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A FEEDING EXPERIMENT FOR MILK.

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This Feeding experiment indicates that corn meal fed with corn fodder, or corn ensilage, results in the more rapid decrease of milk, and its fat, and solids, than the advance in the period of lactation justifies.

That corn meal fed with sorghum ensilage results in very rapid decrease in milk, and milk fat and solids, and that the combination is not profitable.

That corn meal fed with roots and clover hay is palatable and gives good results, without considering the cost of feeds, that was not normal during the experiment.

That the substitution of bran and oil meal for half the amount of corn meal resulted in a marked increase in both quantity and quality of milk, the increase in quality being still more than the increase in quantity.

That good pasture can be substituted for part of a grain ration.

That farmers who feed corn exclusively may have better yields, better sustained, by using clover hay, oil meal and bran, or other albuminous feeds.

That changing milkers is resented by the cows.

Iowa is the corn growing State of the Nation. Our domestic animals during the winter months are fed on corn, almost exclusively. What feeding is done in the summer months is with corn. Bran and oil meal are fed to a limited extent in milk and meat production, but these feeds are not in general use, with the majority of our farmers.

The clover plants are grown extensively in all the counties of the State, but their value in making part of a ration, with corn, in the feeding stable, has not been inquired into by many of our farmers. The ease with which all Iowa farmers can grow corn, clover and flax, suggests the value of experi-

ments where the mixing of these feeds is beneficial. The growth of systems of transportation whereby we can put our meats and dairy products on the world's markets more cheaply every year, also enables our competitors abroad to import our feeds at steadily decreasing cost, and enables them to send here for our oil meal, bran, corn, and other strong feeding stuffs. It is important to our farmers to know by actual trial, the value of each farm crop grown in the State, as a factor in the feeding ration. We grow flax extensively for oil, and import it in large quantities for the oil to paint with. We export the cake after the oil is pressed out, and with it the European farmer makes meats and dairy products, and enriches his manure, so that he can keep up the fertility of his soil, and grow wheat and other grains successfully. This Station deems it to be its duty to Iowa farmers to demonstrate the value of the different feeding plants grown in the State, and in this experiment we begin with corn and gradually change, introducing clover, oil meal, and bran, to get indications of their value. This Station is aware that the relative value of albuminous and carbonaceous feeds has been often demonstrated, and is well known not only to scientific men, but to many practical farmers in the State, but as the Experiment Stations were instituted for the benefit of all the farmers of the country, it is thought wise to make practical trials with Iowa conditions for those who have not had their attention called to the value of balancing a ration. We have in mind the fact that, economy, and palatability, are prime factors in feeding stuffs; that corn is the principal feed in Iowa for all domestic animals, because it is cheap and palatable, comparatively, but this experiment is designed to call attention to clover hay, that is very plenty and readily grown, and to oil meal that foreigners send thousands of miles for, and to bran, that is a staple product of the State. Our farmers can mix and temper rations to suit circumstances, and prices of feeds and products: we indicate in this Bulletin effects produced by different feeds. In Bulletin 13, we compared corn fodder, corn ensilage, sorghum ensilage and roots in milk production, with a mixed grain ration. In this experiment we use the same fodders from February 25 to April 10, without clover hay, so as to note the effects of corn

meal. Roots and clover hay are then fed from April 10 to April 25. Corn fodder and clover hay are then fed to May 18, to note the effects of introducing clover hay with corn fodder. The grain ration is then changed to half the corn meal formerly fed, the other half of the ration being oil meal and bran substituted, with clover hay, continuing to June 7. On June 7, the cow went to pasture, and had her ration of grain reduced one-half as the tables will show.

Rigid conditions were observed. The cow was weighed at intervals during the experiment corresponding with the changes in feed. The milk was sampled night and morning, composite samples preserved, (by a formula invented by Prof. Patrick and observed for eighteen months at this Station), and tested by the chemists every five days. The results for the five day periods are shown in tables in per cents of butter fat, and per cents of total solids, and in total pounds of butter fat, and pounds of solids. It will be remembered that the butter fat in a pound of marketable butter is about eighty-five per cent of it. The cow is a registered Shorthorn, Maud Dudley 2d, but known on the College Farm as 244. From February 25 to March 1, she was gradually brought to the ration indicated in Table No. 1, and each change of feed during the experiment was given after a transition period of five days, so as to get the cow from the effects of one feed to another. Farmers will perhaps be surprised at the shrinkage in milk, in quantity and quality, so soon after the experiment begun, but the cow was not fed for quantity of milk. Strict weighing of special feeds give indications of their different values, but are not best for a continuous flow of milk. The Station is feeding some cows for the greatest yield, that will show natural shrinkage as the period of lactation progresses, which should be about nine per cent a month, and this Bulletin has an experiment regarding quality of milk, where that subject is specially treated. Later Bulletins will treat of feeding for profit, through uniform generous rations.

TABLE NO. I.

	Corn Meal. Lbs.	Corn Fodder. Lbs.	Corn Ensil- lage. Lbs.	Cane Ensil- lage. Lbs.	Roots, Lbs.	Hay, Lbs.	Milk—Five Days.	Fat, per ct. Composite.	Solids, per ct. Composite.	Fat, Lbs. Composite.	Solids, Lbs. Composite.
February 25 to March 1.	20						174.	4.65	14.20	8.09	24.71
March 2 to 6.	20	94.					175.75	4.35	13.50	7.64	23.72
March 7 to 11.	20	91.5					159.75	3.88	12.76	6.20	20.35
Ten test days.		185.5					335.50			13.84	44.07
March 12 to 16.	20						159.25	3.40	12.09	5.41	19.27
March 17 to 21.	20		253.5				164.	3.62	12.32	5.94	20.20
March 22 to 26.	20		259.5				163.75	3.40	12.31	5.57	20.15
Ten test days.			513.0				327.75			11.51	40.35
March 27 to 31.	20						152.75	3.50	12.25	5.35	18.71
April 1 to 5.	20			154			140.	3.40	12.01	4.78	16.81
April 6 to 10.	20			150			143.	3.40	12.11	4.86	17.32
Ten test days.				304			283.			9.62	34.13
April 11 to 15.	20						155.75	3.40	12.23	5.30	19.04
April 16 to 20.	20				250	51.5	150.25	3.60	12.24	5.41	18.38
April 21 to 25.	20				250	65.	141.	3.60	12.48	5.08	17.60
.....					500	116.5	291.25			10.49	35.98

Table No. 1 shows that twenty pounds of corn and cob meal were fed daily, with no other grain. The milking period was fresh; 335.5 pounds of milk was the yield for the ten test days, from March 2 to 11, inclusive. The butter fat per cent was 4.35 and 3.88 for each five test days. The pounds of fat were 13.84, and the total solids were 44.07. This period corn fodder was fed with the meal. Five days now were occupied in changing to corn ensilage, when from March 17 to 26, 513 pounds were fed, that resulted in 327.75 pounds of milk, with 3.62, and 3.40 per cents of butter fat, the pounds of butter fat were 11.51, and 40.35 pounds of total solids.

From March 27 to 31, the change was made to sorghum ensilage, when until April 10, 304 pounds were fed, resulting in 283 pounds of milk that tested 3.40 at each five day trial, with 9.62 pounds of fat and 34.13 total solids. The cow did not eat the sorghum ensilage well, refusing it partially toward the end of the test ten days. Corn meal and sorghum ensilage are evidently not a good combination for milk.

From April 11 to 15, a change was made to mangels and clover hay, when, until the 25th, 500 pounds of the roots and 115.5 pounds of the hay were fed, resulting in an increase of milk to 291.25 pounds, an increase of per cent of butter fat to 3.60 from both five day composite tests, with 10.49 pounds of butter fat, and 35.98 of total solids. The hay was rather poor medium clover. Farmers will see that the corn ensilage gave better results than roots and clover in this experiment, but the sorghum ensilage had deranged the cow's digestion somewhat, and it is not easy to bring back the flow of milk after it has decreased. Bulletin 13 shows that the roots and hay compared well with all other feeds in the experiment recorded there. The practical farmer will also know the comparative cost of preparing a pound of ensilage and a pound of roots.

We were satisfied that the good showing for corn fodder in this table should be mainly attributed to its being fed in the early period of lactation, and resolved to feed it again. The following table will show the results from this change. We gave some clover hay with the corn fodder during this period,

considering a change from roots and clover hay to corn fodder, too violent.

TABLE No. 2.

	Corn Meal, 20 Lbs Daily.....	Corn Fodder, 10 Lbs. Daily.....	Hay, 13 Lbs. Daily.....	Milk, 5 Days.....	Fat, Per Cent Composite.....	Solids, Per Cent Composite.....	Fat, Lbs.....	Solids, Lbs.....
April 26 to May 2.....	-----	-----	-----	142	3.55	12.48	5.04	17.72
May 3 to 7.....	-----	-----	-----	133	4.10	13.21	5.45	17.57
May 8 to 12.....	-----	-----	-----	128	3.65	12.54	4.67	16.13
Ten test days.....	-----	-----	-----	261	-----	-----	10.12	33.70
May 13 to 18.....	-----	-----	-----	137	3.55	12.45	4.86	17.06

A gradual change was made from April 26 to May 2, when, with thirteen pounds daily of first rate medium clover hay, ten pounds of corn fodder were fed daily, until May 18, when we get 261 pounds of milk, 4.10 and 3.65 butter fat tests for the ten test days, and 10.12 pounds of fat, with 33.70 of solids. She was continued five days more with an increase of nine pounds of milk, but the per cent of fat decreased to 3.55, the pounds of fat being 4.86.

If we compare this corn fodder period with the first, and take the average of both, we get 11.98 pounds of butter fat and 38.88 pounds of total solids. This is very near the corn ensilage results, and we are satisfied that had roots and clover followed corn ensilage, instead of following sorghum ensilage, they would have made a much better showing. This suggests to us that two feeds are enough for comparison in one experiment, and that long periods would give safer averages. We regard previous history of a cow's feeding and yields valuable in estimating the effects of new feeds.

The cow had been eating a corn meal ration from February 25 to May 18, with no distinctively albuminous feature in it except the clover hay introduced with the mangels on April 11. The improvement in the yield of milk, fat and solids from the roots is as much attributable to the bad effects of the sorghum ensilage as to the good effects of roots and

and clover hay. The corn fodder and clover hay period in Table No. 2, gives us nearly the same results in per cent of butter fat, and pounds of fat, as the roots and clover hay period at the end of Table No. 1, from less milk. A singular variation is noted in Table No. 2. The change from roots decreases the yield of milk, while the per cent of fat goes up at one five day test to 4.10, the total fat also increasing to 5.45. During the next five days the milk goes down to 128 pounds, and the total solids to 4.67. A third five day period shows 137 pounds of milk with 4.86 pounds of fat, just the quality found in the sorghum ensilage period.

Twenty pounds of corn and cob meal had been fed unvaryingly from the beginning of the experiment until now. The corn had been given a trial with most of the fodders used by Iowa farmers, and the results given in the foregoing tables. We now made a change. Half the amount of corn and cob meal was continued—ten pounds a day. Seven pounds of bran, and three pounds of oil meal were substituted for the ten pounds of corn meal withheld. Table No. 3, inserted here, will show the effects of the change.

TABLE NO. 3.

DAILY RATION.	Corn Meal, Daily, Ten lbs	Bran, Daily, Seven lbs.	Oil Meal, Three lbs. Daily.	Clover Hay, Daily, Fifteen Lbs.	Milk, Lbs., 5 Days	Fat, Per Ct. Composite.	Solids—Per Ct. Composite	Total Fat, Composite.	Total Solids, Composite.
May 19 to 23	10 lbs.	7 lbs.	3 lbs.	15 lbs.	147.5	3.80	12.83	5.61	18.92
May 24 to 28	10 lbs.	7 lbs.	3 lbs.	15 lbs.	154.	3.45	12.36	5.31	19.03
May 29 to June 2	10 lbs.	7 lbs.	3 lbs.	15 lbs.	159.5	3.65	12.43	5.82	19.83
Ten test days					313.5			11.13	38.86
June 3 to 7	10 lbs.	7 lbs.	3 lbs.	15 lbs.	148.75	3.55	12.66	5.53	18.19

TABLE NO. 4.

DAILY RATION.	Corn Meal, Five Lbs.	Bran, 3 1/2 Lbs	Oil Meal, 1 1/2 Lbs	Pasture	Milk, Llb., 5 Days	Fat, Per Ct. Composite.	Solids—Per Ct. Composite	Total Fat, Composite.	Total Solids, Composite.
June 9 to 13	5 lbs.	3 1/2 lbs.	1 1/2 lbs.		142.5	2.75	12.55	5.34	17.88
June 14 to 18	5 lbs.	3 1/2 lbs.	1 1/2 lbs.		139.	3.70	12.36	5.14	17.18
Test, ten days	5 lbs.	3 1/2 lbs.	1 1/2 lbs.		281.5			10.48	35.06

The effects of the change were immediate. During the five day changing period, from May 19 to 23, the milk increased from 137 pounds to 147.5 pounds. The per cent of fat went up from 3.55 to 3.80, and the pounds of fat increased in amount from 4.86 to 5.61 pounds, and the total solids to 18.92 pounds. The testing periods show 154 pounds of milk, with 3.45 per cent of butter fat, 5.31 of pounds of fat, and 19.03 of pounds of total solids, for the first five day test. The second five day test shows 159.5 pounds of milk, with 3.65 per cent of butter fat, 5.82 pounds of fat and 19.83 of pounds of total solids. The ten day test period shows 11.13 pounds of total fat and 38.86 of pounds of solids.

A third five day test was continued, showing a decrease of milk to 143.75 pounds, an increase of per cent of butter fat to 3.85, and a slight decrease of pounds of fat to 5.53, and of pounds of total solids to 18.19.

The pounds of butter fat and total solids from this ration are not equaled until we go back to the corn ensilage period, from March 17 to the 26th, over two months previous, where we find 11.51 pounds of fat and 40.35 of pounds of total solids. We could make a more conclusive showing by leaving the third five day period out, that shows shrinkage in the milk and solids, with gain in per cents of fat and solids, but that is not our duty. An unavoidable change in the milker occurred, that was resented by the cow, and has its lesson.

We turned the cow to pasture on June 9, and in Table 4, follow her for ten days longer, on half the grain ration given in Table No. 3, after which she went into a soiling experiment, that will be reported in next Bulletin.

At the beginning of the experiment, 244 weighed 1,225 pounds, and 1,222 at its close. She was weighed three times at each change of feed, on separate days, at the same hour each day, and averages taken. She is a broad, deep, low set cow, that would fatten readily for the butcher. She responds promptly to feed, and her calves would mature early and feed well, one of them being in the calf feeding experiment of this Bulletin.

If any one desires to farther analyze the effects of different feeds, they may compute on the chemist's analysis of this Station, who found the dry matter in the corn fodder to be 76.65 per cent ; in corn ensilage, 24.30 per cent ; in sorghum ensilage, 26.10 per cent ; and in mangels, 9.50 per cent ; clover hay, 88 per cent.