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Sorghum Crops for Silage ***Feeding Experiments with Dairy Cattle***

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Sorghum crops, both saccharine and non-saccharine (sweet and non-sweet), can be used for silage with good results. The corn plant has considerable prestige as a silage crop, and it has been more generally used for silage than any other crop. In fact, its use has become so general that some of the farmers and stockmen have believed that it was the only crop fit to be used for this purpose.

Two years ago the Dairy Department of the Kansas Agricultural College planned an experiment to determine the value of sorghums for silage. In most parts of Kansas the yield of the sorghums, such as kafir and sweet sorghum, is considerably larger than that of corn, and in some seasons the acre yield is several times larger. It was thought that if these crops could be made into silage, they would be of particular advantage to the farmers and stockmen of western Kansas, where corn is grown with difficulty and much uncertainty.

The first sorghum crop put into the silo was sweet sorghum, commonly called cane. Previous experiments with this crop and the experience of some farmers have given the general impression that cane contains too much sugar, and that silage made from it would be very sour and would not be eaten by stock. Our results the first year showed that silage made from cane did not contain so much acid at any time during the year as did silage made from corn. This, of course, is quite contrary to the belief here-

tofore held by many, but is easily explained after thought and investigation. In the past, where cane had been made into silage, it had been put up entirely too early. Those who tried it put it into the silo at the same time that they cut their corn for silage. At this stage of maturity, cane contains entirely too much moisture, or sap, and, when put up at this time, is certain to result in sour silage. With us, the cane was not put up until three weeks after the corn silage was made, at which time the cane seed was hard and the stalk was well filled with sap, but did not contain an excess of moisture. The cane used in this experiment was grown on upland soil on the College farm. One-third of the field was drilled and another third was listed. The remainder of the field was in corn. The drilled cane made 12.5 tons of silage to the acre, the listed cane 8 tons, and the corn made 5 tons.

In the fall of 1912, one silo was filled with cane, one with kafir, and one with corn. The following yields were obtained: corn, 7.1 tons of silage to the acre; cane, 8.2 tons; kafir, 6 tons. The yield of kafir was not a representative one. The season of 1912 was not a good season for kafir, and the early frost cut down the yield considerably. Here, again, we had the same results with the cane as we had previously. It made a good quality of silage, and after analyzing the different silages for acidity, it was found that the cane silage did not contain, at any time during the winter, so much acid as did the corn silage.

FIRST TRIAL, 1911-1912.

In the first year's experiment, cane silage was compared with corn silage as a feed for dairy cowsgiving milk. Two lots of four cows each were selected from the herd for the experiment. These lots were handled in the following manner:

The cows in lot I were fed for the first twenty days on corn silage. For the second twenty days (after a period of ten days had intervened) they were fed on cane silage. After another intervening period of ten days, the third twenty-day period began, when the cows were again fed on corn silage. The animals in lot II were fed cane silage during the first period, corn silage during the second period, and cane silage during the third period. It was planned to get a direct comparison of these two feeds by comparing in each case the average of the first and third periods with the second period. Cows gradually decline in milk flow, and the average production of the first and third periods would naturally be about equal to the production of the second period. These cows were fed a grain and a hay ration in addition to the silage. The hay ration was kept constant, and the amount fed was based on what the cows would consume. The grain ration was fed in proportion to the amount of milk produced; this remained practically constant during the experiment. The only change, then, in the ration during the experiment was the change made from one kind of silage to the other. The cows were weighed every morning at a stated time in order that a check might be kept on the gain or loss in live weight for each individual.

The following table gives the results of the experiment:

FIRST TRIAL, 1911-1912.
 CORN SILAGE vs. CANE SILAGE.
 LOT. I.—Four Cows—Twenty-Day Periods.

Period.	Milk.	Butter Fat.	Body Weight.
1. Corn silage in ration	1337	55	4108
2. Cane silage in ration	1252	51	4131
3. Corn silage in ration	1178	49	4106
Av.—1st and 3rd periods, corn silage.....	1257	52	4108
2nd period, cane silage.	1252	51	4132
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Difference.....	5	1	24

LOT II. Four Cows—Twenty-Day Periods.

1. Cane silage in ration	1192	54	4044
2. Corn silage in ration	1167	51	3953
3. Cane silage in ration	989	46	4020
Av.—1st and 3rd periods, cane silage.....	1091	51	4032
2nd period, corn silage.....	1167	51	3953
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Difference	76		79

In studying the table of results on lot I, we find that the cows declined in milk and butter-fat production on being changed from the corn to the cane silage. At the same time there was an increase in live weight when the change was made from corn back to cane silage. During the third period, after the cows had been changed from the cane back to the corn silage, they lost in live weight. This shows a direct influence that the feeding of the cane silage had on the live weight. A study of the table giving the average of the first and third periods at the time the cows were fed on the corn silage, and a comparison of this with the second period when the cows were receiving cane silage, show that the cows gained five pounds in milk and one pound in butter fat on the corn silage. It also shows that the cows, when fed cane silage, made an increase in body weight of twenty-four pounds. The increase made in milk, butter fat, and live weight is the total increase made by the four cows in twenty days. The increase made in milk and fat production in favor of the corn silage is so small as to mean little. In fact, the increase shown here is not much more than a variation that would be caused by change from one feed to another, or a change that would be caused by a change of weather or other such variable conditions. The increase of twenty-four pounds in live weight for the lot is a daily gain of a little more than one-fourth of a pound to the cow for the period, which fact suggests that the cane silage is more fattening than the corn silage.

Lot II made a similar showing. As has been observed, the order of feeding was just the reverse of that in lot I. It will be noticed that here the cows did not make a direct increase in milk when changed from the cane silage to the corn silage, but that there was a direct increase in gains when the change was made. A comparison of the average production of the first and third periods with that of the second period shows that the corn silage produced more milk and butter fat than the cane silage, while the cane silage caused gains in live weight. The four cows made seventy-six pounds more milk and a trifle more fat on the corn silage than on the cane. Each cow produced daily three-fourths of a pound more milk on the corn silage

than she did on the cane silage. Here, again, the increase in live weight when the cows were changed from corn to cane silage, suggests that the cane silage is more fattening than the corn silage.

SECOND TRIAL, 1912-1913.

During the winter of 1912-1913, a feeding experiment was conducted with fifteen dairy cows, in which comparison was made of the respective merits of three crops for silage. The general plan of the experiment was similar to the plan carried out the first year. The fifteen cows were divided into three lots. Lot I, of six cows, was used to compare kafir silage with corn silage. Lot II contained five cows, by means of which cane was compared with kafir silage. In Lot III four cows were used to determine the comparative value of corn silage and cane silage. The cattle in each lot were fed for three periods of thirty days each, with a ten-day period intervening between the first and second periods and also between the second and third periods, at which time the changes in feed were made. The experiment included only the thirty days in each period. The grain and the hay ration were kept constant, as described in the other experiment. The only change made was in the kind of silage, the amount of silage being kept constant. The cows were weighed each day and the gain and the loss in live weight were noted.

The following table gives the results of the second trial:

SECOND TRIAL, 1912-1913.

LOT I.—KAFIR SILAGE vs. CORN SILAGE.

Six Cows—Thirty-Day Periods.

Period.	Milk.	Butter Fat.	Body Weight.
1. Kafir silage in ration.....	3373	142	6010
2. Corn silage in ration.....	3383	140	5994
3. Kafir silage in ration.....	3339	139	6021
Av.—1st and 3rd periods, kafir silage.....	3356	140	6015
2nd period, corn silage.....	3383	140	5994
Difference.....	27		21

LOT II.—CANE SILAGE vs. KAFIR SILAGE.

Five Cows—Thirty-Day Periods.

1. Cane silage in ration.....	2384	107	4852
2. Kafir silage in ration.....	2492	112	4879
3. Cane silage in ration.....	2139	98	4927
Av.—1st and 3rd periods, cane silage.....	2261	102	4890
2nd period, kafir silage.....	2492	112	4879
Difference.....	231	10	11

LOT III.—CORN SILAGE vs. CANE SILAGE.

Four Cows—Thirty-Day Periods.

1. Corn silage in ration.....	1953	89	3743
2. Cane silage in ration.....	1832	86	3747
3. Corn silage in ration.....	1852	85	3755
Av.—1st and 3rd periods, corn silage.....	1902	87	3749
2nd period, cane silage.....	1832	86	3747
Difference.....	70	1	2

Results of experiments in lot I, in which kafir silage was compared with corn silage, indicate that corn silage is slightly superior to kafir silage for milk production. The cows showed a loss in live weight, however, when changed from kafir to corn silage. The increase of twenty seven pounds in milk production in favor of corn is very slight for the lot, as this is the increase of six cows for thirty days, or less than one-sixth of a pound of milk daily to the cow. The kafir silage proved more fattening than the corn silage.

Cane and kafir silage were compared in lot II. The results obtained here are more striking than those secured in the other lots. Kafir silage, according to these results, is much better than cane for milk production. Upon comparison of the production during the periods in which the cows received cane silage with the period in which they received kafir silage, it is found that for a thirty-day period in each case, the five cows produced 231 pounds more milk on the kafir silage than on the cane silage. This means about one and one-half pounds of milk daily to the cow. The cows made a very slight gain in body weight while on the cane silage.

Corn silage was compared with cane silage in lot III. Corn proved superior to cane silage. When the cows were changed to cane silage, they declined in milk production in the second period, as shown in the table; when they were changed back to corn silage in the third period, they showed a general increase in milk. While the cows were on corn silage in the third period, they each produced slightly more than one-half pound more milk per day than they had produced on cane silage. In this trial the cows made a very slight gain in live weight in favor of the corn silage, but this gain is so small as to be negligible.

In summing up the work of both trials, the following conclusions may be drawn :

Corn silage is slightly superior, as a milk producer, to silage made from either kafir or cane.

Kafir silage ranks second as a feed for milk cows.

Cane silage ranks third as a milk producer.

In both trials the cattle gained in live weight on cane silage more readily than on the silage made from kafir or corn. This fact would indicate that it contained more carbohydrates and sugar, or fattening nutrients, than the other feeds. In this experiment the grain and the hay ration were constant, and the only change made in the feeding was in the kind of silage. It is our opinion that cane silage would prove the equal, ton for ton, of corn or kafir silage if the grain ration were changed so that the animal would use the nutrients more economically. This could be done by feeding more protein and less fat-forming nutrients in the grain ration.

Although kafir and cane silage were shown to be slightly less valuable than corn silage from the experiments just explained, there are other factors that must be considered; namely, yield, and adaptability to local conditions. Without doubt, the greater yield of cane and kafir to the acre will offset the slight increase in feeding value obtained from corn silage. Kafir and cane are drouth-resistant crops and can be grown over a wider territory than corn, and from one-third to one-half more tonnage to the acre can be obtained.

During both trials the acidity of the cane silage was never more than that of the corn silage. In the second trial the average acidity for the three

different kinds of silage was as follows: corn, 2.03 per cent.; cane, 1.46 per cent.; kafir, 1.43 per cent.

It was also noted during the experiment that most of the cane seed and a great amount of the kafir seed passed through the animals undigested. This suggests that the nutritive value of these crops as silage is to a certain extent limited to the nutritive value of the stalk and leaves.

The quality of silage obtained from all crops was very good. The kafir silage was perhaps the poorest on account of being immature, as the heavy frost forced an early harvest.

The cows ate the silage with relish. The cane silage seemed most palatable.

The silage was stored in wooden-stave and in cement silos. It kept equally as well in cement as in wood.

The time of cutting cane and kafir for silage is all-important in making good silage from these crops. The crops should be practically mature; that is, the seed should be mature. At this time the stalk is still filled with sap and will make good silage. If put up too green, it will make sour silage. The crops should be put up before frost if possible, but it is better to let the crop stand until after frost than to put it up too green. After a heavy frost, the crop should be cut and siloed immediately. If it dries out too much, sufficient water should be added to cause it to pack well.