The Advantages of Dairying to the Kansas Farmer of Limited Capital.

Graduating Thesis.

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Relation of Feeds to Quantity and Quality of Milk.

In general, the largest quantity of milk is obtained when the conditions are the same as those in June; i.e., when there is plenty of appetizing, succulent food, rich in materials contained in milk. The various grasses, usually found in pastures, contain these ingredients in an appetizing form.

Foods should contain protein, carbohydrates and fats. Protein includes those materials which contain nitrogen. Milk, blood, muscle, hair, brain and nerves contain protein in their make up. Protein must be present as there is no substitute. In addition to the above, protein may furnish heat and energy to the body, and may also be transformed into fat.

Fat includes all fatty substances found in feeds. It furnishes heat, energy, and fat for the animal. One pound of fat is worth 2.2 pounds of protein or carbohydrates for heat production.

Carbohydrates include starches, sugars, gums, and similar substances. They also furnish heat, energy, and fat to the body.

A good ration for an average 1050 pound cow should contain 2.5 pounds protein, 12.6 pounds carbohydrates

and ½ of a pound of fat. This is matter that is actually digested. Of course more food must be eaten to obtain these amounts for there is a great deal eaten which will not be digested. A good ration might be as follows:

			Pro.	Carb.	Fat.
Alfalfa hay,	19 pounds	contain	2.01	7.09	.27
Corn,	7½ "	"	.59	5.	.32
	Total		2.60	12.09	.59
	Needed		2.50	12.50	.40

The excess of protein and fat in this ration will make up for the deficiency in carbohydrates.

Another good ration would be:

			Pro.	Carb.	Fat.
Alfalfa hay,	25 pounds	contain	2.65	9.34	.35
Cornfodder,	5 "	"	.10	1.66	.03
Kaffir corn,	2 "	"	.16	1.14	.05
	Total		2.91	12.14	.43
	Needed		2.50	12.50	.50

In this, there is an excess of protein, but there is not enough carbohydrates, and as protein can be converted into carbohydrates, this is nearly a balanced ration.

A great many Kansas farmers feed cornfodder and corn to their milk cows, then complain that their cows will not give milk but are getting fat. Let us see what this ration would do:

	Prs.	Carb.	Fat.
Cornfodder, 25 pounds contain	,50	8,33	,15
Corn, 10 " "	,78	6,67	,43
Total	1,28	14,97	,58
Needed	2,50	12,50	,40

In this ration, there is great deficiency in protein, while carbohydrates and fat are greatly in excess. In order to manufacture milk, the cow must have the materials to do it with. Protein is absolutely essential in milk. With this ration, she has not the materials for making milk, but she does have plenty to put into fat, and this is what she does. Corn is very poor in protein, and especially rich in carbohydrates and fat. So that to get plenty of milk, you must not feed so much corn but feed something that has plenty of protein (as alfalfa, Cotton-seed-meal, Linseed-meal etc).

It is generally believed that green succulent food is favorable to a large flow of milk, but the quality is supposed to be poor. But, according to the New Hampshire experiment station, this is not true. They experimented with two cows, a Jersey and a Shorthorn, by pasturing on grass and with the following results:

	Jersey	Short horn
Increased milk	2.3 pounds daily	2 pounds daily
" fat	.2 of one percent	.05 of one percent.
" Caseine	No change.	.15 of one "
" Solids	.2 of one percent	No change.
Decreased Sugar.	No change	.2 of one percent.

The short horn's milk was not enriched, but there was no change in the percent of water and solids. The fat and caseine, together, increased .2 of one percent, while the sugar decreased in exactly the same amount. The Jersey milk was not changed in caseine and sugar; but the fat increased .2 of one percent and, to that amount, the solids increased. On the whole herd of seventy cows that were in the pasture, the amount of milk was increased, while the amount necessary to produce a pound of butter fat was decreased 1.5 pounds, so that, in this case, the grass made more and better milk.

Their experiments with feeding ensilage tend to show that it makes more and better milk than dry corn fodder. So that succulence is needed to produce larger quantity and as good quality.

For a cow to give plenty of milk, she must have a good appetite in order to digest lots of food so she can convert it into milk, and to have a good appetite, she

must have a variety in feeds, for she will get tired of the same feed day after day.

It is best to keep up the milk supply with good feeds, for if it once decreases, it is almost impossible to bring it back again until the cow brings forth another calf.

Water is very important for the dairy cow. It should be pure and not cold. Pond water is not so good as well water because it is very liable to become filthy, and in drinking the water, the cow may transfer some of this bad water to the milk and taint it, making it disagreeable to the taste, and probably unhealthy. Besides, some of the germs and dirt from the pond water would cling to the body of the cow as she stood in it to drink and would likely get into the milk while milking, and the milk would be contaminated in this way.

When cows are fed upon dry feed, about one fourth of what they consume remains undigested. In cold weather, and while drinking ice water, this amount is almost doubled; more food being required as fuel to heat the water to the temperature of the body. Where roots or ensilage are given, there is less waste from non-digestion, and the waste is not increased when dry food which has been steamed, is added. By using green or succulent food all the year, the flow of milk is stimulated at less cost than by any other system. The cow does not require so much water, but what she does drink should

not be ice water. In fact no stock should be compelled to stand in the cold wind and drink ice water. They will not take any of it until thirst forces them to, then they take too much which makes the animal uncomfortable and then more food is required to heat the water. In case of milk cows, it reduces the flow of milk, for if a cow is to give plenty of milk, she must be comfortable.

Some people think it is better to warm the water before giving it to the cows to drink. They claim it is more economical even with coal at three or four dollars per ton. In 1889-90, the agricultural experiment Station, University of Wisconsin, made an experiment along this line. This experiment showed that cows that had warm water to drink produced the greater amount of butter-fat and the larger yield of milk. There was a gain of .21 pounds of butterfat with water at 70° F. over that at 32° F. And again; there was a gain in quantity of 631 pounds of milk daily in favor of the higher temperature. It was shown that cows, as a rule, preferred warm water to the cold, but sometimes wanted a change. Their experiments did not seem to show that the gains were sufficient to make it pay to warm the water in winter.

The quality of the water given to milk cows is of utmost importance. On this point, certain errors are prevalent. One is, that cows prefer filthy water to clear. This is a mistake, both in preference and

results in the dairy. That cows have been known to turn from spring water to some dirty pond may be true, but the purpose have been misunderstood. They prefer soft water to hard, and that which has the "chill" off to that which is very cold; so that if foul sources be cut off, and soft water not lower than 50° F. be provided, the cow will be contented. The hardness of the water will affect the proportions of calcium salts and through these, the character of the milk.

According to some authorities, it is best to water cows an hour or two after feeding. But according to many others, it is better to keep water where the cow can get at it whenever she wants it. There are various contrivances in use for this purpose, but most of them are more or less deficient in one or more details. One way is to have a V shaped trough all along in front of the cows, and water running through it all the time, and a lid in front of each cow to be opened and left open whenever the cow is supposed to want a drink. But this has its disadvantages. There is the trouble of seeing to the opening and closing of the lids, and the troughs will get filled up with feed and spoil the water. The cows down the line will have to drink water that cows above have slobbered over, and if there should be tuberculosis in the herd, there would be a good chance to spread the disease.

A good way to water cattle in the stable is to have a pipe from the water supply run through the stable in front of the cows with a water tight box at each stall connected with the pipe by a valve arranged so that it will close automatically when the box is full. This box should also have an automatic lid which the cow can open when she wants a drink. This will give the cow a chance to get good water every time she wants a drink, and it will not be contaminated with water from any diseased cow that may be in the herd. Neither will there be any bother from feed getting into the boxes and spoiling the water.

Salt aids in the digestion, makes the feed more palatable and stimulates the appetite. It increases the flow of the fluids of the body, stimulating all the vital functions of the animal. Salting dairy cows every Sunday is not sufficient, cows that have been without salt too long will probably eat too much when they have a chance. And an over feed of salt to a cow that has been deprived of it, acts like a poison producing irritation of the digestive organs and scouring. If cows have not been fed enough salt, they should be worked up to eating enough, gradually. Loose salt should be used along with rock salt. If rock salt alone, is used, the cow's tongue will sometimes become sore and they will not get what salt they need. A good

plan is to keep under shelter where the cows can get at it, a good supply of loose salt and the cow will eat what she wants, and no more.

Feeding. Begin feeding the dairy cow when she is a calf. Be certain she is of a good dairy type, then feed for bone and muscle, for fat has no place in the dairy cow. After she has reached maturity, feed for the production of milk, and feed plentifully, for she will return the value with big interest. The cow cannot make something out of nothing; so if you want her to give plenty of milk of good quality, you must furnish the raw material from which she can make it. Knowledge and skill in this respect are very important.

As to pastures; the soil itself has a great deal to do with the quality of milk, although this is not generally known. The proportion of phosphate forming materials (P_2O_5 and CaO) vary in different plants, and in the same plants on different soils, according as these soils furnish them abundantly or not. There may be a deficiency or too much calcium salts in milk brought from a certain pasture, and other foods, as hay, will affect the milk in the same way. So dairy men should look out for this and, if need be, change his method of feeding.

Grasses etc. are good for the cow, but along with them are weeds, often, which affect the quality of the milk a great deal in lessening the percent of butterfat

and other solids. And there are many weeds which cause undesirable flavors. There are also many which may injure the health of the cow, and some color the milk.

The occasions known may be few in which the mischief is recognized and traced to a particular plant. A great deal of harm is daily done by the combination of the many weeds, which taken separately, will not cause any disagreeable flavor. How can this be remedied? By keeping pastures clean. If a weed is a pest in a corn field, it is more so in a pasture. It not only hinders the growth of the better plants about it, but also does direct damage to the dairy products. Weeds are the natural consequences of neglect, and require constant warfare to keep them down. Hay is the dried product of pastures, therefore it is just as important to see that it is kept clear of weeds. It should be well made, so as to keep the essential oils and flavors. When hay is heated in the rick, there is loss of fats and carbohydrates and protein. Acetic acid, ammonia and such substances are formed which impart disagreeable flavors to milk.

Silage is a good feed if put up rightly, but if allowed to sour, it had better not be given to the dairy cow, as it injures the milk. This has led many firms of milk buyers, especially of condensed milk makers, to reject all milk from silage fed cows. Food has a great deal of influence upon the flavor of the milk. Some feeds produce

a desirable flavor. Such feeds as the various grasses, clovers etc. do this. But when a cow eats wild onions, garlic and such things, the flavor of the milk is very disagreeable. This flavor is caused by the volatile fat which these foods contain. These disagreeable flavors can be largely prevented by judicious feeding. These oils, being volatile, will easily pass through the tissues of the body of the animal and, in a short time, will pass out through the skin and other excretory organs. These oils are present in the largest amounts while the food is being digested, and by the time the food is entirely digested, they entirely pass away. So by using a little care in adjusting the feeding and milking times so that the milk will be drawn, not less than ten or twelve hours after the undesirable food has been eaten, there will be but little danger of affecting the milk by the presence of the fats. But if the cow is milked within three or four hours after eating this food, the milk will have a strong disagreeable flavor. By taking advantage of this knowledge, dairymen may feed large quantities of turnips or onions without danger of contaminating the milk. If the objectionable feeds are in the pasture, it is a little harder to adjust. But if a cow is pastured but a short time after milking, then kept up and given dry feeds for three or four hours before milking, there will be a great deal less annoyance from this

Source.

Some people think it best to mix the grain with hay by placing a thin layer of hay in the bottom of the manger and putting the grain on this so that in eating the grain, the cow will get some of the hay mixed with it and carried to the first stomach together. There they will be raised and remasticated at the same time. Advocates claim that this will give the best digestion and so economize the food.

It is a waste of time to cut the feeds fine for the cow, as she needs the exercise that is necessary to chew it up.

Quantity is largely dependent upon the kind of feeds, while quality is almost independent of it. The increase of milk due to feeds is caused by the larger yields of milk, not by the increase in per-cent of butterfat. This has been the teachings of many, but the Iowa experiment Station made experiments which proved that quality as well as quantity may result from feeding. In bulletin No. 14, are described experiments in feeding with corn and cob meal and with sugar meal (the latter is a by-product from a sugar refinery). The summary is as follows:

As to gross yields:

1. Sugar meal produced nearly eight per-

cent larger average milk yields than did corn and cob meal.

2. Sugar meal produced twenty seven percent larger yield of butterfat than did corn and cob meal.

3. Sugar meal produced fourteen percent larger yield of milk solids (including fat) than did corn and cob meal; and of solids not fat ninety percent larger yield.

As to the percentage composition of milk:

1. Quality of milk, so far as measured by its percentage of fat, was changed by feed to a much greater degree than was quantity. Two thirds of the increase in average gross yields of butterfat was due to improved quality of milk, and only one third to increased milk flow.

2. Sugar meal produced .55 of a pound more butterfat per one hundred pounds of milk than did corn and cob meal; this difference is seventeen percent of the amount of fat in one hundred pounds of milk produced by corn and cob meal.

3. Sugar meal produced .73 of a pound more total solids per one hundred pounds of milk than did corn and cob meal;

this difference is six percent of solids in one hundred pounds of milk produced by corn and cob meal.

4. As compared with corn and cob meal, sugar meal increased in ratio of fats to solids not fat in one hundred pounds of milk, from 396 per 1000 pounds of solids not fat to 457 per 1000 pounds of solids not fat; an increase of over fifteen percent so that quality as well as quantity is influenced by the character of feeds. But it is not so easy with all kinds of feeds.

Sometimes the quality of the constituents themselves are influenced by feeds. Thus by feeding linseed meal, gluten meal etc. to the cow, the butter will be soft. While such feeds as cottonseed meal, corn meal etc. make it hard.

There are two ways of changing the quality of milk:

1. By decreasing the percent of water; the ratio of fat, caseine and sugar in solids remaining unchanged.
2. By increasing the relative amount of solids; the percent of water remaining unchanged

The two methods might be combined and have the same effect.

There is an increase in the percent of butter fat when cows are turned out for grass. At the Vermont experiment station, the effect of change from barn to pasture was very marked; the cows giving more milk and of a better quality. There was a gain of about one fourth more butter per day per cow.

Cereals, whether fed green in the ear or fully ripened and threshed, are valuable as food in various ways, and, under proper conditions, only affect milk by their variations in feeding value.

Sometimes dairymen are troubled with "sleepy" milk i.e., milk on which the cream is slow to rise.

This is caused by a too radical change in feeds and due, probably, to the formation of too much fibrin. This would suggest that when you change feeds, to do so gradually.

According to the results of an experiment at the Vermont experiment station, in 1891, ensilage produced the larger quantity of milk, but of poorer quality than that produced by corn-fodder. An experiment carried on at the same time by the Wisconsin experiment Station indicates practically the same results. At the Vermont experiment Station, the corn-fodder was stacked in large shocks near the barn and was of

good quality all winter; better than what an average farmer would have. The silage that was fed was taken out of the middle of the silo and was of the best quality.

After being kept on the same feed for four weeks, the cows were shifted; those that had been fed on ensilage were given corn fodder, and those that had had corn-fodder were fed on ensilage. This change was made every four weeks.

The cows drank less water while on ensilage but not enough less to make the total amount of water the same as when they ate corn fodder. There is more water in ensilage than in corn fodder, and the total amount of water taken into the system was greater with ensilage than with corn fodder.

On the whole, there did not seem to be much difference between the feeds, what the corn fodder lacked in quantity, it made up in quality. The cows seemed to like the ensilage best, but they ate the corn fodder with a great deal of relish.

These results are intended to show:

1. That plenty of milk of good quality is produced from pastures, so that the farmer does not need to buy much feed in the summer time.

2. That a good quantity and quality of milk can be produced cheaply by feeding alfalfa and corn or kaffir corn. Alfalfa and kaffir corn are successfully raised in many of the western counties, where it is supposed nothing will grow.
3. That plenty of good water with the "chill" off is needed.
4. That cows should always have access to salt whenever they want it.
5. That weeds in pastures ingure quality of milk but can be gotten rid of by a little work. And the effect of weeds can be gotten rid of by skill in feeding.

Milking Scrub Cows

It is not necessary to have pure-bred milk cows in order to make dairying pay. The Kansas State Agricultural College made an experiment with scrub cows in 1895, explained in press bulletin No. 29, which proves the above statement.

A farmer, who was not a dairyman selected thirty cows a little below the average in quality and at the average price of thirty four dollars per head and shipped them to college in mid-winter.

At the start, the cows were fed alfalfa hay, and a mixture of two thirds bran and one-third old process linseed meal, a ration rich in protein, designed to stimulate the milk flow and to partially overcome the effects from shipping. As soon as the cows were brought to a fair milk flow, they were put on a ration of alfalfa hay and kaffir corn grain. This ration produced the greatest flow of milk with butter at at least cost, but had to be dropped at the end of seven weeks, so that various feed stuffs could be fed in order to show the dairy classes the effects of various feeds on the texture of butter.

The daily grain ration averaged about eight pounds per cow while on dry feed. While on pasture, the daily grain ration averaged three pounds of a mixture of four parts corn meal and one part of bran.

Alfalfa hay was also kept in a rack where the cows could eat it at will when they were brought in at milking time. The yield held up well through the fall drouth. For a short time, green kaffir corn was fed with the pasture, and the cows were pastured on wheat in the fall until the ground became frozen.

Twelve cows were fresh when received January fifth, the rest calving in from one to five months. The records given below are for the twelve in 1898. The butter fat yielded has been credited at the prices paid each month by the Manhattan Creamery, which were as follows: January, 17½ cents; February, 17 cents; March, 16½ cents; April, 15 cents; May, 14½ cents; June, 13 cents; July, 13½ cents; August, 15½ cents; September, 16 cents; October, 18 cents; November, 18 cents; and December, 17 cents. The feed has been charged at the average retail prices in Manhattan for the year; Cost per 100 pounds, corn-meal, 55 cents, kaffir corn meal 55 cents, linseed meal $1.25; Soy bean meal $1., bran 55 cents, cotton seed meal $1.; cost per ton, alfalfa hay $4., corn ensilage $1., pasture 75 cents per month. It would pay many Kansas

farmers who live distant from market to milk cows if through the milk they could obtain the above prices with no additional profits.

Results.— Average yield of milk per cow, 5,707 pounds; best cow, 9,116 pounds; poorest cow, 3,083 pounds. Average yield of butterfat per cow, 238 pounds; best cow 383.7 pounds; poorest cow, 135.7 pounds. Average cost of feed per cow, $29.20; best cow, $32.80; poorest cow, $26.75. Average value of butterfat per cow, $37.75; best cow, $60.88; poorest cow, $21.39. Average value per cow of skim-milk at 15 cents per 100 pounds, $7.69; best cow, $12.29; poorest cow, $4.83. Average income per cow from butterfat and skim-milk, $45.44; best cow, $73.17; poorest cow, $26.22. Average receipts per cow less cost of feed, $16.25; best cow, $40.37; poorest cow, receipts 43 cents less than the cost of feed. Average cost of butterfat per pound, 12.2 cents; from best cow, 8.5 cents; from poorest cow, 19.7 cents. The average price received for butterfat for the year was 15.8 cents. To the receipts given above, should be added the value of the calf at birth.

This test shows the difference in value between different cows with feed and care alike. The year's record of our best scrub cow (9,116 pounds

butter; value of products, $73.17; returns less feed $49.37) is one that many a pedigree dairy cow would be proud of. This cow is of mongrel breeding, but has a pronounced dairy form. The poorest cow's form is a good beef type, and her yield of 3,683 pounds of milk and 135.7 pounds butterfat was worth 43 cents less than the feed she ate. Is a stronger argument needed to induce Kansas dairymen to cull their herds and keep only the best?

This test shows that Kansas cows can be made to give greatly increased yields with proper feed and care. They collected the records of eighty-two herds owned by creamery patrons in one of the leading dairy sections of the State, finding an average annual yield per cow of milk 3,741 pounds, butterfat 164.5 pounds, value of butterfat $49.79. Contrast this with the average for the college scrub herd, milk 6,707 pounds, butterfat 238 pounds, value of butterfat $ 37.75; and remember that the college herd is much inferior to the average herd of the state.

We attribute the greater yield secured from the college herd to three causes;

1. At all times their rations were either balanced or contained an excess of

protein — the material which builds blood and milk — while the Kansas cow usually, when on dry feed, has only half enough protein.

2. Kindness and shelter. The cows were petted, comfortably sheltered, never driven faster than a slow walk, and never spoken to in an unkind tone.

3. A full milk yield was secured through the summer drouth by giving extra feed.

Thus we see that expensive cows are not necessary - to make dairying pay.

Cheap Milk House.

Buildings Etc.

The buildings needed on a dairy farm are a stable in which to keep the cows, and a milk-house in which to keep the milk. Both of these can be made expensive or very primitive buildings will answer the purpose very well. But dairy stables should be made comfortable. The common Kansas hay stable or sod-stable can be made as comfortable as a barn, although not so convenient, perhaps, but at a very small fraction of the cost.

Of course if there is lots of milk, a milk-house will be needed to keep it in. This may also be made very expensive, or may be made of sods or odds and ends of boards picked up over the farm, and at little or no cost. On another page is a rude free-hand sketch of the milk-house built on the college farm to experiment with, in which milk was kept good and sweet for 48 hours regularly, during the hottest weather of the summer of 1895. Its dimensions are 12×14×9 feet. It was built of odds and ends of boards picked up about the college barn. It has no floor but the ground. There are cracks and open spaces

all around, and the roof leaks whenever it rains. If rough lumber had been bought new for it, the cost would probably be less than $10. The room was built around a well. Oil barrels sawed in two made the tanks in which to set the cans of milk. One half-barrel was boxed in, and the spaces packed with wheat chaff and covered with quilts made from bran-bags. A cooler was bought and used.

The utmost cleanliness was used in handling the milk, all the utensils were washed then scalded out to kill the sour-producing germs that may be present. The milker's hands were washed in hot water just before going to milk. The cow's udder was wiped off with a damp cloth to take up the dust that may be there so it will not fall into the milk while milking. The sanitary milk pail was used. This is a covered pail with a six inch opening covered with a removable strainer. The milk was strained into forty quart cans and immediately cooled down to 60° or 62° by passing over a cooler into other cans which were set in the tanks which had just been filled with freshly-pumped water. The whole was then covered over with bran bags. Water was changed night and morning. In this way, and without ice, milk was kept in good condition for forty hours regularly, and many times, if

kept fifty-two hours in good condition.

This should prove that farmers can keep their milk a long time and at very little cost.

The cost of starting a dairy farm will not be very great. We will suppose the man already owns or rents a farm with twenty acres of alfalfa on it. Twenty cows at $35.00 a piece would cost $700.00, the utensils needed (milk pails, milk cans, cooler etc.) would probably cost less than $25.00. This would be about all the capital needed for starting. For the buildings could be built out of the material suggested, and by the farmer himself and would cost practically nothing. The feed could be raised on the farm.

Thus we see that the Kansas dairy man with limited capital can make a good living, if he has alfalfa and scrub cows.