

EXPERIMENT STATION  
OF THE  
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**FARM DEPARTMENT.**

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**SKIM MILK CALVES.**

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THE greatest drawback to the dairy industry in Kansas at the present time is the skim milk calf. Well-bred steer calves allowed to run with their dams until weaning time sell readily at twenty dollars to twenty-five dollars each, and the demand is greater than the supply. No labor is needed to raise a calf in this way, and the only expense is the cost of keeping the cow a year. When a cow grazes on prairie pasture through the summer and is fed through the winter on sorghum hay, stalk fields, and similar cheap feeds, this method of calf raising gives large returns with little labor and small expense.

A calf raised on skim milk needs care two to three times a day, although the time needed is short, and, with the usual method of handling, is a runt—thin, ill shaped, unhealthy looking, and sells for \$7 to \$12. The difference in value between such a calf and one allowed to run with the cow reduces the profits made from milking, and on this account there has been a large decrease in Kansas during the past eighteen months in the number of cows milked.

At the same time, there are Kansas farmers who raise calves on skim milk worth as much at weaning time as calves that run with their dams, and the agriculturist of this Station raised for years pure-bred calves on skim milk that were in condition for the show ring when six months old, and that sold at \$75 to \$125 each.

If a majority of the stockmen of this state could, without much expense for time, raise calves on skim milk worth as much, or nearly as much, at weaning time as calves following the cow, the dairy products of the state would soon be doubled and trebled. The experiments recorded in this bulletin were made to show how this can be done.

#### PLAN OF THE EXPERIMENT.

Thirteen calves from the College herd of scrub cows were used in this experiment. The plan was to use skim milk, and feed with it some grain to take the place of the butter-fat that had been removed for butter-making. The calves were divided into three groups, all having skim milk, and one lot fed Kafir-corn meal, one lot Kafir-corn meal and flaxseed meal, and one lot Kafir-corn meal and Blachford's calf meal.

Kafir-corn meal was selected because it can be grown cheaply on every Kansas farm; it is rich in starch, the material needed to take the place of the butter-fat, and it is a constipating feed. On this account, we thought it might overcome the loosening effect of the skim milk. Flaxseed meal was used because it is usually recommended by dairy writers as the best feed to give with skim milk. Blachford's calf meal was used because it was being extensively advertised at the time, and has been used for years by many successful calf feeders.

A test was also made with each kind of grain of feeding skim milk from the creamery and from the hand separator. The creamery skim milk used was sterilized skim milk obtained six times a week from the Manhattan creamery, and was the same quality as that supplied to their other patrons. The milk was sterilized by a Jensen sterilizer, in which the skim milk passes over a pipe from which steam is escaping from many holes. This method of sterilizing adds ten to twelve per cent. of water to the skim milk. The hand-separator skim milk was from milk separated as soon as drawn from our cows, and fed while warm to the calves.

The dates of birth of the calves fed in this experiment are as follows: December 4 and 28, 1898, and February 17 and 23, March 13, 14, 25, 28, and 30, and April 10, 15, 16, and 21, 1899. This gave both winter and spring calves for the trial.

J. A. Conover, College herdsman, fed the calves in this experiment, and the good gains made are due to his skill as a feeder.

#### FEED AND CARE OF THE CALVES.

The calf was allowed to run with the cow until the cow's udder became all right and her milk good—usually four to five days. The calf was then taken from the cow and left without feed for twenty-four

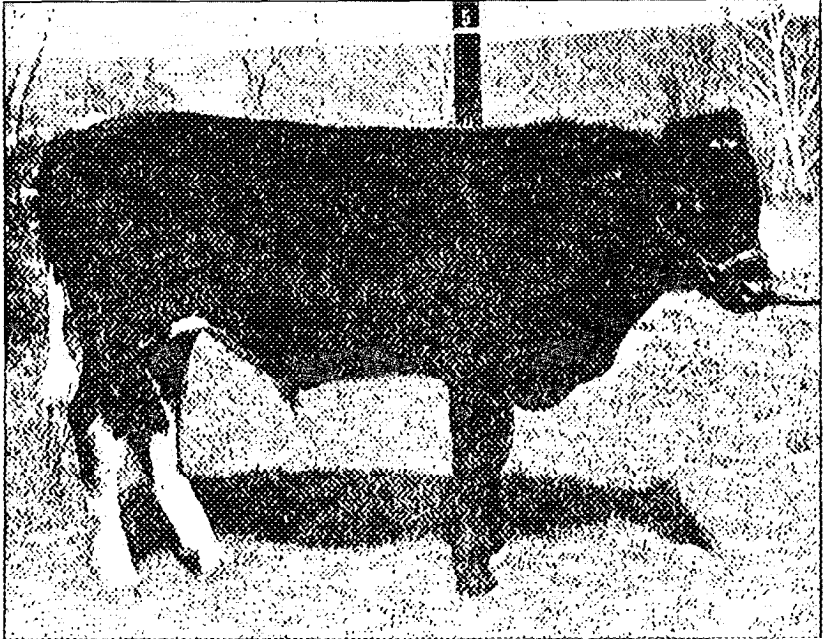


PLATE I. Skim Milk Steer.

hours, when it became hungry enough to be easily taught to drink. The first week a calf was given ten pounds of warm whole milk a day: four pounds in the morning, two pounds at noon, and four pounds at night. The second week the amount of milk fed was about the same, but it was given in two feeds, morning and night. In two or three weeks after being taken from the cow the calf was gradually put on skim milk.

At the first feed of skim milk, one pound (one pint) of skim milk was given; at the second feed, one and one-half pounds, and at the third, two pounds. As the skim milk was increased the whole milk was decreased, until the entire feed became skim milk, the change being made at the rate of half a pound per feed. The amount of skim milk fed was slowly increased as the calf could safely take it. At the end of a month from the time the calf was taken from the cow the daily amount given was usually from twelve to fourteen pounds per calf; at two months, eighteen pounds, and finally reached twenty-two to twenty-four pounds per day per calf.

A quart weighs a little over two pounds, so that the number of quarts fed was only half the number of pounds. This will seem a small amount to many feeders, but it was all that the calves could eat and thrive, and the gains made show that the quantity was sufficient.

Four of the calves were fed flaxseed meal. The meal was placed in a tin pail, boiling water poured over it, and the pail closely covered to keep in the steam. A jelly was formed, just enough water being used to do this. The jelly was mixed with the skim milk at the time of feeding. A tablespoonful of flaxseed per calf for a feed was used at first, and this was gradually increased to half a pound per day per head when the calves were three to four months old.

Four of the calves were fed Blachford's calf meal. The meal was mixed with water to form a gruel, according to directions sent with the feed, and the gruel was mixed with the skim milk. The amounts fed were the same as those for flaxseed meal.

All calves were fed Kafir-corn meal. It was fed DRY in boxes. The calves began to eat this meal when ten days to two weeks old. At first a handful was put in a calf's mouth as soon as he had finished drinking his milk, and he soon learned to eat with a relish from the feed-boxes. Never mix Kafir-corn meal or other grain with the milk. The calves were fed what meal they would eat up clean. Calves two months old would eat two pounds each of Kafir-corn meal a day.

When ten days to two weeks old the calves began to nibble hay, and were thereafter fed all they would eat, the hay being given fresh twice daily. If calves are troubled with scours prairie hay is best; if not, alfalfa is the best, and clover hay second. Before turning the calves on pasture we cut green alfalfa and fed it to them, beginning with a small quantity, and slowly increasing until the calves had all they would eat. A sudden change from hay to grass is almost sure to bring the scours.

All milk was fed warm, 95 to 100 degrees, and a thermometer was used frequently, to be sure that the temperature was right. The milk was fed sweet. The sterilized milk came from the factory very hot. At night that wanted for the evening's feed was cooled to blood heat and fed. The rest was cooled to the temperature of our well-water, fifty-eight to sixty degrees, and held at this temperature until fed, when it was warmed to blood heat. With few exceptions, the skim milk treated in this way would keep sweet from Saturday until Monday morning, and there was no difficulty in keeping it sweet for use through the week.

The milk was fed in tin pails, and these and the cans in which the skim milk was kept were thoroughly washed and scalded each time after using. They were then set in the sun when possible. The calves were kept from sucking each others' ears by being kept separate for half an hour after feeding, until their mouths became dry. This was done by tying them up. We are now doing it more conveniently and with less labor by putting them in stanchions, as shown in the cut.

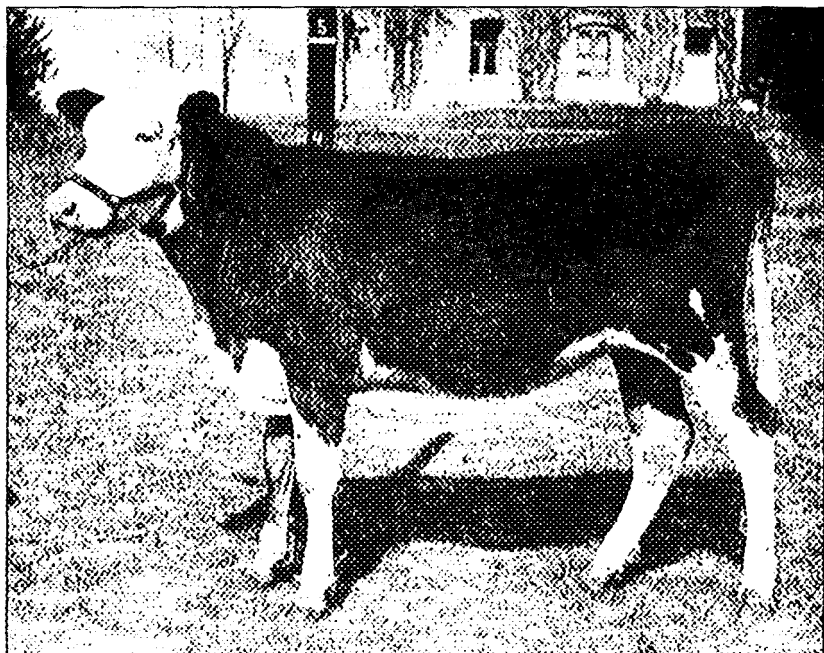


PLATE II. Skim Milk Heifer.

Fresh water was kept within reach of the calves all the time, and it was surprising to find how many times a day a calf would take a sip. The thirteen calves, when one to three months old, drank in seven days in June 868 pounds of water— $9\frac{1}{2}$  pounds per head a day. The calves were watered by attaching a Dewey hog-waterer to a barrel. This waterer kept only a small quantity before them, and, as soon as a drink was taken, fresh water flowed in, giving the calves fresh, clean water at all times. The barrel was kept covered.

As soon as the calves were taken from the cows they were dehorned. The hair on the place where the horn would appear was clipped off with shears, the end of a stick of caustic potash was wet in cold water, and the spot over the horn rubbed with it until the skin appeared raw. A light scab formed, soon to disappear, and the growth of the horn was prevented.

The steer calves were fed all the Kafir-corn they would eat. This was soon found to be too fattening for the heifers intended for dairy use, and their grain ration was changed to bran and oats, fed in such limited quantities as to keep them thrifty and growing, but not to make them fat.

The calves were sheltered in cold weather between two corn-cribs,

the space roofed, and they had an open shed in their pasture in summer where they could go for shade. The shelter and yards used by the calves were kept clean and lime was frequently sprinkled around them. The calves were closely watched, and if one began to scour his feed was at once cut down and he was given from one to two ounces of castor-oil. If this was not sufficient, ten to fifteen drops of laudanum a day were given in the milk, and usually the trouble stopped in two or three days. The calves were inoculated when two to four months old to prevent blackleg. They were treated kindly at all times and became pets.

#### RESULTS TO WEANING TIME.

We stopped feeding skim milk to the calves when they were about six months old. Nine heifer calves weighed at weaning an average of 375 pounds each, and four steer calves at weaning weighed an average of 383 pounds each. All were in good, thrifty condition, in good shape to go into the feed lots, and gave no indication of having been "hand fed."

Six calves were fed creamery skim milk, and made an average gain while on this feed of 250 pounds each. Seven calves were fed skim milk separated by the hand separator as soon as drawn from the cow and fed while yet warm. The calves fed hand-separator skim milk made an average gain while on this feed of 251 pounds each. The calves fed creamery skim milk ate an average of 2497 pounds each, while the calves fed milk from the hand separator consumed an average of 2504 pounds each. This is a rather remarkable showing, as the creamery skim milk contained ten to twelve per cent. of water added in the process of sterilizing.

The calves at first showed a strong dislike for the sterilized milk on account of its peculiar odor, but they soon became accustomed to this odor, and then drank with a relish. When the calves were first put on skim milk, those fed that from the hand separator were troubled more with scours than those having the sterilized creamery milk. Scalding the skim milk in sterilizing helped to overcome the tendency to produce scours. After a few weeks' feeding, no difference could be detected in the thrift of the calves having the different kinds of milk. So far as the growth of calves is concerned, it will not pay to buy a hand separator when good sterilized milk is sent out from the creamery.

Five calves which had nothing mixed with their skim milk gained 1.82 pounds each per day; four calves which had Blachford's calf meal mixed with their skim milk gained an average of 1.9 pounds each per day, and four calves which had flaxseed-meal jelly mixed with their milk gained an average of 1.55 pounds per day. Blachford's



PLATE III. Skim Milk Steers. Average weight, 724 pounds, at one year old.

calf meal cost \$70 per ton, and flaxseed meal \$125 per ton. Neither paid, and this experiment shows that such expensive feeds added to skim milk are not only not profitable, but are useless, practically having no effect on the gain. All the calves were fed dry grain and hay separately from the skim milk, and were pastured during the warm months.

#### COST TO WEANING.

The thirteen calves, while on skim milk, gained 3260 pounds. They were fed: Skim milk, 32,511 pounds; Kafir-corn meal, 3476 pounds; corn-meal, 1872 pounds; soy-bean meal, 109 pounds; oil-meal, 74 pounds; grounds oats, 148 pounds; bran, 536 pounds; Blachford's calf meal, 136 pounds; flaxseed meal, 78 pounds; mixed hay, 466 pounds, and green alfalfa, 407 pounds. Kafir-corn meal was fed to all the calves for the first month, as we found it superior to any other grain. After the calves became older, corn-meal was used whenever it was more convenient to get it than the Kafir-corn. As before stated, we found that the Kafir-corn meal caused too great a gain with the heifer calves, and we were obliged to substitute bran, soy-bean and oil-meals, ground oats, and the other feeds mentioned.

Our record of gains made and feed consumed shows that, to make 100 pounds of gain in this experiment, there was fed: Skim milk, 997 pounds; grain, 197 pounds; hay, 14 pounds; green alfalfa, 12 pounds. Valuing skim milk at fifteen cents per hundred pounds, grain at one-half cent a pound, hay at three dollars a ton, and green alfalfa at one dollar a ton, reasonable prices on Kansas farms, 100 pounds of gain on these skim milk calves cost \$2.50. The thirteen calves, while on skim milk, made an average daily gain of 22.8 pounds. It required two hours a day to feed and care for them. At twelve and one-half cents per hour, this would cost twenty-five cents a day. This would make the cost of labor \$1.10 per hundred pounds gain, and the total cost of feed and labor \$3.60 per hundred pounds gain.

Did it pay us to milk? The calves made as good gains as they would if we had let them run with the cows. The \$3.60, cost of 100 pounds gain, was the additional cost caused by milking, and must be deducted from the amount received from the sale of the milk. Nine hundred and ninety-seven pounds of skim milk were required for each 100 pounds of gain. We sold 45.7 pounds of butter-fat from the whole milk needed to make this amount of skim milk. The creamery paid an average of 15 cents a pound for the butter-fat, making the 45.7 pounds worth \$6.86. Deducting \$3.60 from this, we have \$3.26 left as the returns for the labor of milking and delivering 1100 pounds of milk to the creamery. If all the calves had been intended for beef, we could have fed Kafir-corn as the only grain and increased the gain.



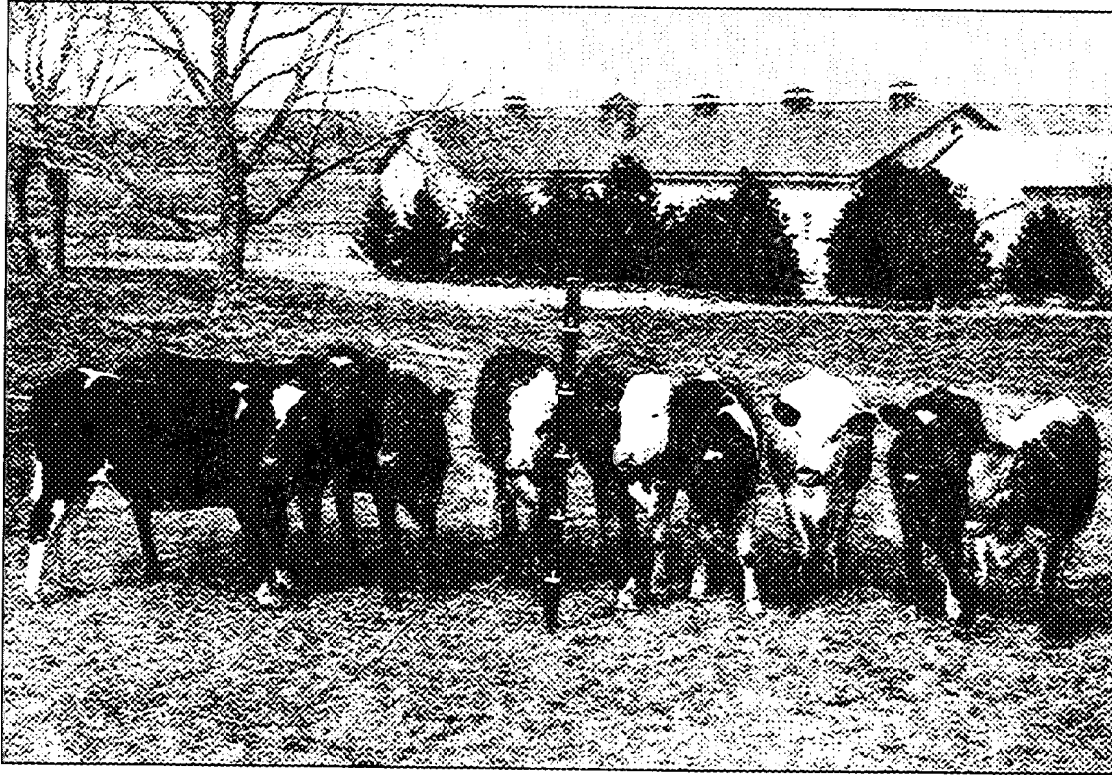


PLATE IV. Skim Milk Heifers, raised for the Dairy. Average weight, 564 pounds, at one year old.

## AS YEARLINGS.

The four steer calves weighed an average of 724 pounds each when one year old, and the nine heifer calves weighed an average of 564 pounds each at one year old. The heaviest steer weighed 810 pounds. These calves were all from scrub cows, and for this class of cattle show good weights.

The calves were weaned when six months old. From weaning to a year old the steers made an average gain of 341 pounds each, an average of 1.89 pounds each per day. The steers were not pushed, but were fed to make good growth. The feed was Kafir-corn grain, corn-fodder, sorghum hay, and alfalfa hay. The heifers were intended for the dairy. They were given the same kinds of feed as the steers, but much less in quantity, as we wanted to keep them from the habit of putting on fat. The nine heifers made an average gain of 189 pounds each from weaning time until a year old, an average of one pound of gain a day each.

The calves were in good condition to go into the feed lots when weaned, and at that time we were offered twenty to twenty-two dollars per head for the steers. The gains made after weaning are greater than those usually made after weaning by calves that have run with the cows. The skim milk calves have the advantage that at weaning time they are already on feed, and do not suffer the check that comes when a six-months'-old calf is weaned and put on dry feed.

In the six months after weaning, the four steers were fed an average per steer of Kafir-corn meal, 677 pounds; corn-meal, 209 pounds; soy-bean meal, 90 pounds; oil-meal, 15 pounds; bran, 41 pounds; corn-and-cob meal, 347 pounds; tame hay, 425 pounds; alfalfa hay, 694 pounds; Kafir-corn fodder, 832 pounds; green sorghum, 21 pounds.

In the six months after weaning, the nine heifers were fed an average each of Kafir-corn meal, 185 pounds; corn-meal, 71 pounds; soy-bean meal, 76 pounds; oil-meal, 7 pounds; bran, 130 pounds; corn-and-cob meal, 108 pounds; wheat, 20 pounds; cow-pea meal, 10 pounds; tame hay, 402 pounds; alfalfa hay, 432 pounds; Kafir-corn fodder, 985 pounds; green sorghum, 27 pounds.

## CREAMERY SKIM MILK.

In our trial creamery skim milk gave a little better returns than that from the hand separator. This is not generally the case, and a large number of creamery patrons claim that skim milk from the creamery is often unfit to feed by the time that it has reached the farm, and that, even when it is not spoiled, it is difficult to keep it sweet until morning or over Sunday. Our creamery skim milk was secured from the Manhattan creamery and was sterilized at the creamery as fast as separated.



PLATE V. The thirteen Skim Milk Calves fed in this experiment.

Skim milk sterilized can be kept sweet forty-eight hours in the most unfavorable weather with the care that can be afforded by every dairyman. To become sterilized, milk must be heated to boiling, 212 degrees. If heated to a lower temperature the skim milk sours quickly, in many cases apparently more quickly than if not heated at all. In several skimming stations in the state we found an attempt made to sterilize the skim milk with a jet pump, this being used to elevate the skim milk from the separator to the skim milk tank. In every case the milk soured quickly, the method was abandoned, and sterilizing declared to be a failure. The trouble was that the jet pump did not heat the milk hot enough to sterilize it.

Every creamery patron should insist that the creamery should sterilize the skim milk. After patrons have induced their creamery man to sterilize the skim milk, they usually in a week or two want the sterilizer taken out, as, on account of the peculiar cooked odor, calves do not like sterilized milk at first. The calves soon learn to like it and the creamery man should keep on sterilizing.

Sterilizing the skim milk has many advantages besides improving the keeping quality of the milk. The milk taken to the creamery must be pure and sweet or the skim milk cannot be sterilized. A single can of sour milk in the sterilizing vat will spoil all the milk put in that vat during a run. For this reason, where skim milk is sterilized, the patrons must deliver pure, sweet milk only, and not a can of tainted or sour milk can be accepted. This insures a better quality of butter than if some tainted milk is received, and both patron and creamery man get more from their sales. It is easier to keep whole milk sweet on the farm when the creamery sterilizes the skim milk. The boiling-hot sterilized skim milk is put in the patron's can and the heat immediately kills all the germs in the can that might otherwise sour the new milk at the next milking. The women of the farm report from all parts of the state that they have much less work in keeping milk cans clean where the skim milk is sterilized, as the boiling skim milk gives the cans a thorough scalding.

The creamery skim milk used in this experiment was sterilized by the Jensen sterilizer, the invention of A. Jensen, Manhattan, Kan. This sterilizer is the only successful one we have found in operation in Kansas.

Sterilized skim milk is very hot when it reaches the farm, even though the farm be a long distance from the creamery. That part of the skim milk which is to be fed at night may be left untouched until feeding time, when, if too warm, it should be cooled to blood heat. That part of the skim milk intended for the next morning's feed, or that which is to be kept over Sunday, should be cooled to the tempera-

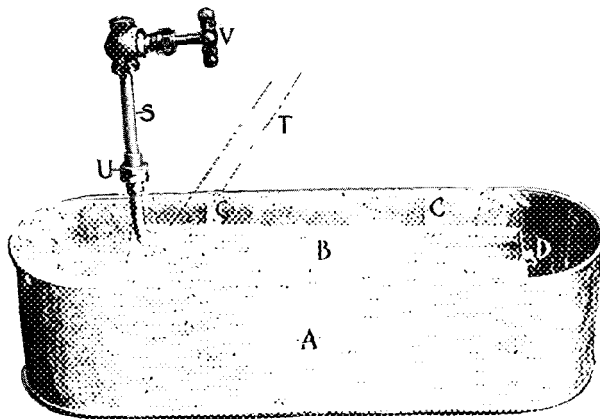


PLATE VI. Jensen Sterilizer.

A represents the skim milk tank; B is a shallow metal trough, placed in the skim milk tank in such a way that the milk overflows at outlet D. A steam-pipe, S, curving at U, runs along the bottom of the trough, and is perforated with many holes. The skim milk from the separator enters the upper end of the trough through pipe T and flows over the perforated steam-pipe and becomes sterilized. Valve V regulates the steam.

ture of well-water, and kept cool until fed. This may be done by setting the can of skim milk in a trough or barrel of cold water and putting a wet bran bag over the top. The milk should be warmed to blood heat just before it is fed.

#### HOW TO RAISE A SKIM MILK CALF.

Nature's way of raising a calf by allowing it to run with the cow produces a good one—the kind feeders want; and the dairyman must provide, as nearly as possible, the same conditions for the calf as it has when with its mother, and he, too, will produce the calf demanded by the feeder.

The cow feeds the calf often, with milk that is blood warm, sweet, and free from germs. Leave the calf with the cow until her udder gets in good condition and her milk all right. This gives the calf the same treatment at the start that he gets if he is to stay with the cow all the time until weaning. If the cow's udder is hard and feverish, rubbing it by the calf's baby head in his attempt to get food reduces the swelling and softens the udder. For about two weeks after the calf is taken from the cow, the best results are obtained by feeding warm whole milk three times a day—two quarts in the morning, one quart at noon, and two quarts at night. After this the calf will do well if fed only twice a day, morning and night, at regular hours. At the end of three weeks, begin to get the calf on skim milk, but do this gradually. The first time, take out half a pint of whole milk and put

in its place half a pint of skim milk; the second feed, use a pint of skim milk and take out a pint of whole milk. This method takes ten days to change from whole milk to skim milk. Increase the amount of skim milk fed slowly as the calf can take it, remembering that ten to twelve quarts of skim milk is a full feed for a calf five to six months old.

The cow supplies the milk to the calf blood warm. Feed both whole milk and skim milk at this temperature. We feed all skim milk warm, even when the calf is five or six months old.

The cow's milk contains all the materials needed for the health and growth of the calf in just the right proportions. Skim milk is without the cream or fat, and must be balanced up. Feeding trials have shown that starch in food takes the place of fat, and serves the same purpose when eaten. It is the dairyman's business, then, to take high-priced butter-fat from the milk, sell it, and supply in its place to the calf a cheap food, rich in starch. Corn is good for this purpose; Kafir-corn grain is better. Calves fed skim milk have a strong tendency to scour; Kafir-corn rich in starch, and is our most constipating grain. It seems to be adapted by nature to be fed with skim milk, the two together producing the natural condition of the bowels. We feed Kafir-corn finely ground to calves, and always feed it dry, separately from the milk. More skim milk calves are probably stunted or killed outright in Kansas by mixing the grain with the milk than by any other means.

Calves need starchy grains to take the place of the butter-fat taken out of the milk. Starch cannot be used to support life until it has been changed to sugar. The saliva of the mouth has the power to change starch to sugar and the more slowly and thoroughly the grain is masticated the better it will be mixed with the saliva and the greater the proportion of starch that will be changed to sugar. Feed dry Kafir-corn meal or other grain to the baby calf and it will chew and chew for a long time on a small quantity of the grain, getting the starch thoroughly mixed with the saliva. Mix the grain with the milk and it is quickly eaten and swallowed, little saliva is mixed with it, and but little starch is changed so that it can be used by the body. The rest not only does the calf no good, but irritates the system, bringing on indigestion and scours and stunting the calf. Feed grain dry.

Keep the calves separated after feeding milk until their mouths become dry, so that they will not suck each others' ears. Where a number are fed, this is most easily and cheaply done by light stanchions, which can be made out of fence boards and set up in the feed yard or pasture, or other convenient place.

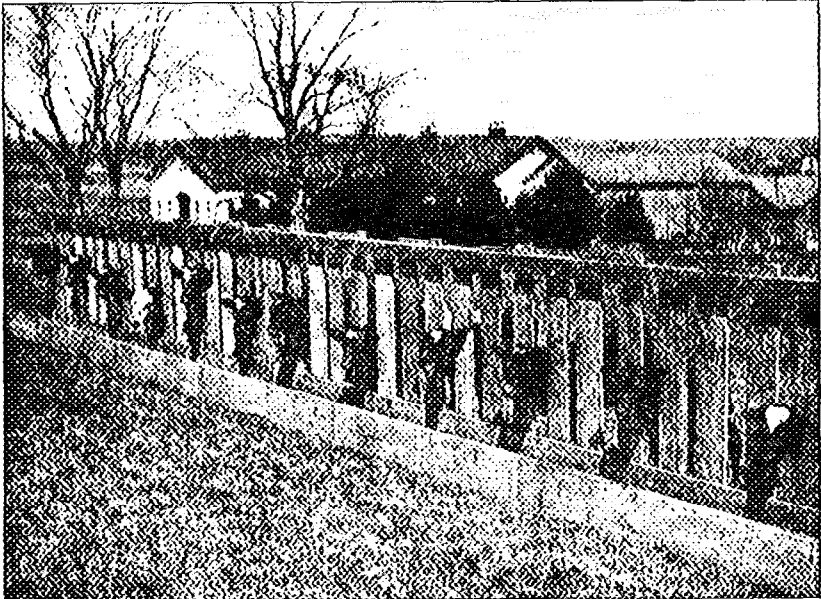


PLATE VII. Skim Milk Calves in a Stanchion.

The calf will begin to eat grain and hay when ten days to two weeks old. These feeds should be given fresh twice a day. Prairie hay or timothy is best for young calves; alfalfa or clover for older ones.

A supply of fresh clean water should be kept within reach of the calves all the time. The most convenient way of providing this is with a hog waterer, attached to a barrel as previously described. Have salt where the calves can eat what they want of it.

The greatest difficulty in raising skim-milk calves comes from scouring. Prevention is easier than cure. The chief causes are over-feeding, feeding cold or sour milk, feeding grain with the milk, and dirty pails and feed-boxes. Careful watching will usually prevent any serious trouble from this disease. At first indications, immediately cut down the feed. Milk pails and cans should be washed and scalded, the same as if the milk was intended for the table. For scouring, give one to two ounces of castor-oil, or, if the case is bad, ten to fifteen drops of laudanum a day, until the trouble is checked. Change feeds very slowly, as a sudden change often causes scours.

Finally, remember that the calf is a baby and give it the kindness and care due every baby. The better a calf likes you the more it will gain. Pet it. Keep its pen and yard dry and comfortable; keep it warm in cold weather and give it cool shade in summer. We like

a shed open on all sides for summer shade, as this will protect from the sun and allow the air to blow through freely. The College has a large stone barn with basement, but we found that our calves thrived better in a common board shed than they did in this barn. The basement was not as well lighted and ventilated as the shed.

Flies often annoy calves so that they do not gain well. The department of horticulture and entomology of this Station furnished us a formula that we used on the calves in this experiment at a cost of one-fourth to one-half cent a day and kept the flies off. It is as follows: Pulverized resin, 2 parts, by measure; soap shavings, 1 part; water,  $\frac{1}{2}$  part; fish-oil, 1 part; oil of tar, 1 part; kerosene, 1 part; water, 3 parts. Place the resin, soap shavings,  $\frac{1}{2}$  part of water and fish-oil together in a receptacle and boil till the resin is dissolved; then add the 3 parts of water, following with the oil of tar mixed with the kerosene. Stir the mixture well and allow it to boil for fifteen minutes. When cool, the mixture is ready for use, and should be stirred frequently while being applied.

From one-eighth to one-half pint is sufficient for one application. To apply the mixture, a brush is used. We find nothing more satisfactory than a large painter's brush. At first it is well to make an application for two or three days in succession. Afterwards an application every other day will suffice. It is often more economical not to attempt to protect the entire animal, but only those parts not reached by the head or tail. It is perfectly safe, and in no case has it appeared detrimental to the health of the calf.

Farmers often object to the expense of handling calves in the way we have indicated. It does not take much time. Two hours a day was all the time needed to feed the calves in this experiment, and part of this was used for taking weights and making records. At the time of writing this bulletin we are feeding forty-five young calves, divided into five lots, and each lot fed a different way. It takes five hours a day, while if they were all fed alike, and each feed did not have to be weighed, much less time would be needed. It does not take much more time to feed a skim milk calf so that he will gain two pounds a day than it does to feed him so that he will become a runt, but it does take thinking, patience, and careful attention to the little things.

This experiment shows that calves can be easily raised on skim milk and fed and handled so that they will be thrifty, gain well, and be in good condition for the breeder or feeder.