

# AGRICULTURAL EXPERIMENT STATION

KANSAS STATE AGRICULTURAL COLLEGE  
MANHATTAN, KANSAS

DEPARTMENT OF DAIRY HUSBANDRY

## GROUND SORGO SEED AS A FEED FOR DAIRY COWS

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### PRELIMINARY STATEMENT

In many sections of Kansas the growing of corn for the grain is very uncertain due to the low annual rainfall and summer drought, and in some sections little attempt is made to raise corn for any purpose.

Sorgo (sweet sorghum or cane) seed has never been considered a satisfactory feed for dairy cows although the entire plant is recognized as one of the best for silage. The seed is generally considered unpalatable and it is the common opinion that when fed to cows giving milk it has a tendency to dry them up.

When sorgo silage is fed a large per cent of the seed passes through the animal undigested. In experiments conducted at this station the amount of undigested seed has been found to be as high as 90 per cent. It has been suggested that sorgo seed might be used more advantageously if ground. If this be true it might be advisable to remove the heads before putting the crop in the silo and grind the seed for feed. Any surplus seed above seeding requirements could be used in the same way. The similarity in the amounts of digestible nutrients in corn and in sorgo seed, as indicated in Table I, suggests that there should be no great difference in feeding value unless the sorgo seed be less palatable or deficient in some other respect.

1. Contribution No. 49 from the Department of Dairy Husbandry.

TABLE I.—Average digestible nutrients in 100 pounds of grain.<sup>2</sup>

GRAIN.	Total dry matter.	Digestible nutrients.			
		Crude protein.	Carbo-hydrates.	Fat.	Total.
Corn.....	Lbs. 80.5	Lbs. 7.5	Lbs. 67.8	Lbs. 4.6	Lbs. 85.7
Sorgo seed.....	87.3	7.5	66.2	2.6	79.5

2. Henry, W. A., and Morrison, F. B. Feeds and feeding. Eighteenth edition, unabridged. 770 pages. The Henry-Morrison Company, Madison, Wis. 1928. Reference: Appendix, Table III, pp. 728-9.

In view of the fact that sorgos are more drought-resistant and more productive than corn in large areas of Kansas, and are grown extensively, it seemed desirable to compare sorgo seed and corn as a grain feed for dairy cows. This comparison was made in experiments conducted in 1920, 1921 and 1922.

PLAN OF THE EXPERIMENT

The “double reversal” method of feeding was used. In this method the experimental animals are fed one of the rations to be compared for a given period, followed by a similar period in which the other ration is fed, and finally by a third period in which the original ration is fed. In the experiments reported herein these periods consisted of 30 days, the first 10 days of each constituting a preliminary period during which the animals might become accustomed to the change in the ration, and the last 20 days the experimental period in which the desired data were secured.

The general plan provided for six cows in each experiment but in several cases some of the cows went off feed or met with accidents, so their records had to be discarded. Cows were selected which were as nearly as possible alike with regard to period of lactation and length of time since they had been bred. They were kept in ordinary stanchions and turned in a dry lot whenever the weather permitted. Salt was provided at all times and the cows were milked and fed twice daily. Sufficient feeds of uniform quality were provided at the beginning of each test to last throughout the trial. All feeds were weighed to the animals and any uneaten portions weighed back. The cows were fed a basal ration consisting of ground alfalfa hay and silage, the amount varying according to the body weight of the individuals. To this was added a grain mixture consisting of four parts of corn chop or ground sorgo, as the case might be, two parts of wheat bran, and one part of linseed oilmeal. The amount of this ration was regulated according to the milk flow. In two of the ex-

periments the corn-chop ration was used in the first and third periods and ground sorgo seed in the other. In the other experiment ground sorgo seed was fed in the first and third periods and corn chop in the second.

EXPERIMENTAL RESULTS

THE 1920 EXPERIMENT

Six cows were included in the experiment conducted in 1920, but one died of *traumatic pericarditis* soon after the test started and another went off feed and dropped abruptly in milk flow, so results of value were secured from only four. A partial description of these animals with respect to breed, age, and lactation periods is given in Table II.

TABLE II.—Partial description of cows used in 1920 experiment.

HERD No.	Breed.	Age, years (a).	Fresh, days (a).	Bred, days (a).	Previous lactations.
417.....	Guernsey.....	5½	41	0	3
414.....	Guernsey.....	5½	33	0	2
212.....	Ayrshire.....	5½	136	0	2
24.....	Holstein.....	9	195	48	5

(a) At the beginning of the experiment.

In this experiment the corn-chop ration was fed during the first and third periods and the ground sorgo seed during the second. The roughage consisted of alfalfa hay and sorgo silage of good quality. The average weight of each animal was determined by weighing each morning at 8 o'clock. The fat yield was computed from the per cent of butter fat contained in daily composites from the morning and evening milkings. All feed offered the animals was consumed and hence the total feed consumption was exactly the same in all three periods. The live weight of each animal, the feed consumed, and the milk and butter-fat production are given in Table III.

It will be noted that the body weight increased somewhat throughout the trial and that the average weight of the lot while on the ground sorgo-seed ration was one pound greater than when on the corn ration, a difference regarded as negligible. As would be expected the milk flow of all the cows declined slightly through the succeeding periods, but the difference was not considered sufficient to make it advisable to reduce the feed. The variations in milk production due to difference in feed were small, the milk flow while on the sorgo-seed ration being 1.9 per cent greater and the total fat production 5.9 per cent greater than while on the corn ration.

TABLE III.—Live weight, feed consumed, and milk and butter-fat production of the cows used in the 1920 experiment.

Grain ration.	Cow No.	Average live weight.	Total feed consumed.			Total production.	
			Grain mixture.	Alfalfa hay.	Cane silage.	Milk.	Fat (a).
Corn chop.	417	Lbs. 876	Lbs. 140	Lbs. 200	Lbs. 600	Lbs. 435.7	Lbs. 17.42
	414	913	100	200	600	366.9	17.30
	212	1,194	100	240	900	432.9	15.75
	24	1,325	100	240	900	418.7	15.01
	Av. or total..	1,077	440	880	3,000	1,652.2	65.48
Ground sorgo seed.	417	859	140	200	600	405.0	16.90
	414	918	100	200	600	355.2	17.37
	212	1,200	100	240	900	396.0	14.84
	24	1,325	100	240	900	417.4	15.42
	Av. or total..	1,083	440	880	3,000	1,573.6	64.53
Corn chop.	417	894	140	200	600	391.9	15.51
	414	914	100	200	600	341.5	14.88
	212	1,190	100	240	900	390.2	13.42
	24	1,350	100	240	900	343.3	12.64
	Av. or total..	1,087	440	880	3,000	1,436.9	56.45
Av. for 20-day period:							
Corn chop.....		1,082	440	880	3,000	1,544.6	60.96
Ground sorgo seed.....		1,083	440	880	3,000	1,573.6	64.53

(a) The milk produced while the cows were fed ground sorgo seed averaged 4.1 per cent butter fat and that produced while the cows were fed corn chop averaged 8.94 per cent butter fat.

THE 1921 EXPERIMENT

Records from only three cows were secured in this experiment, it being necessary to remove two cows whose teats were stepped on and one in which an abscess developed. A brief description of the three animals used is presented in Table IV.

TABLE IV.—Partial description of cows used in 1921 experiment.

HERD No.	Breed.	Age, years (a).	Fresh, days (a).	Bred, days (a).	Previous lactations.
121.....	Holstein.....	2¾	33	0	0
61.....	Holstein.....	6½	52	0	3
56.....	Holstein.....	5¾	58	0	1

(a) At the beginning of the experiment.

The ground sorgo-seed ration was used during the first and third periods and corn chop during the second period of this experiment. Corn silage of good quality was used instead of sorgo silage as in the preceding season. The average weight of each animal and the production of milk and butter fat were obtained by the same method as was used in 1920. The amount of feed consumed was the same

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for the first and second periods, but it was necessary, on account of the declining milk flow, to reduce the grain ration at the beginning of the third period. The live weight, feed consumed, and the milk and butter-fat production are given in Table V.

TABLE V.—Live weight, feed consumed, and milk and butter-fat production of the cows used in the 1921 experiment.

Grain ration.	Cow No.	Average live weight.	Total feed consumed.			Total production.	
			Grain mixture.	Alfalfa hay.	Corn silage.	Milk.	Fat (a).
Ground sorgo seed.	121	Lbs. 1,157	Lbs. 180	Lbs. 220	Lbs. 688.5	Lbs. 684.5	Lbs. 21.76
	61	1,168	240	240	700.0	838.0	23.31
	56	1,013	180	200	700.0	647.9	22.94
Av. or total.	.....	1,113	600	660	2,089.5	2,170.4	68.01
Corn chop.	121	1,184	180	220	688	626.5	20.04
	61	1,223	240	240	700	777.6	20.73
	56	1,045	180	200	700	582.9	19.70
Av. or total.	.....	1,151	600	660	2,083	1,987.0	60.47
Ground sorgo seed.	121	1,209	180	220	700	577.2	20.17
	61	1,234	180	240	700	644.8	18.52
	56	1,038	140	180	700	544.1	18.50
Av. or total.	.....	1,160	480	640	2,100	1,766.1	58.19
Av. for 20-day period:							
Corn chop.....		1,151	600	660	2,083	1,987.0	60.47
Ground sorgo seed.....		1,137	540	650	2,095	1,968.3	63.10

(a) The milk produced while the cows were fed ground sorgo seed averaged 3.21 per cent butter fat and that produced while the cows were fed corn chop averaged 3.04 per cent butter fat.

The live weight of the animals increased somewhat during the progress of the experiment as in the preceding trial. The average weight while on the sorgo-seed ration was somewhat less than while on corn. The difference, however, was only 14 pounds or 1.2 per cent of the live weight which is probably not important. The production of milk on the sorgo-seed ration was 18.7 pounds less than while on corn or a decrease of 1 per cent which may be considered as practically negligible. There was, on the other hand, an increase in the yield of fat amounting to 2.63 pounds of 4.3 per cent, the average per cent of fat in the milk being 0.17 of 1 per cent greater while on sorgo seed than on corn chop.

THE 1922 EXPERIMENT

Six cows were included at the beginning of the 1922 experiment, but one cow went off feed in the third period so results from only five were calculated. Table VI gives a partial description of the animals used.

TABLE VI.—Partial description of cows used in 1922 experiment.

HERD No.	Breed.	Age, years (a).	Fresh, days (a).	Bred, days (a).	Previous lactations.
435.....	Guernsey.....	2½	110	0	0
322.....	Jersey.....	2¾	110	0	0
236.....	Ayrshire.....	3	204	41	0
305.....	Jersey.....	6½	182	10	3
316.....	Jersey.....	10¼	116	0	7

(a) At the beginning of the experiment.

The average live weight and per cent of fat were determined by a somewhat different method from that used in previous trials. The average weight was secured by weighing each animal for the first three and last three days of each experimental period. On these same days individual samples were taken from each milking and tested for butter fat, the average for the two three-day periods being taken as the average for the entire period. The amount of feed offered was the same during each of the three periods as the decline in milk flow was not considered sufficient to warrant a reduction in feed. Corn chop was used during the first and third periods and ground sorgo seed during the second period. Good quality sorgo silage and alfalfa hay were used as roughage during all three periods. The average live weight, feed consumed, and milk and butter fat production are given in Table VII.

The live weight decreased somewhat when the animals were transferred from the corn chop to the sorgo-seed ration and gained slightly when changed back to corn. The differences were small, however, being 10 and 17 pounds, respectively. The average live weight for the corn period was 13.5 pounds or approximately 1.5 per cent greater than for the ground sorgo seed ration.

The production of milk was 30.7 pounds less on the sorgo-seed ration than on the corn ration or a difference of 2.7 per cent. The total production of butter fat, however, was higher while on the sorgo-seed ration, thus agreeing with the two preceding experiments in this respect. The difference in butter-fat production in this experiment was 2.57 pounds or 4.4 per cent in favor of the ground sorgo-seed ration. This difference was due to a decided increase in the per cent of fat in the milk. The increase in fat in the milk was 0.35 of 1 per cent, which is a total increase of 6.88 per cent.

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TABLE VII.—Live weight, feed consumed, and milk and butter-fat production of the cows used in the 1922 experiment.

Grain ration.	Cow No.	Average live weight.	Total feed consumed.			Total production.	
			Grain mixture.	Alfalfa hay.	SorGO silage.	Milk.	Fat (a).
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Corn chop.	435	833	100	158	500	234.3	10.12
	322	894	100	158	500	222.6	13.09
	236	1,005	100	180	560	313.8	12.25
	305	949	100	180	560	281.3	17.68
	316	942	100	180	560	186.9	10.07
Av. or total..	.....	925	500	856	2,680	1,238.9	63.21
Ground sorGO seed.	435	842	100	160	500	220.8	9.85
	322	885	100	160	500	203.4	12.76
	236	979	100	180	560	283.7	11.55
	305	924	100	180	560	259.2	17.12
	316	945	100	180	560	157.2	10.03
Av. or total..	.....	915	500	860	2,680	1,124.3	61.31
Corn chop.	435	861	100	160	500	228.8	10.29
	322	901	100	160	500	187.4	11.45
	236	1,006	100	180	560	275.6	11.35
	305	935	100	174	550	237.7	14.50
	316	959	100	173	560	141.5	6.68
Av. or total..	.....	932	500	847	2,670	1,071.0	54.27
Av. for 20-day period:							
Corn chop.....		929	500	852	2,675	1,155.0	58.74
Ground sorGO seed.....		915	500	860	2,680	1,124.3	61.31

(a) The milk produced while the cows were fed ground sorGO seed averaged 5.46 per cent butter fat and that produced while the cows were fed corn chop averaged 5.09 per cent butter fat.

SUMMARY

The average live weight, total feed consumed, and total production of milk and butter fat of all groups during the three trials are shown in Table VIII. Results from a total of twelve animals are included.

TABLE VIII.—Summary of data obtained in the 1920, 1921, and 1922 experiments.

RATION.	Average live weight.	Total feed consumed.			Total production.		Average per cent fat.
		Grain mixture.	Alfalfa hay.	Silage.	Milk.	Fat.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Corn chop...	1,054	1,540	2,392	7,758	4,686.6	180.17	3.84
Ground sorGO seed.	1,045	1,480	2,390	7,775	4,686.2	188.94	4.05

The consumption of hay and silage was practically the same regardless of the grain ration but the grain consumed was 3.9 per cent less while on the ground sorGO-seed ration than while on the corn

ration. The grain fed per hundred pounds of milk, however, was nearly the same, the amount being 33 pounds for the corn ration and 32 pounds for the sorgo-seed ration. While on the different grain rations there was a difference in the average live weight of only nine pounds, or less than 1 per cent, a difference too small to be considered important.

It will be observed that the total production of milk while on the sorgo seed was 20.4 pounds less than on the corn ration, a difference of 0.4 of 1 per cent which is probably of no significance. The total butter fat production was somewhat in favor of the sorgo seed and as previously noted this was true in each of the three experiments. The average increase was 8.77 pounds or 4.8 per cent. The average difference in the per cent of fat in the milk was 0.21 or an increase of 5.47 per cent in favor of ground sorgo seed.

#### CONCLUSIONS

These experiments have failed to demonstrate any particular difference in the efficiency of corn chop and ground sorgo seed in maintaining the body weight or milk production of cows while on a liberal ration of alfalfa hay, grain, and silage.

There was no apparent difference in the palatability of a grain mixture in which ground sorgo seed was substituted for the corn chop portion of the mixture.

These experiments indicate that, when feeding milk cows a liberal ration of alfalfa hay, grain, and silage, the substitution of ground sorgo seed for corn chop in the grain mixture will increase the per cent of butter fat in the milk.