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JAPANESE HONEYDRIP SORGHUM SILAGE VERSUS JUNE CORN SILAGE FOR MILK PRODUCTION

By

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JAPANESE HONEYDRIP SORGHUM SILAGE VERSUS JUNE CORN SILAGE FOR MILK PRODUCTION

BY

W. S. CUNNINGHAM AND J. R. REED

INTRODUCTION

Indian corn is the most widely used crop for silage. In certain sections of the country, however, its yield does not compare with some of the sorghums. Sweet sorghum silage is considered to be less valuable than corn silage for milk production. The South Carolina Station[1] estimates its value for milk production to be 94.5 percent of that of corn silage. The Kansas Station[2] reports its value for dairy cows below that of corn silage or Kafir corn silage. It is also said to produce a sour silage not relished by cows, particularly if cut before it is sufficiently mature.[1] Preliminary plantings of Japanese Honeydrip sorghum at the University of Arizona farm gave yields of silage approximately double those of corn, and the silage was much relished by the cows. In fact, the herdsman observed that sorghum silage was eaten more readily and cleaned up more quickly than was the corn silage. The purpose of the feeding tests reported in this bulletin is to compare June corn silage and Honeydrip sorghum silage for milk production.

METHOD OF EXPERIMENT

Two separate feeding tests were conducted, one in the winter of 1925-1926 and the other in the winter of 1926-1927. In each case the silage crops had been grown the previous summer. The feeding tests were divided into two periods each. The length of each period was 28 days. There was a 7-day preliminary feeding period just preceding the feeding test and a 7-day interval between the first and second periods for the changing of rations. The cows, in each test, were divided into two groups, designated as A and B. Both groups were fed a basal grain ration and alfalfa hay. The silage part of the ration was alternated so that in each feeding test, Group A received the sorghum silage during the first and third periods and corn silage during the second and fourth periods while Group B was fed

corn silage during the first and third periods and sorghum silage during the second and fourth periods. The method of alternating the rations is shown in Table I. The cows were fed the grain mixture and silage individually but the hay was fed to each group collectively.

The cows were milked twice daily and the milk was weighed at each milking. A 2-day composite sample of each cow's milk was tested for percentage of butterfat at about the middle of each period.

COWS USED IN FIRST TEST

Eight cows were used in the first feeding test. These were divided into two groups of two Jerseys and two Holsteins in each group. The groups were well balanced in regard to breed, age of cows, period of lactation, and amount of milk flow. The reversal method of feeding was used to counteract any differences.

DISCUSSION OF FEEDS USED IN FIRST TEST

The alfalfa hay fed was of the Hairy Peruvian variety and of the grade locally known as No. 1 dairy hay. The same grade of hay was fed throughout the test.

The grain mixture was made up as follows: Wheat bran, 210 pounds; rolled barley, 210 pounds; cottonseed meal, 100 pounds. The grain ration was apportioned at the beginning of the experiment to each cow on the basis of 1 pound of the grain mixture to 5 pounds of milk produced by Holstein cows, and 4 pounds of milk produced by Jersey cows. The ration was not changed during the feeding test in order that no disturbing factor affecting production enter into the test. The decrease in milk production, part of which was due to natural causes, automatically changed the proportion of grain to milk, so that the cows, taken collectively, were actually fed an average of about 1 pound of grain to 3.8 to 3.9 pounds of milk.

The June corn and Japanese Honeydrip sorghum crops for silage were grown on the same field in alternate irrigation borders. The areas were measured carefully and the silage crop was weighed just before being put into the silos. The yield of the corn was 10.1 tons and of the sorghum 21.6 tons per acre. This difference in yield compares favorably with results reported by the Missouri,[1] South Carolina,[1] and Kentucky[1] stations.

In feeding the silage, each cow was given all she would eat twice daily and all that was refused was weighed back. The

net amount eaten was used in the computations for this bulletin. The amounts of silage eaten varied from about 24 pounds daily for one of the Jersey cows to about 45 pounds daily for one of the Holsteins.

TABLE I.—METHOD OF ALTERNATING RATIONS FIRST TEST

	First period	Second period
Group A	Ration 1 Alfalfa hay Grain mixture Sorghum silage	Ration 2 Alfalfa hay Grain mixture Corn silage
Group B	Ration 2 Alfalfa hay Grain mixture Corn silage	Ration 1 Alfalfa hay Grain mixture Sorghum silage

Table II shows the average amounts of feed consumed daily by the groups in the two periods when fed the respective rations. The amounts of silage consumed by Group B in the first period was only 28.3 pounds per head as compared with 34.5 pounds of silage consumed by the same group in the second period when fed Ration 1 containing sorghum silage. This may have been due to the quality of the silage, as the corn silage had occasional streaks of mold in it. Group A was fed 9.3 pounds and Group B 8.6 pounds of the grain mixture in each period, while the alfalfa hay was fed at the rate of 15 pounds per cow daily throughout the experiment.

TABLE II.—AVERAGE DAILY RATION PER COW FIRST TEST

Rations	Corn silage	Sorghum silage	Grain mixture	Alfalfa hay
	Pounds	Pounds	Pounds	Pounds
Ration 1				
Group A, first period		33.3	9.3	15.0
Group B, second period		34.5	8.6	15.0
Ration 2				
Group B, first period	28.3		8.6	15.0
Group A, second period	34.1		9.3	15.0

Table III shows the total amounts of feed fed. A total of 7,002 pounds of corn silage was consumed as compared with 7,614 pounds of sorghum silage, indicating that the sorghum

silage was relished better than the corn silage, which agrees with the observations of the persons feeding the cows. It was observed that sorghum silage was eaten more readily than was corn silage. The total amounts of grain and hay consumed were the same for each ration.

TABLE III.—TOTAL AMOUNTS OF FEED FED. FIRST TEST

Rations	Corn silage	Sorghum silage	Grain mixture	Alfalfa hay
	Pounds	Pounds	Pounds	Pounds
Ration 1				
Group A, first period		3,732	1,050	1 6.9
Group B, second period		3,872	963	1.6>0
Total for Ration 1		7,614	2,016	3,360
Ration 2				
Group B, first period	3 175		963	1 680
Group A, second period	3,827		1 050	1 680
Total for Ration 2	7,002		2,016	3,?60

DISCUSSION OF EXPERIMENTAL RESULTS

Table IV shows the amounts of milk and butterfat produced by each cow of groups A and B and also the percentage of decrease.

Group A, in changing from sorghum silage to corn silage, decreased an average of 9.17 percent in milk production, while Group B gave 12.71 percent less milk in the second period when fed sorghum silage than during the first period when fed corn silage. In the production of butterfat, Group A showed a decrease of 11.9 percent for the second period as compared with the first period, while Group B produced 19.8 percent less butterfat during the second period than during the first period

In both milk and butterfat production the percentage of decrease was greater when the change was from corn silage to sorghum silage. As will be shown later by the graph, however, the decrease in production within the period seemed to be greater in case of the corn silage.

Table V shows the summary of production of milk and butterfat according to the rations fed. The two groups of cows when fed Ration 1 gave a combined production of 7,503.8 pounds of milk and 307.97 pounds of butterfat as compared with 7.619.1 pounds of milk and 321.26 pounds of butterfat when fed Ration 2, a difference of 115 3 pounds of milk and 13.29 pounds of butterfat in favor of Ration 2 containing corn silage. Thus the corn silage produced 1.5 percent more milk

and 4.3 percent more butterfat than did the sorghum silage. It should be remembered, however, that the cows of the two groups ate 612 pounds more of sorghum silage than of corn silage.

TABLE IV.—MILK AND BUTTERFAT PRODUCTION SHOWING DECREASE. FIRST TEST.

No. of cow	Milk		Percent of decrease	Butterfat		Percent of decrease
	First period	Second period		First period	Second period	
	Pounds	Pounds	Percent	Pounds	Pounds	Percent
12	828.2	789.5	4.67	45.88	41.44	9.67
8	628.8	602.5	4.18	38.88	31.75	6.14
121	998.0	958.7	3.93	35.33	37.64	6.53
119	1,663.9	1,390.7	16.41	56.54	40.33	28.66
Total for Group A	4,118.9	3,741.1	9.17	171.59	151.16	11.90
	Pounds	Pounds	Percent	Pounds	Pounds	Percent
13	572.2	501.8	10.12	37.77	29.11	22.92
11	882.8	691.0	21.38	31.20	25.32	31.13
127	1,143.0	1,059.9	7.75	37.92	35.29	6.93
126	1,273.9	1,131.2	11.98	43.12	36.66	14.98
Total for Group B	3,878.0	3,384.9	12.71	170.10	136.39	19.81

Note: Group A was fed sorghum silage during the first period and corn silage during the second period. Group B was fed corn silage during the first period and sorghum silage during the second period.

TABLE V.—SUMMARY OF PRODUCTION OF MILK AND BUTTERFAT. FIRST TEST.

Rations	Milk yield	Butterfat yield
	Pounds	Pounds
Ration 1		
Group A, first period	4,118.9	171.58
Group B, second period	3,384.9	136.39
Total for Ration 1	7,503.8	307.97
Ration 2	Pounds	Pounds
Group B, first period	3,878.0	151.16
Group A, second period	3,741.1	170.10
Total for Ration 2	7,619.1	321.26
Difference in favor of Ration 2	115.3	13.29
Percentage difference	1.5	4.3

If we give corn silage an arbitrary value of $8.00 per ton, the sorghum silage used in this feeding test would be worth $7.28 per ton, or in other words the sorghum silage was about 91 percent as efficient as corn silage for milk production. This difference in value would not compensate for the difference in the yields of the two crops.

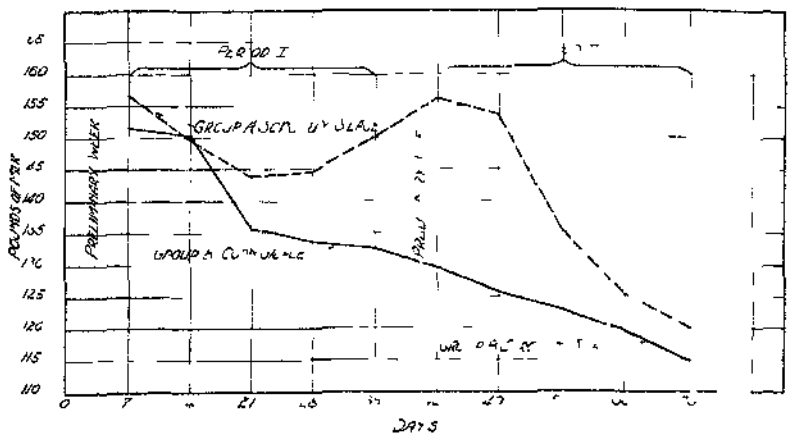

Fig. 1.—Graphic presentation of average daily milk production per group in seven-day periods. First to

Figure 1 shows in a graphic way the milk production by weeks. The figures represent the average daily production of each group during 7 days. The point of starting represents the average daily production during the 7-day preliminary feeding period and the space between the period brackets includes the 7-day interval between the periods for the changing of rations. Group A shows a very erratic production, having first decreased during the first 2 weeks of the first period, then started a gradual increase during the last 2 weeks of that period which continued during the 7-day interval of changing to corn silage. After the first week of the second period, this group started a rapid decrease which was maintained until the end of the feeding test. On the other hand, with the exception of the second week of the first period, Group B showed a very gradual and consistent decrease in each period, whether fed sorghum or corn silage. The major portion of this variation was caused by cow No. 119 which had been fresh about 1 month at the beginning of the first period, although all of the cows of Group A increased in production during the 7-day interval between the periods.

As indicated by Table VI, the cows kept up better in body weight when fed sorghum silage than when fed corn silage

COWS USED IN SECOND TEST

Ten cows were used in the second feeding test. These were divided into two groups of three Jerseys and two Holsteins in

each group. The same precautions were used as in the first feeding test to secure well balanced lots and to offset any differences, as far as possible.

TABLE VI—BODY WEIGHTS OF COWS. FIRST TEST

Weighing dates	Cow Number				Group
Group A	No. 12	No. 8	No. 121	No. 119	Total
	Pounds	Pounds	Pounds	Pounds	Pounds
Feb. 3	960	830	1,070	1,350	4,210
March 3	970	850	1,085	1,335	4,250
Gain during first period	10	20	25	-15	40
March 10	970	845	1,115	1,360	4,290
April 7	985	880	1,115	1,345	4,325
Gain during second period	15	35	00	-15	35
Group B	No. 13	No. 11	No. 127	No. 126	Group Total
	Pounds	Pounds	Pounds	Pounds	Pounds
Feb. 3	1,085	955	1,165	1,120	4,325
March 3	1,105	955	1,150	1,125	4,335
Gain during first period	20	00	-15	5	10
March 10	1,120	965	1,150	1,145	4,420
April 7	1,140	980	1,155	1,180	4,455
Gain during second period	20	15	-35	35	35

DISCUSSION OF FEEDS USED IN SECOND TEST

The alfalfa hay used in this feeding test was of the Hairy Peruvian variety. It was somewhat coarse-stemmed but leafy and of green color.

The grain mixture allowed was made up as follows: Wheat bran, 240 pounds; rolled barley, 210 pounds; cottonseed meal, 100 pounds. The grain and hay were apportioned at the beginning of the feeding test on the same basis as in the first test and the amounts were not changed during the period of the experiment. This caused the grain ration to be rather heavy toward the end of the test, but this was considered preferable to changing the ration constantly with fluctuations in production.

The June corn and Japanese Honeydrip sorghum used for silage were grown in alternate irrigation borders similar to the plan used in the first test. The plots were measured carefully and the crops were weighed before being put into the silos. The yields of both corn and sorghum were especially heavy, the corn

yielding 21 tons per acre and the sorghum 35.6 tons per acre. The crops were grown on well-manured soil and the season was very favorable.

The cows of each group were given all the silage they would clean up at the time of milking, and about noon of each day they were given silage in the feed manger in the corral. The amounts not eaten were weighed back and deducted from the total amount fed.

TABLE VII.—METHOD OF ALTERNATING RATIONS, SECOND TEST

	First Period	Second Period
Group A	Ration 1 Alfalfa hay Grain mixture Sorghum silage	Ration 2 Alfalfa hay Grain mixture Corn silage
Group B	Ration 2 Alfalfa hay Grain mixture Corn silage	Ration 1 Alfalfa hay Grain mixture Sorghum silage

Table VIII shows the average daily rations in the second feeding test. Group A consumed 35.9 pounds of sorghum silage per head daily during the first period and 40.2 pounds of corn silage during the second period, while Group B ate 36.7 pounds of corn silage in the first period and 43.0 pounds of sorghum silage per head daily in the second period. Group A was fed 7.0 pounds of the grain mixture and 15 pounds of alfalfa hay, while Group B was given 7.2 pounds of grain and 15 pounds of alfalfa hay per head daily, throughout the experiment. There was a small amount of weigh-back of hay for Group A in the first period; otherwise the hay was cleaned up well each day.

In Table IX are shown the amounts of feed used. There were 278 pounds more of sorghum silage consumed than of corn silage. This excess of sorghum silage consumed is somewhat less than in the first feeding test.

TABLE VIII—AVERAGE DAILY RATIONS PER COW, SECOND TEST

Rations	Corn silage	Sorghum silage	Grain mixture	Alfalfa hay
Ration 1	Pounds	Pounds	Pounds	Pounds
Group A, first period		35.9	7.0	15.0
Group B, second period		43.0	7.2	15.0
Ration 2				
Group B, first period	36.7		7.2	15.0
Group A, second period	40.2		7.0	14.9

TABLE IX.—TOTAL AMOUNTS OF FEED FED. SECOND TEST.

Rations	Corn silage	Sorghum silage	Grain mixture	Alfalfa hay
Ration 1	Pounds	Pounds	Pounds	Pounds
Group A, first period		5 025	980	2,100
Group B, second period		6,020	1.008	2,100
Total for Ration 1		11,045	1,988	4,200
Ration 2				
Group B, first period	5 139		1,008	2,100
Group A, second period	5.628		980	2 082 5
Total for Ration 2	10,767		1,988	4,182.5

DISCUSSION OF EXPERIMENTAL RESULTS

Table X shows the milk and butterfat production by the individual cows of each group by periods, together with the group totals and percentage of decrease in the second period as compared with the first period. Group A gave 5.17 percent less milk and 3.39 percent less butterfat in the second period than in the first period, while Group B gave 8.54 percent less milk and 9.57 percent less butterfat in the second period than in the first period. The decrease was greater in the case of both milk and butterfat when the change in ration was from corn silage to sorghum silage than when the change was from sorghum silage to corn silage. This compares favorably with the results in the first test.

The summary of the production of milk and butterfat according to rations fed is shown in Table XI. The combined production of milk and butterfat by the two groups when given Ration 1 are 8,103.7 pounds and 338.72 pounds respectively, while the same groups when fed Ration 2 gave a yield of 8,239.9 pounds of milk and 348.68 pounds of butterfat. This represents a difference of 136.2 pounds of milk and 9.96 pounds of butterfat in favor of Ration 2 containing the corn silage. Expressed in terms of percentage, the corn silage ration produced 1.68 percent more milk and 2.94 percent more butterfat than did the sorghum silage ration. These results are quite similar to those of the first feeding test. It is also noted that in the second test the cows ate 278 pounds less of corn silage than of sorghum silage.

If we value the corn silage at $8 00 per ton, the sorghum silage used in the second feeding test would be worth $7.66 per ton. The sorghum silage produced 95.8 percent as much milk per ton as did the corn silage.

TABLE X.—MILK AND BUTTERFAT PRODUCTION SHOWING DECREASE. SECOND TEST.

Name of cow	Milk		Percent of decrease	Butterfat		Percent of decrease
	First period	Second period		First period	Second period	
	Pounds	Pounds	Percent	Pounds	Pounds	Percent
Alden	499.0	514.7	- 3.15	31.84	38.36	- 21.24
No. 21	648.3	605.0	6.68	35.33	31.28	11.46
Lass	549.2	529.8	3.5	29.05	27.44	5.54
Roxana	1,111.2	1,075.7	3.19	35.29	32.27	8.4
Pell	1,469.7	1,330.9	9.44	41.03	36.27	11.64
Total for Group A	4,277.4	4,056.1	5.17	172.28	164.62	3.30
	Pounds	Pounds	Percent	Pounds	Pounds	Percent
Noble E.	535.2	486.0	8.83	27.09	26.36	2.70
Topsy	661.8	621.5	6.04	30.70	27.21	8.58
Myrtle	817.2	717.4	12.21	42.00	39.53	5.88
Moensje	1,014.4	929.3	8.39	35.56	30.85	13.17
Belle L.	1,155.1	1,070.0	7.37	38.83	32.53	16.22
Total for Group B	4,183.8	3,826.3	8.51	184.06	166.44	9.57

Note: Group A was fed sorghum silage during the first period and corn silage during the second period, while Group B was fed corn silage during the first period and sorghum silage during the second period.

TABLE XI.—SUMMARY OF PRODUCTION OF MILK AND BUTTERFAT. SECOND TEST.

Rations	Milk yield	Butterfat yield
	Pounds	Pounds
Ration 1		
Group A, first period	4,277.4	172.28
Group B, second period	3,826.3	166.44
Total for Ration 1	8,103.7	338.72
Ration 2	Pounds	Pounds
Group B, first period	4,183.8	184.06
Group A, second period	4,056.1	164.62
Total for Ration 2	8,239.9	348.68
Difference in favor of Ration 2	136.2	9.96
Percentage differences	1.68	2.94

Figure 2 shows the milk production by the week. It indicates that both groups decreased more rapidly in milk production during the first period, the decrease being more marked in the case of Group A fed sorghum silage. In the second period the curve shows a similar trend in production for the two groups.

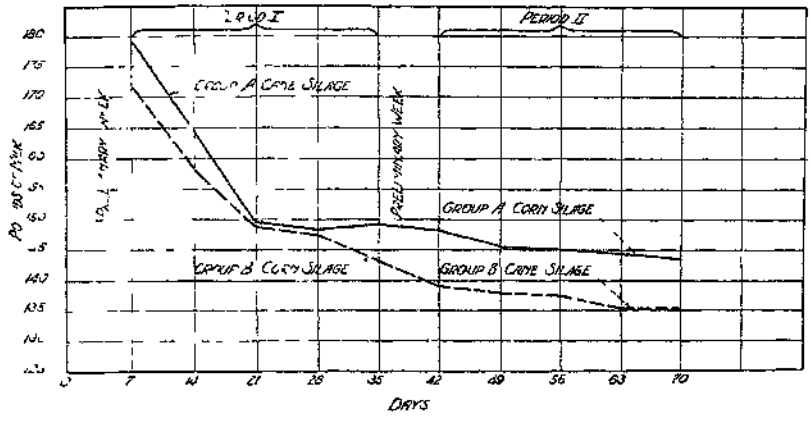

Fig. 2.—Graphic presentation of average daily milk production per group in seven-day periods. Second test.

TABLE XII.—BODY WEIGHTS OF COWS. SECOND TEST.

Group A Weighing dates	Name of Cow Alden	No. 20	Lass	Roxana	Pell	Group total
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Jan. 11, 12, 13	885	888	842	1,170	1,320	5,105
Feb. 8, 9	867	902	872	1,222	1,270	5,133
Gain during first period	-18	14	30	52	-50	28
Feb. 15, 16	905	910	887	1,237	1,327	5,266
March 15, 16	902	917	912	1,272	1,325	5,328
Gain during second period	-3	7	25	35	-2	62

Group B. Weighing dates	Name of Cow Noble E.	Topsy	Myrtle	Maensje	Belle L.	Group total
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Jan. 11, 12, 13	910	1,122	1,015	1,155	1,403	5,605
Feb. 8, 9	915	1,117	1,032	1,182	1,450	5,696
Gain during first period	5	-5	17	27	47	91
Feb. 15, 16	920	1,132	1,030	1,177	1,457	5,716
March 15, 16	925	1,137	1,065	1,192	1,480	5,799
Gain during second period	5	5	35	15	23	83

Table XII gives the body weights of the cows on the different weighing dates. On the average, the cows gained more in weight when fed corn silage. This is opposite to the result of the first feeding test. The difference, however, is not marked in either case.

COMPARATIVE EFFECT OF CORN AND SORGHUM ON THE FOLLOWING CROP

The Arizona Experiment Station[1] has found that crops following sorghum yield considerably less than crops following corn. This is particularly true on heavy, tight soils. In the case of sandy soils or where the land lies fallow for several months before the next crop is planted, sorghum affects the following crop-yield very little more than does corn. A good application of manure to the soil offsets the effects of either sorghum or corn.

SUMMARY

1. The yield of Japanese Honeydrip sorghum is approximately double that of June corn. In the first test the yield of the sweet sorghum was 21.6 tons per acre, while the yield of June corn grown on adjacent irrigation borders was 10.1 tons per acre. In the second test the yield of sorghum was 35.6 tons per acre, and the yield of corn was 21 tons.

2. In each feeding test, more sorghum silage was eaten than corn silage. The cows relished the sorghum silage more than corn silage.

3. More milk and butterfat were produced with corn silage. In the first test corn silage produced 1.5 percent more milk and 4.3 percent more butterfat, while in the second feeding test corn silage produced 1.68 percent more milk and 2.94 percent more butterfat than did sweet sorghum silage.

4. On the basis of quantity of silage consumed, each ton of sorghum silage produced about 91 percent as much milk in the first test and 95.8 percent as much milk in the second test as was produced by the same amount of corn silage.

5. If we consider corn silage worth $8.00 per ton, the sorghum silage used in the first feeding test would have been worth $7.28 per ton and that in the second test $7.66 per ton.

6. There was very little difference in the effects of corn silage and sorghum silage on the weight of the cows. In the first feeding test the cows gained more in weight, when fed sorghum silage, while in the second test they gained more on corn silage. The difference was slight in either case.

LITERATURE CITED

1. South Carolina Experiment Station Report 1923.
2. Kansas Experiment Station Circular 28.
3. Missouri Experiment Station Bulletin 197.
4. Kentucky Experiment Station Bulletin 233.
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