EXPERIMENT STATION

OF THE

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FARM DEPARTMENT.

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FEED AND CARE OF THE DAIRY COW.

FALL CALVING.

The greatest yield is obtained from cows that calve in the fall, if proper care, feed and shelter are provided during the winter. The prices of butter fat and butter are higher during the winter, and with cows fresh in the fall or early winter this higher price comes during the period of greatest yield.

A cow owned by the College gave the following yields of butter fat in pounds, by months, for ten months: 21.3, 31.9, 31.2, 30.5, 32.9, 29.0, 28.7, 28.8, 26.2, and 22.2. If this product had been sold to one of the leading Kansas creameries at the prices paid last year, and the cow had calved April 1, the returns would have been $44.80, while if she had calved Sept. 1, the same product would have brought $49.44—a difference of $4.64 for a single cow.

A cow that calves in the early fall while on grass is in the best condition to make a high yield when fresh. Good feed and care thru the winter will maintain a good yield, and when the cow is turned to pasture in the early spring a fresh flow will be started that will considerably increase the year's yield.

A cow that calves in the spring has the best milk-producing

feed at a time when she will do well with any good ration. As the flow begins to slacken the quality of the feed grows poorer, and flies and heat help to cut it down still lower. In the fall when the milk begins to drop rapidly on account of the time from calving, the cow goes from green pastures to dry feed—a change that tends to reduce the yield and dry up the flow entirely. Winter dairying avoids injury to flavor of butter from weeds in summer and fall pastures.

Cows, with fair surroundings, can be made more comfortable in winter than in summer, and with fall calving will be dry when heat, flies and drouth are severest and when butter prices are the lowest.

Winter dairying furnishes profitable employment for the farmer and his men at a season of the year when, without it, farm forces are either idle or work for low wages.

Another advantage of fall calving is that the calves can be raised at a season when there is time to give to them that careful attention which is so great a factor in calf-raising by hand, when losses from heat, flies, diarrhea, and sour milk can be avoided and when, at weaning time, the calves can go from milk to green pasture without a check in growth.

TREATMENT BEFORE CALVING.

With most cows the highest yield for the year can be obtained by having them go dry six to eight weeks before calving. This is especially true of those cows whose milk is rich in butter fat, and continuous milking of such cows without rest before calving usually results in a serious lowering of the yield for the entire year following calving, and also frequently in a weak, puny calf. From these cows the most milk and butter fat can be obtained in a series of years by milking ten months in the year only. It is frequently the case with this class of cows that if milking is continued to the time of calving the milk of the last eight or ten weeks has a bad flavor and odor, is hard to churn and will injure the butter made from any milk with which it is mixed, and it is profitable to dry up the cow on this account as well as for the effect of the rest. Rest does not seem so essential for cows giving milk low in butter fat, and it is impossible to dry up many heavy yielders of thin milk without injury to the udder. In such cases the only reasonable plan is continuous milking; but if too much difficulty is not experienced in drying up this class of cows, it should be done, as better results will be secured by the rest.

Dairymen handling cows of the beef type have hard work to keep their cows in fair flow for the ten months, but with dairy cows, and the number is increasing in Kansas, the rest before calving should be provided for, and the general rule to follow is that the average dairy cow and the cow giving milk with a high per cent of butter fat should go dry six to eight weeks before calving; and heavy yielders of milk low in butter fat may be milked continuously if there is much difficulty in drying them up.

To dry up a cow, reduce the feed, take away the grain, and when the milk yield drops, milk first once a day, then once in two days, and in one to two weeks the average cow will be dry and her udder in good condition. With persistent milkers there is seldom difficulty if hay only is fed for a time. If a cow continues to give milk under this treatment or if the udder is hard and feverish, the work of drying up must stop, and the ration be changed to a light milk ration, with loosening feeds, and the cow milked regularly. Forced drying up under these conditions injures the cow. If by oversight the drying-up process has been neglected until within three or four weeks of calving, do not attempt it, as there is risk of injury to the health of the cow and her udder.

After becoming dry, the cow will need little attention before calving if she is on good pasture, except to see that she has plenty of good water and shade, is comfortable and not annoyed or injured by other cattle, particularly steers. If the cow is on dry feed, more attention is necessary. She must be in fair condition but not fat, and should have bulky feeds—both roughness and grain—and succulent feed is exceedingly desirable, either ensilage or roots. One of the best grain mixtures for cows before calving is, by weight, two-thirds bran and one-third linseed meal. This grain mixture is a good one for the first two weeks after calving. Alfalfa hay is excellent for roughness. The bowels should be kept loose. This is essential and needs more attention than any other condition, and for this purpose roots and silage are very helpful. Corn and corn meal should not be fed.

TREATMENT AT CALVING.

In winter the calving cow will do best in warm, comfortable quarters, free from draft. It is well to blanket her as soon as the calf is dropped, and to keep her blanketed until she has regained her normal condition. We have sewed bran bags together for a blanket when nothing better was at hand. Her bowels must be kept loose. Give her light, loosening feeds and all the water she

will drink, removing the chill from it until the afterbirth has come away. When cold water is given before the afterbirth has been removed, the chill frequently causes a contraction of the mouth of the womb and the retention of the afterbirth. If the afterbirth does not come away in from twenty-four to forty-eight hours, it should be removed by a competent man, as its retention causes a serious loss in the milk yield, often lowering the yield thru the entire milking period.

Where a box stall is kept for calving cows, and a number calve in it, all bedding should be removed after each birth and the floors and sides thoroly cleaned and disinfected with quicklime or solutions of carbolic acid or corrosive sublimate.

Unless the cow's milk is so rich that it scours the calf, we prefer to have the calf stay with the cow for a few days. The colostrum, or first milk, is needed as the first food for the calf. If the cow's udder is caked and feverish, the rubbing of the baby calf against it in attempting to suck will help to reduce the inflammation. It is not difficult to teach the calf to drink, even when it has been with the cow for a week, if it is allowed to get quite hungry before the first feed is offered.

The udder is often hot and caked. When this is the case, the cow should be milked frequently, at intervals of not longer than two hours, and if the inflammation is serious more frequent milkings are better. Never milk the udder dry while it is in this condition, as, if it is milked out clean, a fresh flow is stimulated, which frequently increases the inflammation and sometimes leads to the fatal milk fever. If the udder is badly inflamed the cow should have a physic, and for this we use 1½ pounds Epsom salts per 1,000 pounds live weight of cow, dissolving the salts in warm water and giving it as a drench from a long-necked bottle. Besides keeping the bowels loose and frequent milkings, hot applications and rubbing are the best means of reducing the inflammation. Dip a flannel cloth in water as hot as the hand will bear, wring it out lightly and hold around the udder. Before the cloth cools dip it again in the hot water and apply as before. Keep this up as long as time will permit. Thirty minutes of such application is good, two hours is better, and after a rest repeat the operation until the swelling is reduced and the fever gone. Whenever this steaming of the udder is discontinued for a rest, the udder should be rubbed dry by using the hands gently, and we often used camphorated vaseline while rubbing, as it allays the soreness on the surface of the udder.

When the udder has been badly inflamed, we have sometimes made a sack, covering the entire udder, and suspended it by straps from the hips; coarse bran is packed between the udder and the sack and kept saturated with hot water by pouring from cups. Holes are made in the sack for the teats, so that the cow can be milked frequently. Twenty-four to seventy-two hours of such treatment will sometimes save the udder of the most valuable cow in the herd, and the increase in milk for the first month will more than pay for the extra work.

Milk should not be used until there is no fever in the udder and not until the udder and womb have regained a healthy condition. Ordinarily this will be in about five days; but if the afterbirth is retained, or there is a flowing from the vagina or severe inflammation of the udder continues, the period is longer, and in exceptional cases the milk may not be fit to use for a month after calving.

TREATMENT OF THE COW AFTER CALVING.

After the cow has recovered from calving, the feed should be gradually increased until the full limit of profitable feeding is reached, and the cow should be pushed to her utmost possible limits for the first three months. It will often pay to give the cow for the first three months after calving more feed than will produce butter at the lowest rate, e. g., if a cow on a certain amount of feed will produce a pound of butter for 7 cents for the feed, it may pay to increase the feed 25 per cent to 50 per cent, or even double it, though this increase brings the cost of butter up to 8 or 10 cents per pound for feed, if a good increase in yield is obtained, because a high yield during the first months after, calving brings an increase thru all the months of the milking period, and a cow that is pushed at the beginning of her year will give a good flow longer than one not so treated.

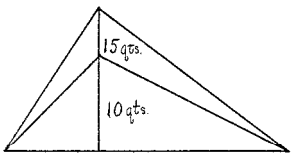

FIG. I.

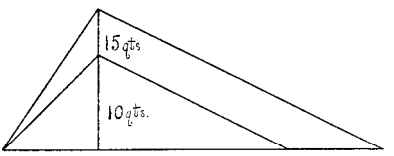

FIG. II.

Fig. I shows the gain obtained by pushing the cow to a high yield the first three months, even tho the milking period is not extended.

Fig. II shows the gain from forcing while the cow is fresh.

and also the usual gain which this method gives in extending the milking period.

When other work is pressing, the dairyman is sometimes tempted to let the fresh cow go with the ordinary care and feed until the rush is over, expecting to make up for this neglect by good treatment when he is less hurried. He cannot afford to do this, for if a cow starts with a low or moderate milk yield, no amount of care or feed afterward will succeed in securing her best yield.

Cows will give, and do give milk without any of these careful attentions. A cow will give milk if little attention is paid to drying her up and no cooling and loosening feeds are given before calving. Cows calve every winter without shelter or care, with ice water only to drink, and with no care given to their udders, and yet they give milk. But the best yields and most profitable returns can be obtained only by careful attention to every one of these details, and neglect of any one of them frequently cuts down the yield 25 per cent for the year. It is the neglect of many and sometimes all of these details in caring for the cow that makes the average cow yield less than one-third of that produced by the good dairy cow properly handled.

After the cow has passed the point of greatest flow the feed should be gradually reduced, feeding to produce yield at most profit. Care should be taken to keep her in moderate flesh, and the ration slowly changed until, during the last month of milking, it is similar to that recommended to be fed before calving.

BEST CONDITIONS FOR MILK PRODUCTION.

The best yield of milk is obtained under the conditions found in Kansas in the early part of June. Then every cow, if fresh, no matter what her breeding or form nor what has been her previous treatment, gives a generous yield and the true dairy cow makes her highest record. June conditions, then, are the best conditions, and the nearer these can be provided for the entire year, the greater will be the returns received from the cow. Feed and surroundings that make every cow do her best are exactly what the dairyman needs and should secure so far as practicable. In June the cow has appetizing, succulent feed, rich in milk-making materials, the various grasses give a palatable variety to the flavor of the ration, the temperature is mild, pure air and water are abundant and the whole surroundings comfortable. We will consider each of these conditions in detail.

COMPOSITION OF THE FEED.

In farm feeds there are three groups of substances which are to be considered in making a combination of feeds to secure best results. These are known as protein, carbohydrates and fat.

Protein includes those materials which contain nitrogen. It enters into the composition of milk, blood, muscle, hair, and the brain and nerves, and is absolutely indispensable in the formation of all of these, and no other substance can take its place. It may also furnish heat and energy to the body, and be transformed into fat.

Carbohydrates include the fiber of feeds, the sugars, starch, gums and similar substances. They furnish heat, energy and fat to the body.

Fat includes all fatty substances found in feeds. The fats in the food produce heat, energy and fat in the body. One pound of fat is worth 2.2 pounds of protein or carbohydrates for heat production.

Only part of the protein, carbohydrates and fat given in the feed can be digested by the cow, the rest passing away in the droppings; and it is only from the portion digested that benefits are received. When a cow is fed 100 pounds of alfalfa hay, she digests 10.6 pounds protein, 37.3 pounds carbohydrates and 1.4 pounds of fat, a total of 49.3 pounds—the rest is waste. It is the digestible portion alone, of each feed, that is considered in planning a ration.

In this bulletin, whenever amounts of protein, carbohydrates or fat are mentioned the amounts digestible are considered.

The weakest point in Kansas dairying is in the composition of the ration given, the average ration being greatly deficient in protein and having too much carbohydrates and fat. As no other substance can take the place of protein, the insufficient quantity given in the feed limits the milk yield and reduces it to that which the protein can form. Investigation has shown that a fair milk ration for an average 1,000 pound cow should contain about 2.5 pounds digestible protein, 12.5 pounds digestible carbohydrates and 0.4 pounds digestible fat. Last winter many Kansas farmers fed their dairy cows prairie hay and corn.

	Protein, pounds.	Carbohydrates, pounds.	Fat, pounds.
Twenty pounds prairie hay contains	.70	8.36	.28
Ten pounds corn contains	.78	6.67	.43
Total	1.48	15.03	.71
Needed	2.50	12.50	.40

This ration contains too much carbohydrates and fat, the materials which furnish heat and fat to the animal, and but little more than half enough protein, the material which is the basis of milk and blood, and with such a ration a cow could not possibly give a full yield of milk. Other dairymen fed corn fodder and corn.

	Protein, pounds.	Carbohydrates, pounds.	Fat, pounds.
Twenty-five pounds of corn fodder	.50	8.30	.15
Ten pounds corn	.78	6.67	.43
Total	1.28	14.97	.58
Needed	2.50	12.50	.40

Here we have the carbohydrates and fat too high and the protein very much below the amount needed to secure a good milk yield. The feeder finding his milk yield low with such a ration, often doubles the grain. Under such a condition the ration would be twenty-five pounds corn fodder and twenty pounds corn, and would furnish

	Protein, pounds.	Carbohydrates, pounds.	Fat, pounds.
Total	2.06	21.64	1.01
Needed	2.50	12.50	.40

With such a ration the cows would give an abundant flow of milk for a little while, then dry up and fatten. The dairyman finding that neither the first nor second rations give satisfactory results, decides to substitute bran for corn meal in the first ration. He would then have

	Protein. pounds.	Carbo-hydrates. pounds.	Fat. pounds.
Twenty pounds prairie hay	.70	8.36	.28
Ten pounds bran	1.23	3.71	.26
Total	1.93	12.07	.54
Needed	2.50	12.50	.40

This ration is better than either of the preceding ones, and with it the cow will give more milk than with them, but the supply of protein is insufficient for a full yield. Many dairymen have corn fodder. Let us add ten pounds of this to the last ration.

	Protein. pounds.	Carbo-hydrates. pounds.	Fat. pounds.
Twenty pounds prairie hay	.70	8.36	.28
Ten pounds corn fodder	.20	3.32	.06
Ten pounds bran	1.23	3.71	.26
Total	2.13	15.39	.60
Needed	2.50	12.50	.40

With the corn fodder added, there is nearly enough protein to produce a fair milk yield, but 23 per cent too much carbohydrates. On such a ration a cow gives a good yield of milk for a short time and then increases rapidly in flesh and dries up. If either the hay, fodder or bran in this ration is increased sufficiently to give the required amount of protein, the carbohydrates and fat are also increased even more rapidly, and the more these are increased the quicker the cow will fatten and dry up. In going to Farmers Institutes last winter we found such methods of feeding common. Two instances will be sufficient to show this. At an institute in the eastern part of the state, a dairyman asked for help, in making a ration that would secure better returns from his cow. The previous year his cow had given, when fresh, ten to twelve pounds of butter per week while on pasture. This year she had calved in the winter, and with good shelter, care, and the best feed he could give her, she was producing only five pounds of butter a week and was slowly drying up. His cow was a good feeder and had all the good prairie hay, corn fodder and corn she would eat, and the owner said that the more she ate, the faster she seemed

to dry up. A cow with a good appetite would probably eat 15 pounds prairie hay, 10 pounds corn fodder, and 15 pounds corn. If this is what the cow ate, she had

	Protein, pounds.	Carbohydrates, pounds.	Fat, pounds.
Fifteen pounds prairie hay	.53	6.27	.21
Ten pounds corn fodder	.20	3.32	.06
Fifteen pounds corn	1.17	10.00	.65
Total	1.90	19.59	.92
Needed	2.50	12.50	.40

Is it any wonder that her milk yield was low and that she was drying up and fattening? In the western part of the state, at a Farmers' Institute, a leading dairyman stated that his cows were drying up faster than they should, and, as he was feeding sorghum hay, he thought that might be the cause, and asked if sorghum hay had this tendency. We told him that depended on what he fed with it, and explained the needs of the cow in regard to protein, carbohydrates and fat, and asked what he was feeding. He replied that his cows were having all the sorghum hay, corn fodder and prairie hay that they would eat and some corn. A study of the table of feeds will show that for dairy purposes every feed-stuff he was giving has an excess of carbohydrates and fat and a great deficiency in protein—the essential milk-producing element, and that whenever this dairyman increased the feed more than was necessary to maintain the cow's body, the feed tended to fatten the cow and stop her milk flow.

Protein is essential to the production of milk and blood and of all other substances in the body containing nitrogen, and no other material can take its place or be changed into it. On the other hand, if protein is in excess in the feed, it can be used by the animal for supplying heat and energy, and may become a source of fat, taking the place of the carbohydrates and fat. For this reason, the amount of protein in the ration may be increased above the amount, 2.5 pounds, called for by the standard ration, and the amount of carbohydrates and fat correspondingly decreased, as the protein will take their place. Carbohydrates and fat can not take the place of protein, and no matter in how large quantities they may be fed, if the protein is deficient the milk yield will be cut

down. Take the instance given of the cow that gave ten to twelve pounds of butter a week on grass alone, but failed on heavy feeding of rations poor in protein and rich in carbohydrates and fat. The grass eaten furnished nutriment in the following proportions: Protein 2.90 pounds, carbohydrates 11.83 pounds, fat 0.58 pound, and this is a good proportion to take as a standard, provided feeds are at hand that, when combined, will furnish such a proportion at an economical cost. A cow can have too much protein, and a few dairymen in this state are feeding too much. The mistake is usually made by farmers who have fed timothy or prairie hays or corn fodder and have found that with these feeds they have had to use bran and linseed or cottonseed meal to get a satisfactory milk yield. Many such farmers, when feeding alfalfa hay, continue to use the same grain rations as before. This gives an over-feed of protein, injures the cow, and is a waste of feed. Alfalfa, properly cured, has too great a proportion of protein to carbohydrates, and should be given with grain feeds rich in carbohydrates, such as corn, Kaffir corn or corn and cob meal. It should not be fed with grain feeds rich in protein, such as linseed, cottonseed, gluten or soy bean meals or bran, unless roughness rich in carbohydrates is also fed. Two rations will show this:

	Protein, pounds.	Carbohydrates, pounds.	Fat, pounds.
Alfalfa hay, nineteen pounds	2.01	7.09	.27
Corn, seven and one-half pounds	.59	5.00	.32
Total	2.60	12.09	.59
Needed	2.50	12.50	.40
Alfalfa hay, nineteen pounds	2.01	7.09	.27
Bran, five pounds	.62	1.87	.13
Linseed meal, two and one-half pounds	.72	.82	.18
Total	3.35	9.78	.58
Needed	2.50	12.50	.40

In the first ration, the slight excess of fat makes up for the deficiency in carbohydrates, and the ration is a good one, except for variety. With the last ration, there would be a tendency to stimulate the milk glands, with a likelihood of poor health and garget, and the cows would become thin. A ration rich in protein maintains a high yield of milk for a much longer period than one poor in protein and rich in carbohydrates.

FEED.	Digestible Nutrients. Pounds per 100 pounds feed.		
	Protein.	Carbohydrates.	Fat.
CONCENTRATES.			
Barley	8.9	64.8	1.6
Corn	7.8	66.7	4.3
Corn and cob meal	6.5	56.3	2.9
Cottonseed meal	37.0	16.5	12.6
Flax seed	20.6	17.1	29.0
Chicago gluten meal	31.1	43.9	4.8
Kaffir corn seed	7.8	57.1	2.7
Linseed meal (old process)	28.8	32.8	7.1
Linseed meal (new process)	27.9	36.4	2.7
Oats	9.3	48.3	4.2
Rye	9.1	69.7	1.4
Sorghum seed	7.0	52.1	3.1
Soy bean meal	29.6	22.3	14.4
Wheat	10.2	69.2	1.7
Wheat bran	12.3	37.1	2.6
Wheat middlings	12.8	53.2	3.4
Wheat shorts	12.2	50.0	3.8
GREEN ROUGHAGE.			
Corn silage (well eared)	1.3	14.0	.7
Fodder corn (with ears)	1.0	11.6	.4
Pasture grasses (mixed)	2.5	10.2	.5
Sorghum fodder	.6	12.2	.4
DRY ROUGHAGE.			
Alfalfa hay	10.6	37.3	1.4
Corn fodder (husked)	2.0	33.2	.6
Fodder corn (planted thickly, with ears)	2.5	33.4	1.2
Millet hay	4.5	51.7	1.4
Oat hay	4.3	46.4	1.5
Oat straw	1.6	41.6	.7
Orchard grass hay	4.8	42.0	1.4
Prairie hay	3.5	41.8	1.4
Red clover hay	6.8	35.4	1.7
Sorghum hay	2.4	40.6	1.2
Timothy hay	2.9	43.7	1.4
Wheat straw	.8	37.9	.5
ROOTS AND TUBERS			
Mangel-wurzels	1.0	5.7	.1
Sugar beets	1.1	10.2	.1
Turnips	.8	6.5	.1
MILK.			
Whole milk	3.2	5.0	3.6
Skim-milk	3.9	4.5	.1
Buttermilk	4.0	4.1	.1

SUCCULENCE.

The June pasture which forces every cow to her best yield, furnishes a succulent ration, and for best results from the cows through the winter, succulent feed must be given. On June pasture alone a cow will give a heavy yield. Cut the grass, dry it carefully, so that water only is lost, give this dried grass to the cow as her only feed, and she will soon go dry. The grass has lost its succulence. We know the value of fruit and vegetables to human animals in winter, and during this time succulent food is equally valuable to the cow. It may be secured either from ensilage or roots. When the first expense can be afforded, the silo is the cheapest and best way of providing green feed for the winter, and corn the best crop for silage. Where the dairyman has no silo, mangelwurzels or sugar beets should be raised to furnish succulent winter feed.

Succulent feeds in winter have two advantages; they are appetizing, which makes the cow enjoy her feed, and they keep the system in a healthy condition and the bowels loose. The nearer we can feed our cow in winter to secure the natural loose condition of the droppings as they are from June pasture, the more she can eat and the more she will be able to give in return for each pound of feed eaten. When a cow is constipated there is a feverish condition of the body, a smaller per cent of the feed is digested and converted into milk and the yield is lowered.

If the dairyman has neither ensilage nor roots, he should combine his feeds to secure as nearly as possible the right condition of the bowels. This is hard to do without succulent feeds. In the list of feeds following, the general effect which each has in this respect is given:

LOOSENING FEEDS.	CONSTIPATING FEEDS.
Alfalfa.	Corn fodder.
Sorghum hay.	Corn stalks.
Ensilage.	Kaffir corn fodder.
Roots.	Prairie hay.
Bran.	Timothy hay.
Soy bean meal.	Kaffir corn grain.
Linseed meal.	Corn (in light feeds).
Gluten meal.	Cottonseed meal.

Rations can be made from these constipating feeds alone which will contain the food elements (protein, carbohydrates and fat) in the right proportions, and such rations are frequently used with

results of low milk yields, altho the cows have apparently an abundance of nutritious feed. This factor in profitable milk production should always be considered. Correspondents report especial trouble from constipation when feeding Kaffir corn grain. We overcame this effect last winter by feeding alfalfa, which has an opposite tendency, with the Kaffir corn grain, and kept our cows in good condition, securing a good yield of milk at a low cost, and butter of good quality.

VARIETY.

Cows, like human beings, crave variety in their food, and do best when they have it. A ration containing the proper food elements can sometimes be given by using one rough feed and one grain feed only, and fair results be obtained, as in feeding the College herd when alfalfa hay and Kaffir corn grain were the feeds used, but best results are secured when a variety is given, and it is well to have a variety both in roughness and in grain. A mixture of two grains will produce a higher yield than the same amount of food given in one grain, and four or five, or even more, kinds of grain mixed together will usually give better returns than two, altho the bulk of the mixture is made of one grain. Small additions of a number of feeds flavor the mixture and make it more appetizing and for this reason the cow will eat more and yield more in proportion to what she eats. Ground oats usually cost too much to form any large portion of the dairy cow's ration, but cows like this feed and it is frequently profitable to add a handful of ground oats to the grain ration of each meal, as it makes the whole feed taste better, and when cows relish their feed it adds to the yield. The feeders of the cows that have made the high records have thoroly understood this fact, and a part of their success is due to feeding a mixture of a number of nutritious, palatable foods, thereby inducing their cows to eat large quantities.

While cows need a variety, they want it to come by having a mixture of feeds at each meal, and not by receiving one kind of feed at one meal, another at the next, and still another at the third. Such a method of giving a variety is sure to reduce the yield, as the cow, at a given feeding time, expects the same kind of feed that she ate yesterday at the same time, and if not given it will be disturbed and will give less milk. It is not necessary to give a cow the same kinds of feed for supper that she has for breakfast, but the breakfast mixtures should be alike for all breakfasts and the supper feeds the same for all suppers for a considerable period.

Sudden changes usually decrease the milk yield, even when the new ration is better than the old, and when it is necessary to make a change in feed the change should be made gradually, taking a week to ten days to make any radical change.

APPETIZING RATIONS.

It was stated in the last paragraph that a variety in the ration brought better yields because it made the food more appetizing, inducing the cow to eat more and to yield more for what she ate. Whatever makes the feed taste better or makes it more enjoyable to the cow increases its value for milk production. Early-cut hay is best for the dairy cow, not only because it contains more protein than that cut late, but because its aroma and flavor make it more palatable to the cow. The appetizing effect from the early cutting and careful curing of all forage crops increases their feed value for milk production. Freshly-harvested and freshly-ground grain are the most palatable to the dairy cow and will give best results. Dairymen who grind feed should grind often, as grain that has lost its freshness is not the best relished by the cow.

Often the dairyman has a large quantity of coarse, rather unpalatable rough fodders, such as corn fodder and over-ripe or slightly damaged hay, which he must feed, and has only a limited quantity of choice roughness to feed with it. In this case, best results can be secured by giving the more palatable roughness in the morning or with the grain night and morning and feeding the poorer roughage as the last feed at night, to be eaten at the cow's pleasure during the night, or else put in racks in the yard for midday meals. Palatable feed in the morning gives a contented cow through the day, and this contentment brings more milk.

When several kinds of feed are given it is usual to throw them together into the manger and let the cow eat at will. This method does not secure the highest milk yield. You do not want your soup and pie served together on the same plate, and neither does the cow like this method of serving her food. If all the feedstuffs for a meal are thrown together, the more palatable are eaten first. In separating and eating these, the others are "mussed" over. and when the cow comes to eat them, they do not taste good and she will not eat enough to produce the greatest milk yield. We like to feed our most palatable roughness and give this just before the milkers go to their meal. When the milkers come back from eating, the cows have finished their first feed, and the less palatable roughness can then be given them. It will not then have been slob

bered on and will be better relished and more of it eaten. This method of feeding requires time and care, but it pays.

If the cows are given their rough feed in racks out of doors, it will pay to put feed in these racks often, so that the feed will be clean and appetizing. Mangers, feed troughs and racks should be kept clean and fresh from old, soiled feed, both as a matter of health and because the food in a clean manger smells and tastes better.

The dairyman's rule should be to harvest feed in its most palatable form and feed in the most appetizing manner.

FEEDING FOR QUALITY OF BUTTER.

In winter, when the cows are eating fodder, prairie or timothy hay, straw and corn, the butter is so hard that it goes on the bread in lumps unless warmed. The common opinion is that the cold weather makes the butter hard, but the cold is only a part of the cause for this hardness. Cold does make butter firm, but the extreme hardness is caused by the feed, as all the feeds mentioned have a tendency to harden butter. In the early spring, when the cows first go on grass, the butter is soft and what dealers call "slushy." After the grass becomes less watery, the butter is firmer, altho the weather may be much warmer than when the cows were first turned out. The hardness of the butter is determined by the feed. An excess of linseed, gluten or soy bean meals will make butter soft, no matter what the weather may be, while corn, Kaffir corn and cottonseed meal harden the butter. Bran has a tendency to soften butter slightly and oats to harden it. The roughness fed does not have as strong an influence on the firmness of the butter as the grain, but still it has considerable. Alfalfa has a tendency to soften the butter, prairie hay, timothy and corn fodder to make it hard.

The spreading quality of butter is a strong factor in increasing or decreasing its consumption. No one likes it soft and oily, and butter should be firm, having good body, but it must spread easily. In winter, if the butter goes on the bread in chunks, with butter here and dry bread there, bread and butter is not appetizing and little is eaten; while if the butter spreads easily, so that the bread is entirely covered with a thick, nice coat of it, bread and butter tastes good and a great deal is eaten. We have known cases where dairymen in winter have had orders doubled from private customers by changing the feed from that which produced hard, crumbly

butter to feed that made butter which spread well. In summer firm butter brings greatest consumption.

The feeds should be blended so as to secure the firmness desired. Last winter, when feeding alfalfa, we balanced its softening tendency with Kaffir corn. If corn, Kaffir corn or cottonseed meals are fed and the butter is too hard, add linseed, gluten or soy bean meals to the ration until the desired body is produced. The dairyman who makes his own butter can readily control this matter. It is important that creamerymen should look after the feed their patrons' cows are receiving. A single example will show this: A contract was to be let for supplying a large quantity of butter to a point in the South. A dairyman in the North tried to get this contract, sending a sample of his butter with his bid. His butter was rejected. It was like oil when received at the Southern station. He was feeding bran and linseed meal, and altho his butter was a little soft when put on a Northern market, it ranked as fair in quality, but it would not stand the Southern warmth, even in winter. If corn meal had been substituted for part of the bran, and cottonseed meal for all the oil meal, the butter would have been firm enough to have secured the Southern contract, and it was secured by another Northern dairyman who knew how to feed firmness into butter. It will pay creamerymen to inform their patrons as to where their butter is marketed and work for a concert of action in feeding to produce the needed degree of firmness. If butter is to be marketed in the South, it should be harder than if intended for either the East or the mountains, and butter intended for long shipments should be quite firm. Considerable of the softness of early grass butter can be avoided by feeding corn or adding cottonseed to bran and oats.

Always feed the dairy cow after milking and never just before or while milking. There are often odors from the feed or dust that may be absorbed by the milk which will taint the butter if the cow is fed during milking. If there are volatile matters in the feed, as in ensilage and in some weeds, and the cow is fed just before or during milking, these volatile materials may go directly to the milk and taint the butter, while if the feed is given after milking, these volatile materials are worked out of the body before the next milking. A cow properly trained will give more milk when she devotes her whole attention to giving milk than when she is fed during milking time and is moving backward and forward trying to snatch her feed and being constantly scolded by the milker for not standing still.

The cow should have clean, wholesome food. The dairymen who get fancy prices for butter sold to private customers make it a rule to give only such feed as is clean enough to go on their own tables. Spoiled, rotten or moldy feed taints the milk and butter.

ONE HUNDRED RATIONS.

The figures indicate pounds, each ration is for twenty-four hours feed for a cow in full milk. If the cow is fed twice a day, use one-half of the ration at each feed:

1. Alfalfa 25, corn fodder 9 or sorghum hay 7 or millet hay 6.
2. Alfalfa 25, corn fodder 5, Kaffir corn 2.
3. Alfalfa 25, corn 3½ or Kaffir corn 4.
4. Alfalfa 20, corn 7 or Kaffir corn 8.
5. Alfalfa 20, corn 6 or Kaffir corn 7, oats 2.
6. Alfalfa 20, corn 4, Kaffir corn 4.
7. Alfalfa 20, fodder corn 15.
8. Alfalfa 20, corn fodder 8, corn 4.
9. Alfalfa 20, millet 5, corn 4.
10. Alfalfa 20, sorghum hay 8, corn 3.
11. Alfalfa 20, prairie hay 5, Kaffir corn 5.
12. Alfalfa 20, mangels 20, corn 5½.
13. Alfalfa 20, corn ensilage 15, Kaffir corn 5.
14. Alfalfa 15, corn fodder 10, corn 5, soy bean meal 1½.
15. Alfalfa 15, millet 5, Kaffir corn 7, soy bean meal 1.
16. Alfalfa 15, sorghum hay 4, Kaffir corn 8, soy bean meal 1.
17. Alfalfa 15; prairie hay 5, corn 6, soy bean meal 2.
18. Alfalfa 15, mangels 10, corn fodder 5, corn 3, Kaffir corn 3, bran 2.
19. Alfalfa 15, corn ensilage 20, corn 4, bran 3.
20. Alfalfa 10, corn fodder 15, corn 4½, linseed meal (o. p.) 3.
21. Alfalfa 10, millet 10, corn 3, soy bean meal 1½, bran 3.
22. Alfalfa 10, sorghum hay 10, corn 1½, oats 5, Chicago gluten meal 2.
23. Alfalfa 10, prairie hay 10, Kaffir corn 5 or corn 4½, soy bean meal 3.
24. Alfalfa 10, mangels 10, corn fodder 15, Kaffir corn 3, soy bean meal 2, bran 2.
25. Alfalfa 10, corn ensilage 30, corn 5, soy bean meal 3.
26. Alfalfa 5, corn fodder 15, corn 6, cottonseed meal 3, bran 1.
27. Alfalfa 5, millet 15, bran 5, cottonseed meal 2.
28. Alfalfa 5, sorghum hay 15, corn 4, bran 2½, cottonseed 3.
29. Alfalfa 5, prairie hay 13, corn 4, soy bean meal 3, bran 3.
30. Alfalfa 5, ensilage 40, corn 3, oats 3, cottonseed meal 1, linseed meal (o. p.) 2.
31. Corn fodder 26, bran 6, soy bean meal 3, cottonseed meal 1.
32. Corn fodder 20, oats 4, Kaffir corn 2, soy bean meal 3, bran 2½ cotonseed meal 1.
33. Corn fodder 20, sorghum hay 7, bran 5, linseed meal (o. p.) 2, cottonseed 2.
34. Corn fodder 20, mangels 10, corn 4½, cottonseed meal 2, Chicago gluten meal 2, linseed meal (o. p.) 1.
35. Corn fodder 20, ensilage 20, bran 6, cottonseed meal 3.
36. Corn fodder 15, millet 10, corn 1, Chicago gluten meal 3, cottonseed meal 2.
37. Corn fodder 15, sorghum hay 10, corn and cob meal 2½, cottonseed meal 4, linseed meal (o. p.) 2.
38. Corn fodder 15, prairie hay 8, oats 1, Kaffir corn 3, soy bean meal 3, cottonseed meal 2.
39. Corn fodder 15, oat straw 10, bran 4½, linseed meal (o. p.) 3, cottonseed meal 2.

40. Corn fodder 10, mangels 10, millet hay 7, corn 5, Chicago gluten meal 3, cottonseed meal 2.
41. Millet hay 20, bran 4, cottonseed meal 3.
42. Millet 20, bran 1, linseed meal (o. p.) 2, cottonseed meal 3.
43. Millet 20, mangels 10, soy bean meal 1, bran 1, cottonseed meal 3.
44. Millet hay 15, corn ensilage 15, bran 1½, Chicago gluten meal 2, cottonseed meal 2½.
45. Millet hay 15, corn fodder 8, bran 1, linseed meal (o. p.) 3, cottonseed meal 2.
46. Millet 15, mangels 10, Kaffir corn 2½, bran 4, cottonseed meal 3.
47. Millet hay 10, fodder corn 10, soy bean meal 2, bran 5, cottonseed meal 2.
48. Millet 10, corn fodder 10, oats 3, bran 4, cottonseed meal 3.
49. Millet 10, prairie hay 10, mangels 10, bran 4, cottonseed meal 3.
50. Millet 10, oat straw 10, bran 6½, cottonseed meal 3.
51. Sorghum hay 25, bran 1½, Chicago gluten meal 2, cottonseed meal 3.
52. Sorghum hay 20, corn 3, Chicago gluten meal 3, cottonseed meal 3.
53. Sorghum hay 20, Kaffir corn 3, oats 1, soy bean meal 2, cottonseed meal 3.
54. Sorghum hay 20, bran 8, cottonseed meal 3.
55. Sorghum hay 15, corn fodder 10, soy bean meal 3, bran 3, cottonseed meal 2.
56. Sorghum hay 15, prairie hay 10, bran 1½, linseed meal (o. p.) 2, cottonseed meal 2.
57. Sorghum hay 15, millet hay 6, bran 6½, cottonseed meal 3.
58. Sorghum hay 15, mangels 15, corn 5½, Chicago gluten meal 1½ cottonseed meal 3.
59. Sorghum hay 10, orchard grass 13, bran 3, Chicago gluten meal 1, cottonseed meal 3.
60. Sorghum hay 10, oat straw 10, oats 4, Kaffir corn 1, soy bean meal 2, cottonseed meal 3.
61. Prairie hay 20, Kaffir corn 3, bran 2, Chicago gluten meal 2, cottonseed meal 2.
62. Prairie hay 20, Chicago gluten meal 3½, bran 6.
63. Prairie hay 20, bran 8, cottonseed meal 2½
64. Prairie hay 20, corn 3, Chicago gluten meal 1½, cottonseed meal 3.
65. Prairie hay 20, oats 3½, bran 4, linseed meal (o. p.) 1, cottonseed meal 2.
66. Prairie hay 18, mangels 20, bran 6, cottonseed meal 3.
67. Prairie hay 15, millet 5, bran 4, corn 2, cottonseed meal 3.
68. Prairie hay 15, sorghum hay 10, bran 2½, Chicago gluten meal 1. cottonseed meal 3.
69. Prairie hay 15, sorghum hay 7, bran 6, cottonseed meal 3.
70. Prairie hay 10, fodder corn 12, Kaffir corn 4, soy bean meal 5½.
71. Timothy 10, corn fodder 10, corn 3, bran 4, cottonseed meal 3, linseed meal (o. p.) 1.
72. Timothy hay 10, clover 10, sorghum hay 5, corn 2, bran 2, cottonseed meal 3.
73. Timothy 10, clover 10, corn 4, bran 2, linseed meal (o. p.) 3½.
74. Timothy 10, clover 10, mangels 10, corn 3, bran 3, cottonseed meal 2½.
75. Timothy 10, clover 5, corn ensilage 15, oats 4, corn 2½, cottonseed meal 3.
76. Timothy 8, clover 8, corn fodder 8, oats 2½, bran 4, linseed meal (o. p.) 3.
77. Timothy 5, clover 5, corn fodder 10, corn 3½, bran 5, linseed meal (o. p.) 2, cottonseed meal 1.
78. Orchard grass 10, clover 10, corn fodder 10, Chicago gluten meal 3, bran 1, linseed meal (o. p.) ½.
79. Orchard grass 10, clover 10, corn 3, bran 3, bean meal 3.
80. Orchard grass 10, clover 10, mangels 10, corn 2, Kaffir corn 2, bran 3, cottonseed meal 1½.

81. Orchard grass 10, clover 10, corn 4, Chicago gluten meal 3, bran 1.
82. Orchard grass 10, clover 5, prairie hay 5, corn 3, oats 2, Chicago gluten meal 3, cottonseed meal 1.
83. Orchard grass 7, clover 7, corn ensilage 16, corn 4, cottonseed meal 2, soy bean meal 2.
84. Orchard grass 5, clover 5, corn ensilage 25, corn 4½, bran 1½, cottonseed meal 3.
85. Orchard grass 13, corn ensilage 20, corn 3, cottonseed meal 3, bran 3.
86. Corn ensilage 40, prairie hay 10 or millet 8, bran 4½, cottonseed meal 3.
87. Ensilage 40, corn fodder 10, bran 4, Chicago gluten meal 2, cottonseed meal 2.
88. Ensilage 40, sorghum hay 5, corn 3, bran 1½, Chicago gluten meal 3, cottonseed meal 1½.
89. Ensilage 30, millet 10, corn 4, Chicago gluten meal 1, cottonseed meal 3.
90. Ensilage 30, fodder corn 15, bran 2½, Chicago gluten meal 3, cottonseed meal 1½.
91. Ensilage 30, corn fodder 10, corn 3½, bran 4½, cottonseed meal 3.
92. Ensilage 30, oat straw 10, oats 2, bran 4, Chicago gluten meal 2, cottonseed meal 2.
93. Ensilage 25, prairie hay 10, corn fodder 5, corn 1, Chicago gluten meal 3, cottonseed meal 2.
94. Ensilage 20, oat straw 9, oats 3½, bran 7, soy bean meal 2, cottonseed meal 1.
95. Ensilage 20, alfalfa 20, corn 3.
96. Cat straw 20, bran 7, cottonseed meal 4.
97. Oat straw 15, corn 6, Chicago gluten meal 3, linseed meal (o. p.) 3.
98. Oat straw 15, mangels 10, corn 5, Chicago gluten meal 3, cottonseed meal 3.
99. Oat straw 10, wheat straw 10, mangels 8, bran 6, Chicago gluten meal 2, cottonseed meal 2½.
100. Wheat straw 18, mangels 15, corn 2, bran 4, cottonseed meal 2, soy bean meal 3.

These 100 rations contain nearly equal quantities of milk-producing food but do not have nearly equal feeding values. The composition of a ration is only one factor. The more nearly a ration meets the requirements in regard to succulence, variety, palatability and to keeping the cow in good health, as well as in composition, the better will be the results obtained from it.

In using these rations, the amounts of the different feeds that are equivalent to each other for milk production are roughly as follows: Corn fodder 1.0 lb. = prairie hay 6 lb. = sorghum hay 9 lb. = millet hay 5 lb. Linseed meal (o. p.) 5 lb. = soy bean meal 5 lb. = Chicago gluten meal 4½ lb. = cottonseed meal 4 lb.

FEEDING THE INDIVIDUAL.

Each of the 100 rations given above is calculated as the feed needed for twenty-four hours for a cow in full milk, weighing 1,000 pounds, the cow to be fed twice a day and one-half of the ration to be given at each feed. Suppose the dairyman has ten cows and selects ration No. 38. The weights given in the rations are for

amounts eaten. As not over half the weight of corn fodder given is eaten, and as this ration calls for fifteen pounds per day, each cow will need to have daily thirty pounds of corn fodder as it comes from the field. This will make a little over a ton of corn fodder per week for the ten head, and a ton of prairie hay will be needed every twenty-five days, provided it is of good quality and is all eaten. For the grain, take 200 pounds of ground oats, 600 pounds of ground Kaffir corn, 600 pounds ground soy bean meal and 600 pounds cottonseed meal. Put these in a box or on a tight floor and thoroly mix with a shovel. Four and a half pounds of this mixture will be required twice daily for each cow. Weigh out this amount once and find how much bulk it makes, and you can measure the feed quite accurately. These rations, like all others, are calculated for cows weighing one thousand pounds. If cows average more or less in weight, the ration should be proportionally increased or decreased.

In a herd of fifty cows, the average amount eaten, per cow, will correspond closely with the amount given in the one hundred rations, but individual cows will vary widely from the average, some eating not more than half the amount called for in the ration and others eating and giving returns for twice the amount. We find many Kansas dairymen feeding all cows in a herd alike, the fresh cows, the cows that have been milking six months and those nearly dry getting the same amount of grain. This is a mistake. In most herds cows will be found that, after milking three months, begin to put on fat and slacken in milk yield. As soon as the first signs of this appear, cut down the grain ration. Other cows will be found to keep thin, turning all their feed into milk. Increase the feed of such cows just as long as they will give returns for it. In the same herd we have with profit varied the grain ration for different cows from two to twenty-four pounds. If the dairyman has the conveniences it will pay to vary for each cow the proportion in which the grains are given, which is easily done if the grain mixture is fed from a box mounted on low wheels. Fill the box with the mixture of grain selected for the ration, select the two grains in your mixture that are respectively richest and poorest in protein and put them in small boxes on your feed-box. Taking ration No. 38, the feed richest in protein is cottonseed meal, that poorest in protein is Kaffir corn meal. You come to a cow that is milking well but is beginning to put on flesh; give her only a part of a feed of the general grain mix-

ture and add some cottonseed meal; this will tend to force her to a higher milk yield. The next cow may be a heavy milker that is getting so thin that she is losing vitality; give her only a part of a ration of the general mixture and add a liberal allowance of Kaffir corn meal. This will help her put on flesh enough to keep up strength. The nearer each cow's wants are met, the greater will be the yield and the more the profits. Feed according to the yield of milk and the condition of the cow.

FEEDING TO DEVELOP.

It is often claimed that heavy feeding burns the cow out, and that cows handled in the way recommended give high yields for a while but soon break down. The effect of heavy feeding depends on the character of the ration. A true dairy cow fed on a ration rich in protein and light in carbohydrates will continue to develop for years, both in ability to consume feed and to yield milk, and properly handled does not reach her highest yield until 8 or 10 years old, and is then good for from five to eight more years of profitable work. A cow heavily fed on a ration of average composition, greatly deficient in protein and high in carbohydrates, does burn out and will not last long.

This year's feed increases next year's yield. A cow high-fed this year will give better returns for food consumed next year than one having a light ration now; and the skillful dairyman can. by studying his cow, gradually increase from year to year the amount of feed consumed and the yield of milk produced per pound of feed eaten for a number of years. In this work of developing, the poor cows will reach their limits much earlier than the good ones and can be fattened and sold.

Where cows have been fed a ration deficient in protein, the amount of protein given should be increased slowly, as a sudden change is often hurtful.

Before us is the records of a dairy cow that was developed by these methods and in three years was worked up to a consump tion while in full milk of eighteen pounds of grain daily, besides the usual quantity of roughness, and gave 610 pounds of butter in a year. This butter cost less than that produced by the ordinary cow on ordinary feed and giving ninety pounds of butter a year.

VALUE OF THE DIFFERENT FEEDS.

Alfalfa is essential, under Kansas conditions, to the cheapest production of milk and butter fat. When fed in considerable quantities it can be combined with the other feeds usually grown on the farm, to make a good dairy ration without any purchased feeds. Good alfalfa hay contains over 86 per cent as much protein as bran, is our most palatable rough feed, keeps the cow in healthful condition, and, cut early and well cured, is eaten without waste. Fed in sufficient quantity, it produces an abundant flow of milk, with butter of good character. Under favorable conditions three or more crops are harvested a year, and at least one good crop in the dryest year in any part of the state. It is often hard to get alfalfa started, and if seasons are unfavorable it is sometimes necessary to reseed in order to get a good stand, but the crop is worth the cost. Alfalfa is a crop that is worth great care in harvesting. Our table of feed-stuffs gives the average amount of digestible protein in alfalfa as 10.6 per cent. The amount varies from 9.9 per cent when poorly cured and roughly handled to 16.2 per cent where the greatest of care has been taken in curing. As bran has only 12.8 per cent digestible protein, it can be seen that by careful handling alfalfa hay can be made which is worth more than its weight of bran. With a good stand the leaves are more than half the weight of the cured crop and contain 85 per cent of the total yield of digestible protein. At the Colorado Experiment Station tests showed the leaves in alfalfa hay to contain 14¾ per cent digestible protein, making a ton of them worth 2,400 pounds of bran. Yet alfalfa hay is frequently found which has been so roughly handled that it consists of stems only. If the dairymen who make such alfalfa hay knew that in wasting the leaves they were wasting a product worth more to them than an equal weight of bran, greater care would be taken to avoid the loss.

Corn Ensilage supplies succulent feed thru the winter, enabling the dairyman to get as good or better returns from his cows than in summer. When corn is put in the silo more feed can be produced from an acre than if handled in any other way. This feed is stored in good condition, in small space, saved with little waste, preserved in a palatable form, eaten with small loss and its influence is for the best on the health of the cow, her digestion and on the quality of her products. The summer silo is one of the best means of keeping up the flow of milk during the annual

failure of pasture from drouth, and for this purpose alone it will pay Kansas dairymen to use ensilage and keep their cows in full flow when the price of dairy products is high. In drouth, when corn is burned up too early to be saved for fodder, it can be put in the silo and will give a moderate yield of good feed when otherwise the crop would be a total loss.

Ensilage will keep as long as the silo is not opened, and has been kept in good condition for seven years. This is a special advantage to Kansas dairymen, as in years of heavy crops the surplus can be stored in silos for years of drouth—making all years good crop years for silo dairymen.

Ensilage is poor in protein and should be fed either with alfalfa or feeds like linseed, cottonseed, gluten and soy bean meals. Kansas dairymen should raise alfalfa and put up corn ensilage, and with these feeds give corn, Kaffir corn or oats or all three, and they will not need to buy feed.

Corn Fodder could be improved on many farms by earlier cutting and by putting up in larger shocks. The larger the shock, the less the loss from weather. It will pay more Kansas dairymen to plant in rows the usual distance apart with stalks eight inches apart in the row, cultivate thoroly, put up in large shocks and feed without husking. This makes a cheap feed. In our rations we have called corn put up in this way fodder corn, and corn planted in the usual way and husked, corn fodder.

Kaffir Corn Fodder, without the heads, has about the same feeding value as husked corn fodder, and one can be substituted for the other in the feeding rations we have given.

Millet should be cut early, before the seeds get firm. It is then considerably richer in protein than corn fodder, timothy or prairie hay.

Orchard Grass cut early is worth about the same as millet hay, and late is not much better than wheat straw for milk production.

Prairie Hay varies greatly in quality; when early cut it ranks between corn fodder and millet. It is poor in protein and needs alfalfa or the heavy meals, as linseed and soy bean, to balance it for milk production. It tends to produce constipation, and this must be counteracted by the other feeds if good results are secured.

Timothy Hay is one of the poorest milk-producing feeds used by Kansas dairymen, as well as one of the most expensive. It is low in protein, high in carbohydrates, tends to produce constipation and requires a large amount of grain feed, rich in protein.

to be given with it to produce a good milk flow. It is largely fed in eastern Kansas, but under ordinary conditions it will pay to sell timothy and buy other feed if milk is wanted.

Sorghum Hay is a sure crop in all parts of the state. It is our most succulent dry feed and can be handled cheaply. Many dairymen report that when cows are fed sorghum hay they dry up rapidly, while others get good results when feeding it. A glance at the table of feed-stuffs shows that sorghum hay is low in protein and high in carbohydrates. If fed with alfalfa, red clover, bran or the meals rich in protein it is one of our most profitable rough feeds, but when fed with other feeds low in protein. as prairie hay, corn and Kaffir corn fodder and grain, the combination makes a poor milk-producing ration, and with most cows heavy feeding will quickly stop the milk flow.

Red Clover Hay is next in value to alfalfa, but contains much less protein. When it is impossible to raise alfalfa, red clover should be grown, as it contains from two to three times the protein found in most farm forage except alfalfa.

Mangels, or mangel-wurzels, is the best root crop for the Kansas dairyman to raise, and if he does not have ensilage he should raise sufficient mangels to furnish ten to twenty pounds per day to each cow thru the feeding season. The best yields cannot be secured in winter without succulent feed, and ensilage or mangels are the succulent feeds most practicable for Kansas dairymen. Sugar beets are worth more per ton than mangels but do not yield as well. Plant the Long Red for feeding before New Years and the Golden Tankard to feed from that date until the cows are turned to grass.

Bran is a standard dairy feed and is one of the best feeds to use with linseed, cottonseed, gluten and soy bean meals.

Corn is poor in protein and rich in carbohydrates and is one of the best grains to feed with alfalfa. Experiments at this Station have shown that corn and cob meal is worth as much as an equal weight of corn meal, provided it is finely ground. Coarsely-ground, the cobs irritate the digestive organs of the cow, producing scouring, and the milk yield is lowered.

Kaffir Corn grain has the same properties as corn but is not quite equal to it in feeding value, seven pounds of corn having about the same feed value as eight pounds of Kaffir corn.

Oats are one of the most healthful and palatable feeds but are usually too expensive to be fed, except in small quantities.

Cottonseed Meal is the richest in protein of any feed in reach of the Kansas dairyman. It is a powerful milk stimulating feed, hardens the butter and tends to produce constipation. The price varies a great deal, and it is often the cheapest source of protein. We do not feed over four pounds per day to a cow, and prefer not to feed more than three, and like to mix it with linseed or soy bean meals. When these rich meals are fed alone or in mixtures it is well to dilute with bran. It should not be fed to cows heavy in calf nor within three weeks after calving.

Linseed Meal is rich in protein, is a healthful feed and can be safely fed at any time, and is especially valuable just before and after calving. Do not feed over four pounds daily and usually not more than three. It softens the butter and should be given with some feed that has an opposite tendency. The old process is generally used in Kansas and is marked o. p. in our table.

Soy Bean Meal has about the same composition as linseed meal, and so far as tested has the same effect on milk production and quality of butter. The soy bean is one of the best drouth-resisting plants and farmers can raise it and not have to buy linseed or cottonseed meals.

Gluten Meal stands next to cottonseed in amount of protein and can often be purchased for much less. It is one of the best milk-producing feeds, causes soft butter and must be fed with something that will harden the butter. This meal deserves more attention from Kansas dairymen who have to buy grain.

BUYING FEED.

When feed must be purchased, it will pay the dairymen to get prices of all the feeds on the market, compute properly balanced rations with a number of combinations with the feeds purchased and those grown on the farm and ascertain which will give the required food at least cost. In making out a ration, besides the cost and composition, succulence, palatability, variety, effect on the health of the cow and her offspring and the influence on the quality of butter should be considered. It requires patience, time and good judgment to make a ration that has all these qualities, but the cash returns for the work pay well. Last winter several persons made rations for dairy cows, based on the prices of feed at Manhattan. All rations contained practically the same amount of milk-producing food, yet the cost per day for feeding a cow varied from 6¼, to 22 cents, depending upon the judgment used

in selecting the feeds. Where alfalfa is not grown, the farm crops usually supply too much carbohydrates, and, when this is the case, the purchased feeds should be rich in protein. Each year there is usually on the market one feed that supplies protein much cheaper than the others, and it pays to carefully study the market and ascertain the cheapest source of protein before any feed is purchased. Often the same feed does not supply protein the cheapest two years in succession.

The following table gives the relative values of the feeds when protein alone is considered:

GRAINS. Value for Protein.	Value when corn is worth per bushel.		
	15 Cents.	20 Cents.	25 Cents.
Oats, per bushel	$0.10	$0.14	$0.17
Kaffir corn, per bushel	.15	.20	.25
Soy beans, per bushel	.61	.85	1.02
Wheat bran, per ton	8.45	11.26	14.08
Wheat middlings, per ton	8.79	11.72	14.65
Linseed meal (old process), per ton	19.78	26.39	32.96
Chicago gluten meal, per ton	21.36	28.48	35.60
Cottonseed meal, per ton	25.40	33.88	42.35

ROUGHAGE. Value for Protein.	Value per ton when Prairie Hay is worth per ton.		
	$2.00.	$3.00.	$4.00.
Alfalfa hay	$6.05	$9.08	$12.11
Red clover hay	3.88	5.82	7.77
Orchard grass hay	2.74	4.11	5.48
Millet hay	2.57	3.85	5.14
Timothy hay	1.65	2.48	3.31
Sorghum hay	1.37	2.05	2.74
Corn fodder	1.14	1.71	2.28
Oat straw	.91	1.37	1.82
Wheat straw	.45	.68	.91
Sugar beets	.62	.94	1.25
Mangel-wurzels	.57	.85	1.14

SUMMER FEEDING.

It does not pay to turn dairy cows on pasture in the spring until the grass furnishes good feed. On the morning of the day on which they are first turned to grass, they should have a full feed, just as tho they were to be kept in the yard all day. The first night the cows come from pasture give them the usual grain ration, and also roughness if they will eat it. Gradually reduce the amount of feed given until, at the end of a week or ten days, the pasture can supply all or most of the feed needed. When a change is made abruptly from winter feed to grass the cows usually scour, the increase in milk flow is not as great as when the change is made gradually, and often the per cent of butter fat is lowered

Where garlic and wild onions grow in the pastures, the dry stock should be turned on a week before the cows giving milk and they will then eat the greater part of the offensive weeds. After the onions are well eaten down, turn on the milking cows taking them off each day at noon while the trouble lasts. The offensive materials will usually work off from the cow's body before the evening's milking and the milk and butter will be untainted.

Our experience leads us to feed some grain all summer. Slight returns, if any, will be shown from grain feeding while pasture is at its best, but this condition lasts but a short time and then the grain begins to show an increase in the milk yield. Experiments indicate that the grain feeding shows no increase of milk during the flush of pasture, yet the feed after the pasture has begun to fail will produce more milk where grain has been given all the time. It is necessary to feed only a small quantity of grain while the pasture is vigorous. This feed not only has the effect on milk yield mentioned, but it makes the cows want to come home to be milked and more contented at milking time. Corn, Kaffir corn and cottonseed meal are the best grains to feed while the grass is green, as they tend to harden the butter and counteract the softening effects of the grass. Never feed cottonseed alone—mix it with bran. During drouth, when grass becomes very dry, laxative feeds are needed, the same as in winter with dry feeds. While pastures are rank and succulent, cows crave dry roughage. and, if nothing better, a stack of good straw will help. This summer (1898) the College cows were started on grass with a grain mixture, by weight, of four parts corn meal, one part bran and one part cottonseed meal the cows receiving while the pasture

was good from one to one and a half pounds of this mixture at a milking. Alfalfa hay was put into the racks every day, the amount put in being what the cows would eat without waste. While the pasture was good, the thirty head ate about 100 pounds of the hay per day, and in addition to this feed the cows had an average of five pounds each daily of a poor quality of corn ensilage. The gain obtained by our method of feeding on pasture is shown by comparing the yield of the college cows with those of neighboring farmers. The college herd numbered thirty cows, selected in western Kansas, sixteen of the number calved in December and January, and the rest in March and April. They were shipped 100 miles in mid-winter and were not as good as the average farmer's cows around Manhattan. The record of eight herds, containing a total of fifty-five cows that had been given pasture alone and whose milk was delivered to the Manhattan creamery, was taken to compare with the yield of the college herd. For the week ending July 5, the college cows averaged 18.42 pounds milk daily per cow. The eight herds on pasture alone, averaged 12.67 pounds milk per day per cow. For the week ending August 16, the college cows gave an average daily yield of 17.59 pounds milk per cow, and the eight herds on pasture alone averaged 7.71 pounds milk daily per cow. In other words, the college cows in six weeks had dropped 0.83 of a pound of milk per day per cow—4½ per cent—while the cows in the eight herds on pasture alone had dropped 4.96 pounds of milk each per day—39 per cent. With the grain charged at retail prices and the milk credited at the price received for it at the creamery, we made a profit of from 20 to 25 per cent on the grain fed while the cows were on pasture.

The prospect for the college cows giving a profitable yield during the remainder of the year is far better than for the cows that had no grain. At the date of the comparison (August 16) each cow in the college herd was eating, in addition to pasture, three pounds of grain of a mixture, by weight, of four parts corn meal and one part bran, five pounds poor corn ensilage and three to four pounds of alfalfa hay. A drouth may be expected every year in August or September, and the startling decrease—39 per cent—shown in the yield of the cows on pasture alone shows the need of providing feed in addition to pasture. The amount of pasture required to maintain milking cows after the first flush of grass is over, is another urgent reason for supplemental feed. June 4, the thirty milking cows in the college herd were being well fed from

twenty acres of tame grass pasture from which a crop of hay had been cut. June 19, forty-two acres of prairie grass pasture were added, and August 19, these two pastures failing to supply sufficient feed, the cows were turned at night on eleven acres of tame grass meadow from which a crop of hay had been taken early in June. With this last addition the cows had seventy-three acres of pasture, and this proved sufficient until the latter part of August, when we had to begin feeding green Kaffir corn. During the whole season our cows had the small feeds of grain and alfalfa previously mentioned.

The feed needed to supplement pasturage may be supplied by feeding alfalfa—green or as hay, corn, Kaffir corn or sorghum. Rye furnishes early and late pasture but it is likely to injure the flavor and grain of the butter unless the milk is thoroly aerated and grains that harden the butter are fed with it. The hardier varieties of oats make good fall pasture, and wheat makes good pasture both fall and spring. For pasture, sow two to three bushels of wheat per acre, pasture in fall and spring, then let it grow up and begin cutting for green feed when the first heads appear. Green wheat does not have the bad effect of rye on the quality of butter, it is in good condition to feed for a longer period than rye, and is one of our best feeds for forcing a high milk yield. Prof. T. L. Lyon, of the Nebraska Experiment Station, recommends sorghum as a pasture for dairy cows thru July, August and September, as affording a large quantity of succulent forage which has a marked effect on the milk flow. He recommends to pasture the sorghum after it has attained its height and before it has headed. He says that at this stage one acre will furnish pasture for ten cows twelve days, that care should be taken when cows are first turned on sorghum pasture that too much is not eaten, and that it is well to feed them in the morning before turning out to pasture until they become accustomed to it.

When the dairyman can afford the first cost, the summer silo is the best means of providing an abundant supply of feed during drouth. Cutting green feed every day takes considerable time and frequently interferes with the regular farm work. The silo can be filled once for the year and then the feed is available whenever needed and quickly fed. If after a time the drouth is broken and the pastures again supply the feed needed, the ensilage can again be covered and left until wanted. In hot, dry weather we have found a tendency for the top of the ensilage in the silo to dry out

between feedings. We overcome this by sprinkling with water after each day's feed has been taken out and covering with bran bags.

Frost-bitten grass injures the quality of both milk and butter and cuts down the yield. It pays to begin feeding early in the fall.

For eastern and central Kansas we recommend the following mixture per acre for seeding tame grass pastures: Orchard grass 20 pounds, English blue grass 15 pounds, red clover 5 pounds.

WATER.

An abundant supply of water, easily obtained whenever the cow wants it, is necessary to the highest milk production. About 87 per cent of milk is water, and if the cow's supply of water is limited the milk yield is proportionately reduced. It pays to furnish pure, palatable water, summer and winter, so that the cow will drink large quantities, as, within reasonable limits, an increase in water consumption brings an increase in the milk yield. Some dairymen are obliged to water their cows in summer from artificial ponds. When this is the case, the ponds should be fenced and the water drawn off into a trough by a pipe controlled by a float valve, so that the trough will always be full of clean water. When cows are allowed to stand in a pond the water becomes indescribably filthy and the cows will not drink enough to maintain a full milk yield, such water is liable to taint the milk, and some of the filth which collects on the cow's body while standing in the water is very apt to fall into the pail at milking. This summer we saw dairy cows drinking from ponds in which they stood and in which pigs wallowed. Milk from a single herd of cows watered in this way might taint the entire product of a creamery.

In winter, dairy cows which have poor shelter and are obliged to drink ice-water from a creek dread the chill and often do not drink as much water as needed. It will often pay to warm the water, using one of the cheap heaters on the market.

On stormy days if cows are exposed while drinking the milk yield will be reduced sometimes as much as 25 per cent, and when the weather is bad it will pay either to have the watering-trough under a shed or else carry water to the cows and let them stay in the stable.

There are devices on the market which keep a supply of water constantly before cows in the stable, and tests made with these devices show that when used the milk yield is increased over that given by any other method of watering.

SHELTER.

The dairy cow must have better shelter than the beef animal if she is to give a full yield of milk, because she puts the product from her feed into the milk pail, while the fattening animal's gain affords its body protection and strength. The cow does not need expensive shelter in winter, but she does need shelter that will keep her warm and dry and that will furnish good light and pure air. The best winter temperature is from 50° to 60°. If the air in the stable goes below 50°, the milk yield is reduced, and if it is kept much above 60° in severe weather the cow is liable to catch cold when turned out.

While the dairyman's capital is limited, he finds it difficult to provide shelter that will secure the highest milk yield, and afterwards, when he can afford to build a barn, he is likely to make one that will furnish too little air and ventilation. A cow confined in a stable should have a cubic foot of air for each pound of live weight, and with this, ventilation should be provided that will keep the air pure without draft. It is as injurious for cows to breathe impure air as it is for human beings. If the ventilation is poor and the cows breathe impure air, the milk yield will be cut down just the same as when the cows are exposed. Light is also essential for securing best returns from a dairy cow and for keeping her in a healthy condition. The stable should be light enough for a living room for people, and this requires about four square feet of glass per cow. Light is an effective destroyer of disease germs.

It is best not to have feed in a barn above dairy cows. The moisture from the cattle injures the feed, and if a cow is diseased, the germs causing it are likely to float in the air, collect in the feed and spread at feeding time to all the herd and may fall into the milk.

A sanitary barn can be made by building a high structure to contain the grain, forage, implements and machinery, and connecting with it a one-story, well-lighted, well-ventilated, easily-cleaned cheap building for the cows. Such a building can be cheaply disinfected in case of disease, and if fire occurs there is an opportunity to save the stock.

COMFORT.

Whatever adds to the comfort of a dairy cow increases the yield; discomfort reduces the yield. Comfortable shelter, clean-

liness, good dry bedding, and, if stabled, comfortable methods of fastening add to the milk yield.

Frequency of feeding, whether two or three times a day, is largely a matter of habit, but regularity of feeding, to the hour, is essential to securing the greatest yields. If feeding twice daily is the method adopted, the cows should be fed at the same hour every morning and at the exact time selected for evening feeding every evening. The same rule holds good if the cows are given a mid-day feed. Rough experiments with a large number of cows indicate that feeding dairy cows twice daily will result in as large a yield as is obtained when a noon feed is also furnished, provided the same quantity of feed is given with each method. In either case, regularity as to time is essential, for, if the cows have to wait half an hour or an hour for feed after the usual time, their fretting cuts down the milk yield.

Garget is often brought on in late fall and early spring by allowing the cows to lie on frozen ground, and the heavier the milker the greater the damage from this cause.

Shade in summer will add to the milk yield, and if this cannot be supplied by trees, it will pay to build an open shed on high ground where the cows can obtain relief from the blazing summer sun and where, if there is a breeze, they will get the benefit from it.

It also helps the yield and adds to the comfort of both cow and milker in fly-time to throw a light blanket over the cow while she is being milked.

KINDNESS.

Kindness is an efficient aid in increasing milk yield and costs nothing. The more a milker can make the cow love him as she loves her calf, the more milk she will yield to him. Investigations show that it is probable that a considerable portion of the milk is secreted during the operation of milking, especially the rich milk which comes last. Abuse and excitement reduce the secretion and not only lower the quantity of milk given, but often lower the percentage of butter fat. Kindness and petting make the cow contented and put her nervous system in such a condition that the fullest yield is given. This is not the only cause, but it is probably a chief cause, of the wide variation in butter fat sometimes shown in creamery tests. Hurrying cows, running them with dogs, beating them, or speaking roughly to them will reduce the yield of milk and per cent of butter fat. A change of milkers will often lower the per cent of butter fat until the cow becomes fond of the new milker.

Tests were made by us this year to show the importance of clean milking. Milk was collected in half-pint bottles and showed a gradual increase in per cent of fat from the beginning to the last of the milking with the exception of the last two pints drawn from each cow. In these the per cent of fat would show a sudden increase from 1 to 3 per cent. Below is given the per cent of butter fat found in the first and last half-pints of the milk of each cow

Cow No. l—first milk, 0.6 of 1 per cent.; last milk, 7.2 per cent.
Cow No. 10—first milk, 0.2 of 1 per cent.; last milk, 6.6 per cent.
Cow No. 14—first milk, 1.6 of 1 per cent.; last milk, 5.8 per cent.
Cow No. 15—first milk, 1.5 of 1 per cent.; last milk, 6.8 per cent.
Cow No. 20—first milk, 0.8 of 1 per cent.; last milk, 7.8 per cent.

These results show plainly the need of clean milking. They also show the need of kindness and of keeping the cow free from excitement, for if the cow is abused or excited this last milk, so rich in butter fat, is not secreted.

The changes in butter fat caused by excitement was strongly shown in the milk from the cows recently purchased for our dairy school. These cows were loaded on the cars at Lincoln, in the afternoon, and came by rail to Manhattan, one hundred miles, where they arrived at night, and were unloaded into large pens. At 4 o'clock in the morning they were driven to the college barn, one and one-half miles from the station, watered, fed and milked, being handled as gently as possible. Samples from the milk of each cow were taken for analysis at this milking, and from all succeeding milkings until the milk seemed to have become normal. The figures given below are the per cents of butter fat found in the milk at consecutive milkings.

Cow No. 23—3.0, 7.2, 3.6, 2.6, 2.9, 3.4. This cow's milk shows 3 per cent. butter fat in the morning and 7.2 per cent butter fat at night, a change of 4.2 per cent between milkings; and that it was not until the sixth milking that the milk became normal in regard to butter fat.

Cow No. 25—3.2, 8.3, 6.0, 5.0, 4.2, 4.2, 3.6. Here, then, is a difference of 5.1 per cent of butter fat between morning's and night's milk of the first day; and the milk did not reach the normal until the seventh milking.

Cow No. 26—1.5, 2.0, 2.4, 3.8, 7.2, 11.1, 5.3, 4.7, 3.9. This cow's milk showed a very low butter fat content the first milking, gradually increased in butter fat the next three milkings, and then suddenly increased to 7.2 per cent on the morning of the third day, and to 11.1 on the evening of the third day—the latter amount about 7

per cent above her normal. A gradual decrease followed until the ninth milking, when the fat content became normal.

Cow No. 28—0.9, 3.9, 4.9, 3.4, 3.6, 3.7, 3.1, 3.3. This yield of 0.9 of 1 per cent of butter fat for the first milking is the lowest amount we have ever found in the whole milk. This cow's milk was apparently normal at the second milking and did not vary an unusual amount thereafter.

Cow No. 29—1.2, 1.2, 3.4, 10.7, 4.1, 6.2, 3.4. These figures show a very low fat content for the milk of the first day, normal the morning of the second day, and 10.7 per cent butter fat the evening of the second day—an increase of 7.3 butter fat between the milking of a single day. This was followed by irregular fluctuations until, on the morning of the fourth day, the milk became normal.

These cows were handled quietly and made as comfortable as possible from the hour they arrived at the barn. The excitement of shipping not only affected the butter fat in the milk, but the yield was much reduced. At the end of ten days the cows had become reconciled to the change, their yield of milk had increased 40 per cent and was increasing daily.

Is further proof needed to emphasize the fact that any excitement seriously alters the fat content of the milk and reduces the yield? We have found similar results, tho not so marked, to come from exposing cows to storms and to rough speaking.

SALT.

A supply of salt available whenever the cow wants it, is necessary to maintain a high milk yield. Salt stimulates the appetite, assists digestion and assimilation and increases the flow of the fluids of the body, stimulating all the vital functions of the animal. Salting dairy cows once a week is not sufficient. It is a good plan to keep rock salt under shelter where the cows can get it at will and then feed loose salt twice a week in such quantities as the cows will eat. Loose salt may be used exclusively if it can be sheltered from rain. If rock salt only is used, the cows' tongues will frequently become sore, when they will not eat the quantity needed for a full flow of milk. Do not mix the salt with the feed, because if you do the cow may get more salt than she needs, which will reduce her yield. Cows having salt kept before them all the time will not eat too much. Where cows have not had sufficient salt they should be worked up gradually to consuming a full quantity, the same as for grain. An overfeed of salt to a cow that has been deprived of it acts like a poison, producing irritation of the digestive organs and scouring.

A SERIOUS DECREASE CANNOT BE MADE UP.

A dairyman is tempted, during a rush in field work, to neglect the cow, hoping to make up the loss by unusual care afterwards. If neglect causes any considerable decrease in milk yield, no care or feed, however good, can bring back the cow to her full yield until she calves again.

A decrease in milk yield at any time during the milking period, means less yield for all the rest of the season. For this reason, the cow should have at all times such care and feed as will keep her milking to her full capacity. A cow may be neglected for a while and then be treated so that her milk yield will be greater than it was while she was neglected, but it will not be as great as if she had been well treated all the time.

KEEPING RECORDS.

A great help to keeping up a full milk flow is keeping records of yield. This requires little time and does not cost much. Spring balances are sold on which the hand is set back so that when the empty pail is hung on them the hand points to zero. After the cow is milked and the pail of milk is weighed, the weight shown by the hand is the weight of the milk and no subtracting is necessary. If the dairyman will buy a sheet of paper ruled with thirty-one lines and will rule a line between each of these, he will have space for the weights of night and morning's milk for a month. A page will provide room for all the cows in the herd. A part of such a page is shown below with the names of three cows:

OCTOBER.		Dolly.	Spot.	Brindle.
1.	A. M....			
	P. M.....			
2.	A. M.....			
	P. M.....			
3.	A. M.....			
	P. M.....			
4	A. M.....			
	P. M.....			

Tack this sheet on a board and hang it beside the can in which the milk is emptied. Fasten a lead-pencil to the board with a long string. After each cow is milked, weigh the milk and record the

weight. This will require but a moment. If the cow yields less than she did at the same milking the day before, find out what is the trouble and remedy it. If the cow has increased in milk yield, find out why and you may be able to make the increase still greater. If a month's milk yield is kept in sight on the record board, a dairyman can, by spending a few minutes time each day, see what the tendency of each cow is, whether to increase or decrease in flow, and can often change the feed or care so as to increase the yield without adding to the cost. If, in addition to such a record, the dairyman will once a month make a composite sample from eight consecutive milkings of each cow and get his creamery to test these samples, he will have an accurate check on his dairy operations and will be able to handle his work like a skilled manufacturer.

INDIVIDUAL COWS.

Feed and care are not the only factors in the production of milk. There are wide differences between individual cows and between herds.

This subject will be treated briefly here and taken up more fully in a later bulletin. We have the records of nearly 300 Kansas herds. In one herd the average yield in a year per cow is 127 pounds butter fat; in another herd the average is 334 pounds butter fat per cow in a year. The yields of milk per year per cow vary from 3,466 pounds to 8,682 pounds. These records are all from herds of common Kansas cows handled under Kansas conditions and by Kansas methods. Each of these herds is made up of poor, indifferent and good cows, and if the best cows only had been selected in each herd the averages would have been much higher.

Kansas crameries buy milk by the Babcock test, paying for the butter fat, and for this reason most of the patrons want high-testing milk. A low per cent of butter fat and a high yield may be more profitable than a high per cent of butter fat and a low yield. Before us is the record of a herd where a test was made of each cow's milk. In this herd, one cow whose milk averaged 4.6 per cent butter fat gave 425 pounds butter fat in a year; while another whose milk averaged 5.8 per cent butter fat, gave only 167 pounds butter fat for the same period. There were two cows, each of whose milk tested for the year an average of 4.8 per cent; one gave 378 pounds butter fat, the other 124 pounds butter fat.

Cost must also be considered as well as quantity. In a test of seven weeks, where all the cows of the college herd were given the same kind of feeds, the cost for feed of producing 100 pounds of

milk varied with the cow from 31 to 76 cents and the cost of producing a pound of butter fat from 7 to 15 cents.

Heavy feeders are usually the most profitable. It takes about the same amount of feed to keep the cow's body alive, whether she gives 75 pounds of butter in a year or 400 pounds, and nothing is received for this part of the feed. If the cow eats just a little more than is required to keep her alive, her yield will be small and the cost high, while if she eats a large quantity above what is required to maintain her body, she will give returns from a larger proportion of her feed. It is much cheaper to milk and care for one cow giving 300 pounds of butter fat in a year than it is to milk and care for three cows giving 100 pounds butter fat each; and if the 300-pound cow is heavily fed she will not eat as much as the three 100-pound cows.

It does not pay to mix breeds in a dairy herd. We have seen dairy herds in which in each herd were grade Short-horns, Herefords. Angus, Holsteins, and Jerseys. The different breeds require somewhat different treatment, and for this reason it is best to confine the herd to grades and pure-bloods of one breed.

The dairyman who wants to obtain the highest yields should weed out his poor cows, keeping the cows that produce high yields of butter fat at a low cost; cows that can consume large quantities of feed and turn it into milk.

TOPEKA, KANSAS.
KANSAS FARMER COMPANY.
1898.