowing the calf to become infected after birth. To guard against this danger the calf must be removed from the cow immediately upon birth. The cow must not be allowed to lick nor suckle the calf, and the calf must not receive milk from any tubercular cow unless this milk be pasteurized.

To make further provision for the health of calves they must be born in sanitary quarters. The maternity pen must be clean, light, well ventilated and comfortable. It is a misfortune for a calf to come in a stall infected with any of the calf diseases. Before the calf is dropped the pen should be thoroly cleaned, slaked lime should be spread on the floor and dip should be used. Then clean straw completes the preparations and the calf can be protected.

SEASON OF YEAR FOR FRESHENING

Under the best dairy practice cows are bred to freshen in the fall of the year. The primary object of fall freshening is to secure

the greatest milk flow from the cows during the winter season when milk prices are highest. It has also been found that fall freshening cows will produce from 12 to 15 percent more milk for the year than spring freshening cows.

There is yet another reason why fall freshening is desirable, in that better calves will result. Many breeders greatly prefer the fall calves and it has been found that they grow more rapidly and are larger at first freshening than spring calves. Also fall calves are more cheaply raised. They demand milk and grain for their first six months but then can be turned onto pasture, which is cheap. Spring calves demand milk their first six months, then winter comes and they require expensive winter feeds so that they are more costly at one year of age than fall calves.

CARE OF THE DAM

It is generally recognized that the size of the dam has an influence upon the size of her calf. The Iowa station has found that cows weighing 700 pounds produced 55 pound calves while the calves of 1,500 pound cows weighed 100 pounds at birth. The factor of breed is not excluded from these figures, but as a rule larger calves are more easily and satisfactorily raised. The rule is almost invariable when the larger and smaller calves within a given breed are concerned. It readily follows that the best calves will be produced by the cows which are rugged and of normal size.

The amount of nutrients required by a fetus is naturally small, yet it is important that enough be furnished the cow during pregnancy to develop properly the unborn calf.

The limiting of a pregnant cow's ration to the point where she is unthrifty and emaciated affects her calf adversely. It is reported by some that extremely fat cows also drop weak calves. This may be true of fat sows and mares but it is doubtful if a dairy cow can ordinarily be so fattened as to impair the vitality of the calf she is carrying.

The pregnant cow should be put into as good, healthy condition as possible and should be allowed to carry a great amount of flesh. It is a commendable plan to dry the cow up from a previous lactation not later than two months before the calf is due. This allows the cow sufficient time to rest, to build up her body and to nourish the developing fetus. It is probably true that just as good a calf would be dropped if she were not rested, but this is due to the cow's natural tendency for maternity to the point where she will forsake her own body stores that the fetus may be taken care of. Failure to give the good cow this much needed rest impairs her own development and forces her to start the next lactation on too low a plane of condition. Inferior cows require no attention in this regard; they will dry up without effort from their owner, but good cows demand a rest and the feed the good cow eats in preparation for a lactation is as profitably used as any during her life.

Too many dairy men make the mistake of not resting their cows for a sufficient time, due either to a desire to secure as much milk as possible from the cow or to difficulty in getting her dry. In the first case the additional milk secured will be offset by the reduced flow thruout the ensuing lactation, while difficulty in drying off a cow may be overcome. It must be remembered that the greater the difficulty in drying a cow off, the greater is her need for a sufficient dry period. Such cows invariably produce extremely large quantities of milk for a few weeks following freshening. During the early part of this flush period they are not recovered from the effects of calving and can not receive full feed for three or four weeks. During

this time they do not consume enough nutrients to provide for the milk they give and they produce the milk from their own body stores. The rest period should provide sufficient of these body stores so that they will not be depleted too soon and result in a weakened cow for the remainder of the lactation.

Two or three weeks is generally a long enough time to dry off a 30 pound cow. A good plan is to take away any silage or succulent feeds she may be getting. If on pasture she should be kept in the barn and the grain feeding should be stopped. Likewise legume hay should be withheld. It is at this time that timothy hay has its greatest value for dairy cattle feeding and it may be supplied partially to satisfy the cow's hunger. If timothy hay be not available, straw, corn stover or any such dry roughages are equally effective.

If the cow be giving 30 pounds or less, she should be milked only once daily. After three or four days the milk flow will generally be so reduced that two consecutive milkings may be omitted. Within another few days she should be down to 10 or 12 pounds, at which time milking can be stopped entirely. The udder must be watched, however, at this time for spoiled quarters may develop. After this last milking the udder may fill too much in two or three days and should be relieved, but unless it appears too full or feels hard, the milk will be reabsorbed. A precaution in this connection is to be careful, but not unduly alarmed. Also the udder should not be handled any more than necessary because handling it, especially at a regular feeding and milking time, induces further secretion.

When the udder is dry and in good condition, feeding can be resumed.

The plan suggested is a drastic one but drastic action is required with many cows. The cow will probably show the effects of her limited feeding and this treatment must be ended just as early as possible so that it may be overcome in good time.

The feeding of the cow in preparation for freshening is important. If she be on pasture the problem is greatly simplified for the pasture is palatable, nutritious and has a desirable laxative effect. Also pasture is generally made up of different grasses so that sufficient variety is provided to furnish the fetus with the materials which it demands.

When the cows are not on pasture, silage or any other succulent feed is nearly indispensable in providing the laxativeness so much needed. The succulent feed should be supplemented with a legume hay if possible. The legume hay contains great amounts of protein and minerals, especially calcium. The protein is demanded for the tissues of the fetus and for rebuilding the tissues of the cow. The need for minerals in building up the bony structure of the fetus is apparent. When cows are forced to live upon timothy hay or any non-legume roughages with insufficient minerals in their grain allowance, they often drop dead calves or weak calves because of the calcium deficiency. Legume hays prevent this difficulty and should be used. An ample supply of minerals for a dry cow also greatly prolongs and increases her subsequent production.

Except in a few cases, when dry cows are in good flesh, grain must be furnished them in liberal amounts. A good grain mixture for the early part of the fitting period is 2 parts cracked corn, 2 parts ground oats, 2 parts bran and 1 part linseed oilmeal. This mixture is satisfactory for cows either on pasture or on winter feed and it may be varied to suit individual conditions. The amount of grain to feed must be left entirely to the judgment of the feeder. Plenty of grain is desirable but overfeeding must be avoided.

Corn as a feed for a dairy cow is desirable in that it builds up her flesh readily, it is palatable and is available on nearly all farms. It does have a tendency to heat an animal and should be omitted for a week before the calf is due. Oats are generally expensive, but even if they are not being used for the general herd a small amount is very desirable for the dry cow. Bran is looked upon with great favor for dry cows. Its content of protein is high; it is a good source of minerals, especially phosphorus, and its laxative effect aids in keeping the digestive tract in good physical condition. Oilmeal can be replaced by cracked soybeans or by soybean oilmeal if the latter feeds are available. These feeds are very high in their protein content and are very laxative. Cottonseed meal should never be used for the cows that are about to freshen. It has a tendency to constipate them and may affect the calves unfavorably.

About a week before the cow is due her grain allowance should be reduced for she is liable to go off feed easily. For a few feeds immediately before freshening, a wet mash consisting of equal parts of bran, oats and oilmeal is very good. If the weather be cold the use of quite hot water for this mash is recommended.

Every effort must be made to keep the cow's bowels in a loose condition for this tends to avoid the danger of retained afterbirth and results in a better start on feed after freshening. The slightest tendency to constipation must be avoided. If the feces be at all dry and firm, a dose of one quart of raw linseed oil or of castor oil, or a pound of epsom salts is a very desirable safeguard.

Exercise for the dry cow is essential. If the cow be on pasture this exercise is provided. If she be in the barn she should be turned out frequently. The plan of removing the cow from the stanchion to a box stall as early as possible has everything to recommend it because of greater comfort and ease.

ATTENTION AT CALVING TIME

At birth a calf undergoes the most critical time in its life. The occasion is likewise a critical one for the cow. If the cow has been properly fitted for freshening and if the calf be due so that the danger of an abortion is past there is little need for anxiety. But even with the best preparation difficulties may occur. Careful and prompt attention is very necessary during the ordeal of calving and it should not be neglected. The experienced attendant can generally calculate pretty closely as to when the calf will come. He can note the pronounced loosening of the vulva and the "falling away" on either side of the tail setting which forms a pretty reliable indication that calving is near. Another quite reliable guide is the filling and distention of the teats. The latter point is ridiculed by some men, yet it is well to make this observation and know that a normal calving will generally come within a few hours after the teats fill.

When the attendant satisfies himself that the calf will come within the next few hours, he can prepare to make frequent observations. The cow must be placed in a box stall and well bedded with clean straw. It is not well for most cows to know that they are being watched; consequently a constant light near the cow at night is desirable so that she may not be repeatedly disturbed by an approaching lantern nor turned on lights.

At calving the cow is generally not in need of assistance and it is better to avoid the disturbance of even entering her stall. If difficulty appears an examination should be made to determine the manner of presentation. Normally the front hoofs will appear first, immediately followed by the nose. Even before the nose appears it is possible to determine whether the feet are the front or rear feet.

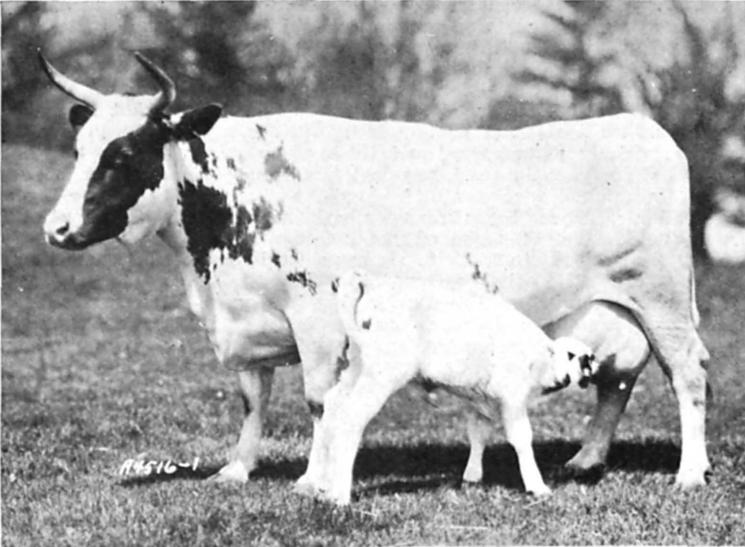


Fig. 2. A two-day old calf securing her last meal at the family larder. This calf has received the colostrum and is well started. Skill and care can quickly accustom her to hand feeding. Note the good condition of the cow. She is ready to start a hard year's work.

Front feet will be turned down normally and rear feet up. This must be determined quickly and if the calf is on its back or is coming rear end first it demands immediate attention and a veterinarian should be secured. A frequent abnormal presentation is with the head turned back. When this occurs the calf must be pushed back and adjusted. Any abnormal presentation should be corrected and after it is corrected the cow can deliver alone unless she is exhausted. If it becomes necessary to pull the calf, secure sufficient help, attach a rope to the fore legs and pull with the cow's labor. If the cow be standing, pull outward and downward rather than straight back. If the cow be lying down, pull in the corresponding direction. After the head is delivered exercise every precaution against allowing the calf to be choked.

When the calf comes it must start breathing as soon as possible. It is well to remove any mucus from the nose and mouth with the finger. Blowing in the calf's mouth may often displace any phlegm that may be out of reach of the finger. If the calf continues motionless and fails to emit a sound, there are different methods of starting respiration. A common method is to dash cold water on the calf, or slap the chest vigorously. If these fail, alternate compression and relaxation of the chest may bring results.

As soon as the calf breathes, its navel should be disinfected to protect it against white scours or other infections. For this purpose any disinfectant is satisfactory and it may be quite strong. A good plan is to stand the calf up, fill a cup with the solution and hold this up so that the navel is immersed. Following this some powdered alum should be sprinkled on the navel to dry it and make it a less favorable site for infection.

Ordinarily a cow will start licking her calf as soon as it is born. This helps to clean and dry the calf. In extremely cold weather the calf can also be rubbed vigorously with a gunny sack and may be covered to avoid chilling. If after an hour the calf has not sucked it may be helped up and assisted in getting the teat and some warm milk.

It is a good practice to allow a calf to remain with its dam for about two days. This allows the calf time to receive the colostrum milk and secure a good start. It also permits the calf to suck frequently, which is beneficial both to the calf and the cow's udder. If the calf is left with the cow longer than two days both it and the cow are more disturbed when finally separated. Also the longer the calf sucks the more difficult it is to teach it to drink.

The colostrum milk has long been recognized as of value in furnishing a laxative to enable the calf to void the first feces, or meconium, and to keep the bowels in good order. Some recent investigators on this subject have concluded that the value of colostrum does not lie entirely in its laxative effect but in its property to provide the calf with certain anti-bodies which are said to fortify it against the many infections liable to occur at this delicate age. Without regard to the especial use to which the colostrum is put, the fact remains that it is valuable and should be given whenever possible.

TEACHING THE CALF TO DRINK

The time immediately following the separation of the calf from its dam is a decisive one. The change from sucking to drinking is difficult and even tho necessary in dairy herds it frequently works a hardship upon the calf. A large part of the difficulty lies in teaching the calf to drink; it is eager for milk and will put its nose in the pail but it does not know how to drink. Patience on the part of the feeder is very essential in providing the necessary instruction.

When the calf is to drink for the first time it should be quite hungry, for then it responds more readily to the will of the feeder. All that is generally required is a small amount of milk in a pail set in the manger or held so spilling is avoided. Most calves will learn to drink after a few minutes. Some of them, of course, are not such apt pupils. When they utterly fail to secure any milk thru coaxing, other action is required. This consists of getting astride the calf's neck, using one's legs for stanchions, and backing the calf into a corner so that some stability may be obtained. Then it is well to let the calf suck a finger and while so doing lower the finger into the milk. This allows the calf to secure some milk and after a few seconds the finger can be withdrawn and the calf will continue to drink. Generally one such lesson suffices, but if it fails the procedure must be repeated until the lesson is learned. Force is the first inclination on the part of the feeder of an obstinate calf, but force really avails nothing; success comes with patience and practice.

WHOLE MILK PERIOD

In dairy herds it is impractical for cows to suckle their calves until weaning time. The milk from each cow is valuable and it is too abundant for one calf. At best the raising of calves by hand is difficult and many times unsuccessful. While dairymen can meet the obstacles by hand feeding, some of them use nurse cows exclusively. The time will probably come when nurse cows will be more widely used and there is every reason that they can be successful, but care will be required to select suitable cows and to allot each cow a sufficient number of calves so that none will overeat.

To raise the calves successfully by hand precautions are necessary. When the calf is taken from its dam at two days of age the amount of milk it first receives is very important. This amount should be limited and determined largely by the size of the calf. The tendency on the part of most feeders is to furnish too much milk in an effort to avoid hunger and to grow the calf out properly. Under natural conditions the calf takes its milk frequently and in small quantities. Too much milk over exerts the digestive tract and invariably results in scours. A safe rule is to feed one pound of milk for each ten pounds of live weight.

Table IV gives the birth weights of 149 calves that have been dropped at the College dairy farm.

TABLE IV. THE BIRTH WEIGHTS OF CALVES

Breed	Purebred calves lbs.	Grade calves lbs.
Ayrshire	66	60
Guernsey	64	65
Holstein	94	81
Jersey	54	54
All breeds	70	68

Five pounds of milk a day for the first two days is a good allowance for normal sized Jersey calves or other calves weighing about 50 pounds. It is even better in many cases to feed less than this amount. The larger Holstein calves may receive eight pounds and the calves between these extremes should be fed accordingly.

During this time the calves should be fed three times daily if at all possible. More frequent feedings are sometimes given but their increased advantage hardly offsets the greater labor required. The feeding three times a day should continue for three weeks, at which time two feeds a day should be sufficient.

After the calf has been on hand feeding for two days, the feeder may calculate how rapidly increase in amount of milk may be made. The increase should be made gradually. They should be designed so that the amount fed at first will be doubled in about four weeks. This will mean an increase of a quarter of a pound a day or, as is generally true in practice, a half pound every second day. Such details as one-fourth pound increases may appear superfluous to indifferent calf feeders but they are really important. To properly apportion milk for young calves guessing is not satisfactory and scales or a quart measure must be employed. Also the calves must be fed individually in pails; otherwise more greedy and faster calves will rob the others.

There are many points other than the amount of milk which must be observed in successful calf feeding. The milk should have a temperature of about 95° when fed. This is the temperature of fresh drawn milk and if the calves be fed immediately upon milking no heating is necessary except in quite cold weather. If the calf feeding be delayed too long after milking the milk should be heated either with live steam or a proper amount of hot water. The hot water entails difficulty unless its amount be carefully and regularly determined so that a variation in the fat percent of the milk can be avoided.

Variation in the temperature of the milk at different feeds is even more serious than allowing the milk to regularly be colder than 95°.

Another essential is that sour milk be avoided for it will induce scours more quickly than any other condition, especially with younger calves. For older calves sour milk may be used if it is not alternated with sweet milk but even then it is not so satisfactory as sweet milk.

The pails used for the calves should be washed and scalded after each feeding rather than allowed to remain in the manger or pen without attention. Regularity in time of feeding is also important for irregularity results in scours just as do uncleanness and variation in the amount, temperature or acidity of the milk.

After three weeks of whole milk feeding the calves will be taking from ten to twelve pounds, depending upon their size. Sixteen pounds is sufficient for the largest calves and they seldom need more than this amount. At this time twice a day feeding may be started. It is sometimes recommended that the change to twice a day feeding can be made while changing from whole to skim milk. Experience teaches, however, that twice a day feeding had better be started a few days before the skim milk is started so that the two changes may not become effective at the same time.

SKIMMILK PERIOD

Whole milk is expensive for calves and it may cost up to 30 or 40 cents a day for each calf. For this reason whole milk feeding must be terminated as soon as possible. The safe time for changing from whole milk varies with the vigor of the calves, and the care and success with which they have been attended.

Calves which receive whole milk for a long time are generally fatter and smoother than skim milk calves but many trials prove quite conclusively that they do not make superior cows. When calves are exceedingly well attended and fed for several months the feeding they receive following weaning is often such a change for them that they suffer a setback and are inferior to the cows which received skim milk in moderate amounts while young. Changing from whole to skim milk must proceed gradually and should require about ten days. It is well to displace one pound of whole milk each successive day with one pound of skim milk.

Calves may profitably be fed on 14 or 15 pounds of skim milk until they are seven or eight months old if the milk is available. The Wisconsin station has found that limiting the amount to ten pounds of skim milk daily could give very satisfactory gains. Calves will not suffer seriously if weaned at four months and some trials have shown satisfactory results when weaned entirely at six weeks of age.

Five and six months old calves will readily consume up to 30 pounds of skim milk daily. These large quantities give a bloom and condition not to be obtained in any other way but the practice is not recommended. First of all, it is a sort of pampering which does not have a beneficial effect later and it is generally extravagance in that such quantities are not utilized efficiently by the calves. If large quantities of skim milk are available they can be more profitably fed to a sufficient number of hogs.

In feeding freshly separated milk it is a good plan to remove the foam from the milk. This foam, if eaten by the calf, causes bloating and has been known to enter the nostrils and the lungs, thus causing death.

BUTTERMILK AND WHEY

If skim milk is not available, buttermilk or whey may be used with fairly satisfactory results. At the Kansas station buttermilk gave less returns than did skim milk for calves. The buttermilk is generally secured from creameries and this fact entails a risk that must be avoided. Creamery buttermilk often contains excessive amounts of wash water; it is often stored in very filthy tanks at the creamery, and is liable to be infected with tubercular bacilli or other pathogenic organisms unless properly pasteurized.

Whey is not to be strongly recommended for calves but it can be used with reasonable success. It must be remembered that whey lacks the protein found in buttermilk or skimmilk and when used must be supplemented with a large amount of protein in the grain allowed. The Wisconsin station fed calves whey with quite good success when the grain furnished consisted of 3 parts ground corn, 3 parts standard middlings and 4 parts linseed oilmeal along with a legume hay.

Caution must also be exercised that the whey comes from a source that is free from filth and contagion.

DRIED MILK PRODUCTS

Dried milk products have not been extensively used in calf feeding. These products have given quite satisfactory results, however, where they have been tried. Skimmilk powder, condensed buttermilk or semi-solid buttermilk and low grade malted milk have been used in experiments at the Minnesota and Washington stations with success. Mixing skimmilk powder with nine times its weight of water gives a product that cannot be distinguished from the fresh materials. Undoubtedly these substances have an adaptability for the calves in the herds from which whole milk is sold. They are entirely safe as a result of sterilization and drying and their only limitation is in the price which must be paid for them.

MILK SUPPLEMENTS AND SUBSTITUTES

A milk supplement is a concentrate or mixture of concentrates fed with skimmilk to take the place of butterfat. A milk substitute is a substance designed to entirely replace milk.

The supplements are almost universally used because of the common practice of rearing calves largely on skimmilk. The grains to be discussed later serve as supplements and they can be easily provided.

Where no skimmilk is available the use of substitutes generally causes difficulty. Possibly the dried products previously referred to will have wider use in the future and thus obviate the need for substitutes but at present they are not commonly employed. No substitutes have yet been discovered which can satisfactorily replace all the milk from the time the calf is born. Some milk is necessary for six or eight weeks. After this age the milk can be eliminated but even then it is doubtful if normal growth can be obtained. The milk has properties which cannot be secured from any other source. The proteins of milk are entirely adequate for growth; the proteins of the substitutes are not so efficient. Also the vitamins are supplied abundantly in the milk.

As substitutes many proprietary calf meals have been devised and can be purchased. They are generally quite satisfactory as substitutes but they are expensive and have not been found to be superior to home made calf meals. Many home made calf meals have been suggested, but most of these, however, require ingredients that are difficult to secure. Probably the simplest of these is one suggested by the Indiana Experiment Station as follows:

Equal parts of:	Hominy meal	Red dog flour
	Linseed oilmeal	Blood meal

It is recommended that one pound of this mixture be added to eight pounds of water and this amount be fed daily in the case of a calf six weeks old. A large part of the protein of this mixture is not digested, but the meal gives reasonably satisfactory results.



Fig. 3. A hand fed calf that shows no ill effects from its treatment. It is healthy vigorous and in good growing condition.

FEEDS

Grain.

It is desirable to induce the calves to eat grain at as early an age as possible. When only a few days old a small amount of grain can be furnished. If this grain be given immediately following the milk the calves will generally start using it. Feeding this grain after the milk helps also to keep the calves from sucking each other. It makes little difference which grains are used at this time. Corn or oats alone, either whole or ground, or a regular calf mixture is satisfactory. Calves relish whole corn and oats more than the ground grains. Bran and oilmeal are also desirable.

By gradually teaching the young calf to eat grains it will be consuming about one quarter pound per day at three or four weeks of age when the skim milk feeding is started. At this time a grain mixture is most practical. A good grain mixture is 3 parts corn, 3 parts oats, 3 parts bran and 1 part oilmeal. Modifying this mixture to a great extent can give just as satisfactory results. Even tho the calves prefer the whole grains it is difficult to get a uniform mixture with them and grinding is generally practical. Corn is of advantage in that it is palatable and its high fat content partly compensates for the butterfat removed in separation. The bran is desirable for its phosphorus content, involved in building the skeletal tissue, its palatability and its laxative effect. The oilmeal contains abundant protein and it is also laxative.

Cottonseed meal should not be fed to young calves.

The calves should be given only as much grain as they will readily consume. It is not a good plan to leave grain in the mangers after they are thru eating. Such grain becomes wet and soiled and the calves will not eat as much as if they were supplied with fresh feeds each time.

Hay.

Calves will start eating hay in appreciable quantity when two weeks old. From this time on their consumption of hay increases and it should be provided all the time. The importance of hay in the ration for calves has been shown at the Iowa station. Two calves were fed milk and alfalfa hay as the only feeds for six months. These calves were normal and healthy thruout the period while other calves fed milk alone or milk and grain developed many abnormalities of skeleton and were nearly dead in seven or eight months. Then alfalfa hay was furnished these calves and they showed rapid recovery in health and appearance. The value of this alfalfa hay undoubtedly lay in its bulkiness and in its supply of calcium so necessary for the skeletal development of these growing animals.

The choice of hay for young calves is a frequent problem. Alfalfa hay is palatable and furnishes a liberal supply of protein and calcium. In many places it constitutes the only hay on the farm and calves have been raised successfully on alfalfa. However, the use of alfalfa may cause trouble, and some cases of scours can be attributed to its use. Also the high protein and ash content may cause urinary troubles. If one has used alfalfa for young calves and has had favorable results he would better continue its use. It is well to limit its use for two or three months until danger of scours is past and during this time mixed hay, timothy or oat hay can be furnished. Red clover and alsike clover have given good results in calf feeding.

Silage.

Practical feeders differ as to the use of silage for calves. Most of them feed silage even to the very young calves. At times calves have been found to develop scours if silage were supplied. The fact remains, however, that it is widely used and generally gives satisfaction. At the Iowa station calves which had received silage at six weeks of age were found to do better than those without silage; they grew faster and the cost of gains was lower. In using silage care must be exercised to exclude any frozen or spoiled chunks and to clean the mangers of any refused silage.

Roots.

Roots are a very desirable feed for calves. When sliced they were found at the Iowa station to give slightly larger gains than silage but were not so economical. No scouring resulted from their use, tho they were frequently frozen when fed or had softened as a result of thawing.

Pasture.

There is very little value in pasture for calves under six months of age, provided they are properly fed otherwise. When on pasture the calves do get exercise, which is desirable, and they are generally more comfortable than in most calf pens, but they can secure these advantages in a dry lot. Pasture often causes paunchiness in young calves. Fall calves can go to pasture the following spring, but spring calves will derive no value from the pasture their first summer. Such calves can be better protected from the heat and flies in a good barn.

Water and Salt.

Water is necessary for calves even tho they are quite young and are on a milk ration. It is probably desirable to have water before them at all times, but watering in pails twice a day, or even once, has been found to give entirely satisfactory results. When the calves are watered in pails in winter it is well to supply warmed water.

Salt should be furnished at will as soon as the calves start to eat grain and hay. In connection with salt the use of so-called mineral supplements may be considered. There is no doubt that calves demand considerable quantities of calcium and phosphorus for their

bone growth. However, if calves be fed liberal quantities of milk they get a sufficient supply of these minerals. Alfalfa hay provides an abundance of calcium, and the grains, especially bran or middlings, furnish phosphorus plentifully. From this it is evident that the purchase of supplemental minerals or commercial mineral mixtures for calves is unnecessary.

SELF-FEEDERS FOR DAIRY CALVES

The self-feeder for dairy calves has never been employed to any great extent. It is successful for fattening hogs and steers and this has suggested to some the possibility of its use in dairy herds. A few experiments in self-feeding grains have been conducted and they show quite favorable results, but on the whole there is little value in self feeding over hand feeding. In a trial at the Iowa station calves were given access to six different concentrates in the feeder until two years old. These concentrates were shelled corn, cracked corn, whole oats, ground oats, bran and oilmeal. The heifers on this trial grew exceedingly well and were larger and fatter at all times than heifers normally are, their weight being 30 percent greater at two years of age. One of them became so fat that difficulty in getting her safe in calf was attributed to her condition. Upon her removal from the self-feeder and lowering her condition, she was safely bred. None of the heifers developed into a cow that can be considered superior to those that were hand fed. The feed cost of growing the self-fed heifers was about the same as the hand fed heifers and the labor required was about the same with both methods.

Some interesting facts are that calves and heifers are able to select feeds so that their ration is well balanced. They do show a decided preference when young for the whole corn and oats rather than for the ground grains, they also showed a decided liking for oilmeal and as a result their feed was unnecessarily expensive.

In another trial calves had access to a grain mixture in a feeder. These calves ate the grain in large quantities and grew well but no advantages could be ascribed to this method of feeding.

THE GROWING HEIFER

When the calves are five or six months old they are generally weaned. At this time the bull calves should be separated for accidental breeding might otherwise result. After the heifers are weaned the common tendency is to neglect them for they have passed the calf stage and they become old enough to partly rough it for themselves. They cannot entirely subsist without care and any neglect will result in stunted cows with limited production.

The desirability of properly attending heifers is well demonstrated in some material obtained in the experiment with scrub cows at the Iowa station previously referred to. To start this experiment fourteen scrub females were purchased. Seven of these were young heifers, two were four years old and five were mature on arrival at the College farm. Table V gives the production records of the scrubs of these different ages.

TABLE V. AVERAGE YEARLY PRODUCTION OF SCRUB COWS

	Average production		Percent increase over mature cows	
	Milk lbs.	Fat lbs.	Milk lbs.	Fat lbs.
Mature	3169	154
Four-year olds	3598	166	14	8
Heifers	4036	191	27	24

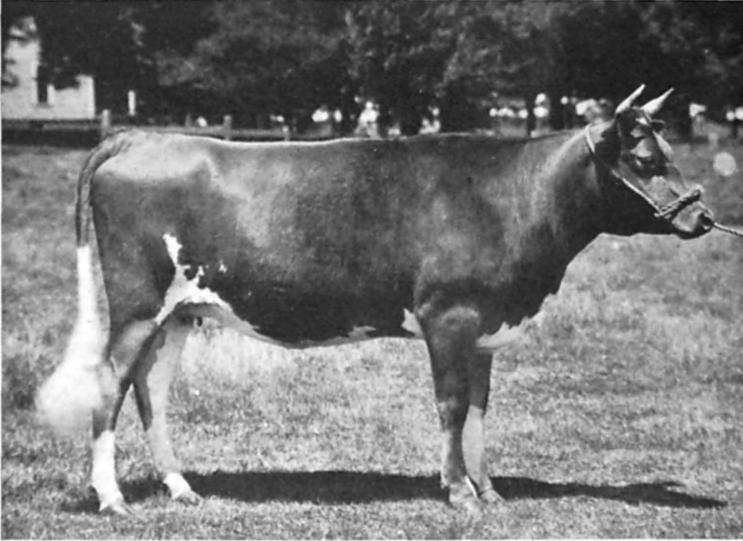


Fig. 4. A thrifty, well grown heifer. She was two years old when photographed and freshened two months later.

The animals which arrived at the farm as heifers carried the same breeding as the others. They were, however, subjected to good care and feed earlier in their life and they developed into better cows. They produced 27 percent more milk and 24 percent more fat each year than did the cows that were mature upon arrival. Even the cows that were four years old showed some improvement over the older ones.

Fall calves can be weaned the next spring and turned on pasture. Very little difficulty need be experienced in taking them thru this first summer but they must be watched. During this summer they should have some grain to supplement the pasture. Many men hesitate to feed grain to heifers at this time but grain feeding is profitable unless carried to an extreme. The capacity of these heifers is yet limited and they can not eat enough pasture to supply their needs. If they are in a pasture with the cows, a creep can be provided so that they can go to a manger at feeding time. A very good grain mixture at this time is one containing equal parts of cracked corn and ground oats. These feeds are generally cheap and they can be profitably fed in amounts as large as will be cleaned up. Another good plan is to have a rack of legume hay accessible during all of the summer season. Great quantities of hay will be consumed to the advantage of the heifers.

In the fall the heifers should be taken into the barn early. It is not a good plan to wait until snow covers the pasture before starting the winter feed. If the heifers have been well attended during the summer they will go into the winter in good shape and they must be kept vigorous and growing. The change need not be harmful unless the heifers have suffered too long on frosted and dried pasture before the winter feeding starts. The object in feeding these yearling heifers is to develop them into large vigorous cows with

ample capacity and constitution. Pampering the heifers is not good and they can stand pretty cold weather in an open shed if properly attended to. Corn silage should be fed in large amounts. They will eat 15 or 20 pounds a day. No other roughage equals alfalfa hay and it can be fed in amounts up to 10 pounds daily. The heifers should have all the silage and alfalfa hay they will eat. If they do well and continue to grow they do not need grain till along in January or February. In January they will be bred for fall freshening as two-year-olds and four or five pounds of grain can then be given daily. With silage and alfalfa hay, corn and oats make a good mixture. Oilmeal improves the mixture but is too costly unless the heifers are in poor condition. Grain is well used on these heifers all winter unless they are quite fat.

If silage is not available more care must be exercised in the grain feeding. Likewise, if corn fodder, stover, or timothy hay be fed, the grain mixture must be cracked corn, ground oats and oilmeal in the ratio of 3:3:1.

During the following summer the heifers will do well on pasture alone during May and June. When the hot weather comes they will need grain. A good plan is to take them into their stanchion and feed grain and get them accustomed to the barn before they freshen. If they are due to freshen in September or October, they should receive large quantities of grain. The mixture recommended of corn, oats and oilmeal is very good and it is profitable to feed this mixture up to six or eight pounds a day.

Spring calves cause more difficulty than fall calves. They generally suffer from heat and flies during their first summer. Then weaning them and immediately putting them on winter feed often causes a setback. They will have to receive grain all the first winter for they cannot consume enough roughage to meet their needs. After this first winter they can go onto grass and be fed the same as the fall calves.

The calf barn should be clean, well lighted, well ventilated and warm. Ordinarily the calf pens are in the main milking barn and even in the winter time they will be sufficiently warm. Very young calves cannot stand too cold a barn but as long as the manure is not frozen in the mornings the calves will not chill. If the calves get too cold, blankets can be made of burlap and they can be kept comfortable. Poor ventilation is more harmful than cold in a barn.

Individual pens for each calf are desirable but not indispensable. They cost more and require more time but serve a good purpose in calf raising. They keep the calves from sucking each other; they make it possible to control the amount of feed each calf receives and they help in checking disease. If individual pens are not available, stanchions should be installed for use at feeding time. After the calves are weaned, an open shed will be sufficient even in cold weather. This open shed gives ventilation and it results in more vigorous heifers than could be secured if they were tightly housed all winter.

DEHORNING

Calves should be dehorned when about a week old. The best way is to use caustic potash for this purpose. It is safe and far more humane than waiting several months and using a saw or large de-horning clippers. When the calf is a week old the horns can be detected as small prominences covered with hair. To remove these scurs, clip the hairs over and around them, then take a stick of caustic potash, moisten it and rub vigorously on the horn till it gets red and

the blood appears about to ooze thru. This is a very sure method and is not very painful. Two precautions are necessary in this procedure. The stick of potash must be wrapped at one end so the operator's hands will not be injured and too much water must be avoided so that it will not run down the face of the calf and remove the hair nor get into the eyes. Dehorning detracts from the appearance of a herd to a certain extent but horned cows can do a great deal of damage to one another and a dehorned herd is more easily and satisfactorily handled.

REMOVING EXTRA TEATS

Rudimentary teats often appear on the udders of the heifers. These teats are generally located behind and above the main teats tho they may appear as branches of a main teat or elsewhere on the udder. They generally secrete no milk but at times they do secrete and in certain places near the main teats they may cause annoyance in leaking milk. At best they are unsightly and may detract from the appearance of the cow's udder. They can be easily removed if the heifer is less than a year old. If she is more than a year old, it is probably best not to attempt to remove them.

To remove these teats rubber bands, threads or scissors are used. The latter plan gives good results. It is best to throw the heifer, apply iodine or any disinfectant to the teat and cut it off quickly with sharp scissors. The operation is not painful and seldom bleeds. Care must be exercised, however, in avoiding an infection from the scissors. There is difficulty on young heifers when all the teats are small in distinguishing rudimentary teats from the main ones. The disastrous results of removing the wrong teats are apparent.

DISEASES OF CALVES*

Calves, especially in the early stages of their development, are subject to a few common diseases. Some of these diseases are accompanied by high mortality, while others, tho not responsible for the deaths of so many calves, undoubtedly lead to a considerable amount of unthriftiness on the part of calves and consequently to a considerable financial loss to the farmer.

Prevention is undoubtedly the best treatment for calf troubles and with careful feeding and management considerably less trouble should be experienced with the more common calf diseases. When disease does make its appearance, "cure alls" should be carefully avoided and if the trouble cannot be treated successfully a competent veterinarian should be called. The following suggestions, whose value has been proven by practical experience, are offered.

Constipation. (Retention of meconium). The newly born calf requires the colostrum, or first milk, of its dam to assist in getting the bowels into good working order. Occasionally when the calf fails to receive the colostrum, the bowels remain inactive and the meconium is retained. Enemas consisting of a watery solution of soda or one-half teaspoonful of salt in one quart of water injected with a syringe or allowed to gravitate in thru a hose and funnel, (or an ordinary fountain syringe) relieve this condition. Soap and water irritants should be avoided. In older calves constipation is occasioned by improper feeding, such as lack of sufficient roughages. One of the safest treatments for constipation is the administration of castor oil in doses of one to three ounces depending on the size and age of the calf.

*This section prepared by C. H. Covault, Assistant Professor of Veterinary Medicine.

Indigestion. Digestive derangements in calves may be due to a variety of causes. Among the more common are constipation, over-feeding, irregularity of feeding, feeding dirty milk or other feeds that are in bad condition, feeding from filthy containers, too rapid changes in feeds, or chills brought on by draughts or by damp, cold floors. The cause of the trouble should be immediately located and remedied and in addition the feed should be cut down and castor oil administered. Where abnormal fermentations due to dirty milk are the cause of the trouble, lime water may also be of value.

Bloat. This form of indigestion may be caused by abnormal fermentation in the stomach brought about by dirty milk and also by the calves sucking each other and thus drawing air into the stomach, and also the calves swallowing the foam which is sometimes found on separated milk. The cause should be eliminated and castor oil administered. Sometimes a teaspoonful of ground Jamaica ginger given in hot water will be valuable in giving relief if the bloat is severe enough to cause colic.

Scours or Dysentery. Acute diarrhoea resulting from catarrh of the digestive tract caused by various forms of bacteria is more common among calves than among other new-born animals. Some of these various forms of diarrhoea are regarded by herdsmen as white scours. Overfeeding probably predisposes to this trouble. This rarely occurs when calves are nursing as the nourishment is taken frequently and in smaller quantities. Fermented or partially soured milk, feeding from dirty pails and other unsanitary conditions are all contributing causes.

Common scours are all too prevalent among calves and can be prevented by proper care and feeding. The causes previously outlined predispose calves to the bacterial infection which is associated usually with dysentery. Milk too rich in butterfat may also be a contributing factor. When calves are comfortably housed and regularly, not only in regard to the time of feeding but also with regard to the quantity and quality of the milk and its temperature and cleanliness, is observed there will be little trouble from common scours. When this disease makes its appearance the milk ration should be cut down at least one-half. This relieves the digestive system and it can be assisted in freeing itself of obnoxious materials by the administration of one to three ounces of castor oil. Treatment with formalin also gives beneficial results. A stock solution of one part of commercial formalin to 31 parts of water is made and a teaspoonful of this is added to each pound of milk fed. When the trouble is under control the calf should be brought slowly back onto full feed. Where the calf is very weak and will not drink it can be kept nourished by the occasional administration of an egg. The shell of the egg is cracked and the egg, shell and all, put well back in the calf's mouth which is held closed on the egg so that he will break it up and swallow it.

The stable or stall in which the calf is dropped should be thoroly cleaned and disinfected before the birth of the calf, and after the calf is dropped the stump of the umbilical cord should be thoroly cleansed with a five percent solution of creolin and then painted with one part of tincture of iodine in two parts of glycerin. This treatment should be repeated once each day for four or five days. It is believed that this method of treatment will largely prevent a more serious form of dysentery, known to herdsmen as white scours.

If the disease has made its appearance a cathartic of two ounces of castor or four ounces of raw linseed oil should be given. Following this six grains of calomel may be given twice daily or the following may be used:

Salol	50 grains
Bismuth subnitrate	1½ drams
Sodium bicarbonate	2 drams

Make five powders and give one in milk every six hours. This remedial treatment is equally beneficial for the milder forms of scours.

Hemorrhagic Septicemia and Blackleg. These two diseases are caused by germs and in some cases it is quite difficult to distinguish between them, even when laboratory facilities for diagnostic purposes are available. A vaccine now is being used for each one of them with satisfactory results. However, the vaccines are specific and the one is not effective in preventing the other disease, so that a positive diagnosis must be made before any vaccine is applied, if satisfactory results are to be expected. At the outbreak of either disease the calves should be put in charge of a veterinarian as it is only with expert care that a cure can be accomplished.

Colds. Colds are frequent among calves and tho they may not cause many deaths they retard the growth of the calves and make them not only poorer in condition and stunted but also more expensive. Well ventilated, dry barns and good bedding will prevent colds and if contracted they can be cured by giving the calf a little extra attention, blanketing if necessary, feeding warm milk and water and preventing draughts.

Pneumonia. Pneumonia is commonly brought on by chilling and should be treated by a veterinarian. The animal should be kept in a well ventilated, bright barn which should be cool rather than warm but not draughty. The animal should be kept warm with a blanket. The bowels should be kept open. Further treatment should be prescribed by a competent veterinarian.

Mange. Many young animals become affected with mange in the winter time. The loss of hair is frequently confined to the neck and the root of the tail but it may become generalized. Treatment consists of washing with coal tar dip at intervals of about ten days. Petrolatum oil may also be used.

Ring Worm. Ring worm is caused by a fungus and in calves appears most frequently about the head, especially the eyes and along the neck. The disease may be prevented from spreading by keeping the healthy and infested animals separated and thoroly cleansing the stalls. The crusts should be removed by washing with soap and water after which the diseased skin may be treated with sulphur-iodide ointment well rubbed in, or tincture of iodine and iron, equal parts. Care should be exercised to see that this does not get into the eyes of the animal.

Lice. Lice are most prevalent on cattle in winter and may become so abundant as to cause the animal great discomfort and consequent loss of condition. They are more common in stables where sanitation is lacking and may be seen along the neck and back of the animals. Calves infected with lice generally appear to be unthrifty and are poor doers. Treatment may be carried out by hand applications,

spraying or dipping, or the animals may be washed with a good coal tar solution, and the treatment repeated again in about two weeks. If dipping is deemed expedient, Farmer's Bulletin 909 of the U. S. Department of Agriculture will prove helpful.

Flies. Flies cause considerable annoyance to young calves and it will usually be found convenient to spray the small ones in hot weather. A good fly spray can be made from:

4½ quarts of coal tar dip
4½ quarts fish oil
3 quarts coal oil
3 quarts whale oil
1½ quarts oil of tar

Dissolve three pounds laundry soap in water, add the ingredients of the spray and bring the whole up to 30 gallons with luke warm soft water. This spray will keep off the flies and prevent the coats of the animals from becoming harsh.

