SOME EFFECTS OF FEEDING HEATED GRAIN TO DAIRY COWS DURING THE DRY PERIOD

by

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INTRODUCTION

Sorghum grain (Sorghum vulgare) is an important feedstuff, particularly in the central and southern plains area of the United States. Because of its drought resistance, sorghum is better adapted climatically than corn. In dry years sorghum produces more grain than corn. The nutritive value of sorghum compares favorably with that of corn.

Sorghum grain is usually fed in ground or cracked form to dairy cows both in lactation and during dry periods. Recent studies with cattle and sheep have shown that feeding heated grain results in increased body weight gain and feed efficiency. Since one of the objectives of the dry period is the preparation of the cow for the next lactation, a ration that produces the greatest body weight gain is highly desirable. The effect of feeding heated milo on the efficiency of gain in body weight of dairy cows has not been reported previously.

This experiment was conducted to compare steamed sorghum grain with cold-cracked sorghum grain as concentrate feeds for dairy cows during the dry period.

REVIEW OF LITERATURE

Steam processed grains. Some methods of feed processing change not only the texture but also the chemical nature of grains. These changes include starch hydrolysis and denaturation of proteins. Steamed-rolled and flaked are two terms used to describe a common process by which grain is heat processed.

Hastings and Miller (1961) compared different forms of corn and sorghum grains -- roll-cracked, hammermill-ground, steam-crimped, and pelleted (3/16 inches in diameter) -- in vitro and found that the steam-crimped grains contained the least amounts of total solubles, reducing sugars, soluble starch, and soluble protein. However, Salsbury et al. (1961) reported that starch

subjected to dry heat was digested more rapidly in vitro than untreated starch, and that moist heat caused hydration of the starch. Also, hydrated starch was digested more rapidly by rumen microorganisms than untreated starch.

Shaw et al. (1960) found that dairy steers digested more crude protein and dry matter in a flaked corn-pelleted hay ration than in a ground corn-chopped hay ration. Fisher et al. (1957), working with sheep, reported that the greater total digestible nutrient content of the flaked corn ration was due primarily to an increase in the coefficients of digestibility of nitrogen free extract and fat and to a slight but significant increase in protein digestibility.

Effect on volatile fatty acids. It is recognized that the molar proportion of VFA produced by the microbial population in the rumen may be altered appreciably by various dietary regimes. A large proportion of the carbohydrates ingested by ruminants is converted to acetic, propionic and butyric acids (Edwards, 1955). Shaw et al. (1957) and (1959) noted that cooked rations made up primarily of bread and molasses or of bread, cooked polished rice, cooked potato meal, and molasses caused decreases in acetic acid and increases in the molar proportions of propionic acid and of the valeric and higher acid fraction. Balch and Rowland (1957) reported low levels of acetic acid and high levels of propionic and higher acids in the rumen liquid of cows whose ration was predominantly flaked corn. Similar results were obtained by Ensor et al. (1959) with dairy steers and lactating cows, Eusebio et al. (1959) with dairy cows, and Shaw et al. (1960).

Masson (1951), Phillipson (1952), and Newland et al. (1960) observed that heat processed corn significantly decreased the acetic acid and increased the propionic acid in the rumen fluid of sheep.

Busebio et al. (1959) found that heating corn in the process of flaking resulted in a decrease of approximately 40% in the molar proportions of butyric acid and a much larger increase in the molar proportion of the C_6 and higher acids. This increase in the higher acids was noted earlier by Shaw et al. (1957) with rations containing a large proportion of cooked starch, and by Balch and Rowland (1957) with flaked corn rations. Gray and Pilgrim (1952) suggested that part of the butyric acid may be derived from the protein fraction of the roughage. Hentges et al. (1961) reported that the increase in propionic acid production with flaked corn rations was observed only in the sample taken 8 hr after feeding.

Effect on rumen microflora and microfauna. Leffel et al. (1956) reported that when the ration of cows is changed sufficiently to effect a marked change in the molar porportion of volatile fatty acids (VFA) in the rumen, this change is accompanied by a marked change in rumen microbial metabolism. This has been confirmed by Shaw et al. (1957), Balch et al. (1955a), and Busebio et al. (1959). Masson (1950) observed that when sheep were fed a large proportion of flaked corn, protozoa and yeasts were absent and Gram-positive spore forming rods were predominant. The same author (1951) also found that whereas a microbial population of cocci is primarily responsible for the breakdown of ground corn in the rumen of sheep, Clostridium butyricum and lactobacilli predominate in the rumen if the diet contains flaked corn.

Effect on body gains. Some disagreement concerning the effect of heated grain on body weight gain exists in the literature. Ensor et al. (1959) reported that steers fed steam-heated corn gained 0.5 lb per day more than those fed ground corn. Shaw et al. (1960) obtained 22% more gain in body weight with flaked corn than with ground corn. Arnett and Bradley (1960) obtained 21.0% more gain with cooked grain. Williamson et al. (1961) fed

steers pelleted barley and steam-rolled barley with equal results. However, they reported more efficient utilization of the pelleted ration. Boren et al. (1962) reported that there was no significant difference in gains made by yearling heifers fed dry-rolled and steam-rolled sorghum grain.

Newland et al. (1960) found that steers gained slower when fed flaked corn than ground corn (2.03 and 2.29 lb/day, respectively). However, due to considerable variation within each lot, the difference was not statistically significant. The same group (1961) compared ground corn, pelleted corn, flaked corn, crumbled corn and a commercially heat-treated corn, and found no significant differences due to treatments in weight gains of lambs.

Effect on feed efficiency. It has been reported that the efficiency of gains in steers can be controlled to a remarkable extent by manipulating the ruminal production of VFA. Ensor et al. (1959) obtained better daily gains with steers fed steam-heated corn than with ground corn. Hentges et al. (1961), working with yearling steers, found that the feed efficiencies (lb moisture-free ration per lb gain) for flaked and ground corn were 7.5 and 8.3, respectively. Shaw et al. (1960) found that Holstein steer calves fed flaked corn used their feed 15.3% more efficiently than those fed ground corn. Arnett and Bradley (1960) compared flaked corn with ground corn for yearling steers and found a 12.6% better feed efficiency with the flaked corn. Newland et al. (1960) stated that even after their figures were corrected for moisture content the feed efficiency of the steers fed flaked corn was notably better than that of those fed ground corn. This group (1961) also found that lambs reacted similarly. However, Williamson et al. (1961) found that steers made more efficient use of pelleted barley than of steam-rolled barley.

Effect on milk composition. It is widely accepted that a decrease in the

proportion of acetic acid and an increase in propionic acid in the rumen fluid is accompanied by a decrease in milk fat percentage. Popják et al. (1951), using labeled carbon, found that acetate is rapidly utilized for the synthesis of fatty acids. Shaw et al. (1957, 1959) found that a ration composed primarily of bread caused a decrease of more than 30% in the fat content of milk. Balch et al. (1954, 1955) observed a similar decrease in milk fat as a result of feeding a concentrate ration containing 50% flaked corn. They stated that this decline in milk fat percentage was accompanied by an average increase of 0.48% in solids-not-fat content of the milk. This increase was due entirely to an increase in milk protein. Rook (1959) stated that propionic acid may have a specific role in the synthesis of milk protein. However, Balch et al. (1955a) found that a ration containing flaked corn caused a marked decrease in the fat content of milk and less yield of milk but no difference in solids-not-fat percentage.

Rook and Balch (1961) found in three experiments with lactating Holstein cows that the infusion of acetic acid into the rumen through a fistula consistently produced increases in the yields of milk, fat, lactose and protein. Supplements of propionic acid had no effect on the yield of milk, but decreased the yield and percentage of fat and increased the percentages and yields of protein and solids-not-fat. Storry and Rook (1961) stated that acetic acid increased the synthesis of fat, lactose and protein. Propionic acid decreased the synthesis of fat and increased that of protein.

Fountaine (1961) found no significant differences in total yields of milk, fat, solids-not-fat, and protein between cows fed steamed-rolled milo and those fed pelleted milo.

Udder edema. The literature is in agreement on the results of rations varying in quality and quantity on udder edema. Wise et al. (1946) reported

no significant difference in incidence of edema between groups of cows fed low and high levels of protein. Severity of the edema was more pronounced in heifers than in older cows. Parrish et al. (1948), Shaw and Leffel (1949), and Fountaine et al. (1949) reported no significant difference in the incidence and severity of mammary edema and udder congestion of cows fed roughage alone as compared to roughage and grain during the dry period. The above results have been corroborated by Greenhalgh and Gardner (1958) who fed up to 12 lb of grain daily. They also reported that heifers showed more edema at calving than did older cows. Leffel and Shaw (1957) fed 170% of the maintenance requirements for TDN for a period of 60 days prepartum and also had no significant difference in incidence of edema. Hathaway et al. (1957) fed up to 14 lb of grain per day for 2 weeks prepartum with no difference in incidence of edema. Schmidt and Schultz (1959), who fed up to 15 lb of concentrate daily during 8 weeks of dry period, reported that udder edema was significantly correlated with milk production, but not with body condition at calving time. Henken et al. (1960), who fed up to 18 lb of concentrate daily for 40 to 50 days prior to calving, also found a higher incidence of edema for first calf heifers than for older cows.

EXPERIMENTAL PROCEDURE

Twenty-six cows -- eighteen Holsteins, four Jerseys, and four Ayrshires -- all in their second or later pregnancies, were paired according to breed, lactation number, and expected calving date. The pairs were assigned to two treatments, a) cracked sorghum grain and alfalfa hay, b) steamed sorghum grain and alfalfa hay, one pair mate to each treatment. Effects of these rations on body weight gains, incidence of udder edema, proportions of VFA in the rumen fluid, colostrum production and composition, and milk production and composition were observed.

The steamed, crimped sorghum grain was prepared by steaming to 200°F and crimping with rolls spaced 0.005 in. apart. The roll-cracked sorghum grain was prepared with rolls spaced 0.02 in. apart. To both preparations 1% salt was added. Salt was also available in block form free choice. Water was available in stall cups. Good quality chopped sun-cured alfalfa hay was fed.

The cows were started on experiment 60 days before the expected calving date, and continued for 30 days after calving. They were weighed before feeding in the morning for two consecutive days, and on a third day if weights on the two days varied more than 20 lb. The cows were weighed at the beginning of the experiment, at 14 day intervals thereafter until freshening, and once each week thereafter. The difference in body weight changes was divided into three periods: dry, calving, and lactation. The dry period covered that time between when the cow was started on the experiment until freshening. Calving time was referred as that period in which the difference in body weight before calving and after calving took place. The lactation period covered those body weight changes occurred after calving until the cow was taken out of the experiment. They were confined to stanchions except for short periods in the morning, when they were allowed exercise in a vegetation-free open pen.

Two or three days before the estimated time of calving each cow was moved into a maternity stall. If the cow was expected to calve during the night, an udder cover was fitted in the evening to prevent the calf from nursing. The cows were milked by machine twice daily and milk yields were recorded to the nearest 0.1 lb. Milk production records were kept for the first 30 days of lactation, beginning immediately after calving.

During the dry period, hay was fed at the rate of 1.5 lb/cwt and grain

0.8 lb/cwt. Cows were fed hay and their respective grain ration for 6 days after calving according to the schedule in table 1.

Table 1. Feed allowed first six days after calving

Day after calving	Holsteins and Ayrshires: Concentrate (lb)	Holsteins and Ayrshires: Hay (lb)	Jerseys: Concentrate (lb)	Jerseys: Hay (lb)
1	5	10	3.8	7.5
2	10	20	7.6	15.0
3	12	20	9.0	15.0
4	15	ad libitum	11.3	ad libitum
5	18	ad libitum	13.5	ad libitum
6	20	ad libitum	15.0	ad libitum

Starting the seventh day postpartum all cows were fed alfalfa hay and cracked sorghum grain. Milk production determined the amount of cracked sorghum grain fed -- 0.5 lb/lb milk above 20 lb for Holsteins and Ayrshires; and 0.7 lb/lb milk above 14 lb for Jerseys. Hay was offered ad libitum. Refused feed was weighed back in the afternoon and was subtracted from feed offered to determine feed intake. The amount to be fed for the next 24 hr period was based on consumption for the previous day. The total amount to be fed each day was divided into approximately equal amounts for two feedings.

Rumen fluid samples. Samples of rumen fluid were taken at the beginning of the experiment and on the day following calving, using a stomach tube and vacuum pump. The samples were frozen until analyzed.

The rumen fluid was analyzed quantitatively in duplicate for acetic, propionic, butyric acids, and valeric and higher acid fraction by the Keeney method (1953), with the following modifications: rumen fluid sample of 5 cc, 0.75% butyl alcohol in hexane instead of 1%; bands separated visually rather than by solvent volume.

Udder observations. The degrees of edema and congestion were determined twice weekly by observation and palpation.

After calving. The calves were not allowed to nurse. The mammary secretions were withdrawn as completely as possibly by milking machine. The first milking was performed as soon as possible after parturition, usually within one hour. The total mammary secretion removed at each milking was weighed, mixed and sampled. Colostrum from the first 2 milkings was analyzed separately. Samples taken on the third and fourth, seventh and eighth, thirteenth and fourteenth, and twenty-seventh and twenty-eighth milkings were composited according to yield. Total protein, albumin and globulin, casein, non-protein nitrogen, moisture, milk fat, and ash were determined on these daily samples. These analyses were made in the laboratories of the Department of Biochemistry with the exception of that for milk fat.

Analytical methods. Milk fat was determined by the Babcock method. Total solids were determined by the method described by Parrish et al. (1950). Total protein was determined by Rowland's method (1938), modified by the use of the macro Kjeldahl procedure. The albumin-globulin nitrogen fraction was computed by substracting the values for non-protein nitrogen from those of non-casein nitrogen (Parrish et al., 1950). Ash was determined by evaporating 8 to 10 g of sample to dryness in a porcelain dish and heating overnight at a temperature of 550° C. Lactose was determined by difference.

The pair differences were analyzed statistically by the "t" test (Snedecor 1956).

RESULTS AND DISCUSSION

Description of the individual cows used in the experiment is presented in Table 2.

Table 2. Composition of experimental groups.

Ration group	Cow	Breed	Date calved	Age at calving (mo)	Calving (no)
Steamed sorghum grain					
	103C	H	8/13/61	70	4
	179B	H	8/ 9/61	79	5
	167C	H	8/30/61	38	2
	362C	J	9/26/61	45	2
	224C	A	9/ 9/61	39	2
	170C	H	9/28/61	37	2
	139C	H	10/11/61	54	2
	227C	A	10/ 7/61	37	2
	337C	J	10/16/61	67	4
	127C	H	10/20/61	61	3
	156C	H	11/17/61	50	3
	160C	H	11/26/61	49	2
	157C	H	12/24/61	50	3
Cracked sorghum grain					
	122C	H	8/ 4/61	60	3
	183B	H	8/24/61	79	5
	177C	H	9/ 1/61	34	2
	354C	J	9/24/61	51	3
	1R	A	10/ 3/61	72	4
	171C	H	9/26/61	37	2
	159B	H	10/24/61	97	6
	223C	A	11/18/61	42	2
	360C	J	11/18/61	49	3
	145C	H	11/22/61	53	2
	176B	H	11/20/61	85	5
	159C	H	11/24/61	50	3
	143C	H	12/15/61	54	3

The analyses of the feeds are shown in Table 3. The concentrates were analyzed by the Department of Flour and Feed Milling Industries; and the alfalfa hay by the Chemical Service Laboratory, Kansas State University.

Table 3. Chemical composition of feeds.

Feedstuffs	Moisture (%)	N x 6.25 (%)	Ash (%)
Steamed sorghum grain	13.0	9.2	2.2
Cracked sorghum grain	12.4	8.8	2.3
Alfalfa hay	10.8	18.3	8.8

Changes in body weight. Body weight changes of cows during the experiment are summarized in Table 4. Data for individual cows are presented in Table 12 in the Appendix.

Table 4. Body weight changes.

	Dry period (lb/day)	Calving (lb)	Lactation (lb/day)
Cracked sorghum grain	+2.46	-167.9	-3.08
Steamed sorghum grain	+2.22	-151.3	-2.94
Difference	+0.24	- 16.6	-0.14
Standard error	0.38	18.3	0.73

In this experiment there was considerable variability between cows, due to the difficulty to give the same length of dry period to all the cows. The difference in weight at any of the three periods -- dry, calving, and lactation -- was not significant when steamed sorghum grain and alfalfa hay or cracked sorghum grain and alfalfa hay were fed to dry cows at the ratio of 1.5 lb of alfalfa hay per one hundred pounds of body weight, and 0.8 lb of concentrate per one hundred pounds of body weight.

The results obtained are in disagreement with the findings of Ensor et al. (1959) who obtained better gains with steam-heated corn, Shaw et al. (1960) who obtained better gains with flaked corn, Arnett and Bradley (1960) who obtained more gain with cooked grain. However, they are in agreement with the results of Newland et al. (1960, 1961) who tested flaked corn and Boren et al. (1962) who tested steam-rolled sorghum grain.

Proportions of VFA in the rumen fluid. The results for individual cows are presented in Table 13 in the Appendix, and summarized in Table 5.

Table 5. Volatile fatty acids in the rumen fluid.

	Acetic acid	Propionic acid	Butyric acid	Valeric and higher acids
	(%)	(%)	(%)	(%)
Beginning				
Cracked sorghum grain	64.1	18.1	13.4	4.4
Steamed sorghum grain	66.8	15.9	12.5	4.8
Difference	-2.7	2.2*	0.9	-0.4
Standard error	1.4	0.9	0.9	0.6
After calving				
Cracked sorghum grain	64.4	17.0	14.4	4.3
Steamed sorghum grain	66.6	17.0	12.2	4.2
Difference	-2.2	0.0	2.2	0.1
Standard error	1.7	0.7	1.1	0.5

*$P < .05$

The only statistically significant difference in the proportion of VFA in the rumen fluid was at the beginning of the experiment. The propionic acid fraction was greater in the cows on the group that was subsequently fed cracked sorghum grain.

After calving, neither of the two forms of sorghum grain, steamed or cracked, significantly altered the proportions of the acid fractions in the rumen liquid. This is in disagreement with the results reported by Masson (1951), Phillipson (1952), and Newland et al. (1960) with heated corn; Shaw et al. (1957, 1959, 1960) with cooked rations of bread, polished rice, potato meal, and flaked corn; and Balch and Rowland (1957), Ensor et al. (1959) and Eusebio et al. (1959) with flaked corn. Possible explanations for this disagreement is that none of the previous experiments was conducted with dry dairy cows, the great variation between cows in the same treatment, the small number of rumen samples, and the relatively small proportion of acetic acid in the rumen fluid at the start of the experiment.

Incidence of udder edema and udder congestion. The degree of udder edema and udder congestion of cows on the two treatments are presented in Table 6.

Table 6. Incidence of udder congestion and udder edema.

Cow	Before calving, weeks 4	3	2	1	After calving, weeks 1	2	3	4
Cracked milo group								
122C	0	0	0	C+E+	C+E+	0	0	0
183B	0	0	E+	E+	C	0	0	0
177C	0	0	0	0	C+	0	0	0
354C	0	0	0	0	C+E+	0	0	0
1R	0	0	0	0	CE+	0	0	0
171C	0	0	0	C+E+	C+E++	C+E+	C+E+	CE+
159B	0	0	0	0	CE+	CE	0	0
223C	0	0	0	E	CE+	CE	C+E+	E
360C	0	0	0	0	E	0	0	0
145C	0	0	0	E	E	0	0	0
176B	0	0	0	C++	C++E+	C++E+	C++E+	C++E+
159C	0	0	0	C+E+	C++E++	C+E+	E	0
143C	0	0	0	0	CE	0	0	0
Steamed milo group								
103C	0	0	0	E+	0	0	0	0
179B	0	0	0	0	C+	0	0	0
167C	0	0	E+	C+E+	C+	C	0	0
362C	0	0	0	0	CE	0	0	0
224C	0	0	0	C++	C++E+	C+E+	E+	0
170C	0	0	0	0	C+E+	C+E+	E+	0
139C	0	0	0	C+E+	C+E+	CE+	E	0
227C	0	0	0	C	C+E+	CE	0	0
337C	0	0	0	0	0	0	0	0
127C	0	0	0	C+E	C+E+	CE	CE	0
156C	0	0	0	E	E	0	0	0
160C	0	0	0	0	C+E+	C+E+	0	0
157C	0	0	0	E	CE+	C+E+	CE	0

C = Congestion
E = Edema
C or E = Some
C+ or E+ = Moderate
C++ or E++ = Extreme

The incidence of udder edema and congestion did not vary significantly between the cracked sorghum grain or steamed sorghum grain fed groups. This is in agreement with the findings of Parrish et al. (1948), Shaw and Leffel (1949), and Fountaine et al. (1949) who fed grain during the dry period; Wise et al. (1946) who fed high and low levels of protein during the dry period; Leffel and Shaw (1957), Greenhalgh and Gardner (1958), Hathaway et al. (1957), Schmidt

and Schultz (1959), and Henken et al. (1960) who fed high levels of grain during the dry period.

Colostrum composition. The effect of the two treatments on the production and composition of colostrum with regard to total solids, milk fat, solids-not-fat, total protein, casein, albumin-globulin, non-protein nitrogen, ash and lactose are shown in Table 14 in the Appendix. The averages are presented in Table 7.

Cows fed cracked sorghum grain produced significantly less ($P<.05$) ash in colostrum the first day and significatively more ash and casein the second day than did cows fed steamed sorghum grain.

The two concentrate rations did not significantly differ the composition of colostrum with regards to the amount of total solids, milk fat, solids-not-fat, total protein, albumin-globulin, non-protein nitrogen, and lactose. Neither was the amount of colostrum produced significantly different.

Milk composition. Considerable variation was found in the composition of milk samples taken on the fourth, seventh, and fourteenth days within animals in the same group and between groups. The data are summarized in Tables 8 and 9. Information for individual cows is presented in Table 15 in the Appendix.

Table 7. Yield of colostrum and its constituents

	Cracked grain				Steamed grain				Difference (cracked-steamed)			
	Day 1	No. samples	Day 2	No. samples	Day 1	No. samples	Day 2	No. samples	Day 1	Standard error	Day 2	Standard error
	(lb)		(lb)		(lb)		(lb)		(lb)		(lb)	
Production	31.43	12	40.92	13	35.42	12	36.85	13	-3.99	2.72	4.07	1.96
Total solids	6.83	12	6.31	12	7.21	12	5.76	12	-0.38	0.66	0.57	0.31
Milk fat	1.65	12	1.34	13	1.56	12	1.66	13	0.09	0.32	0.18	0.20
Solids not fat	5.19	12	4.43	12	5.65	12	4.00	12	-0.46	0.39	0.43	0.22
Total protein	3.93	12	2.35	13	4.07	12	1.93	13	-0.14	0.31	0.42	0.20
Casein	1.80	12	1.50	13	1.93	12	1.24	13	-0.15	0.17	0.26[c]	0.09
Albumin & Globulin	2.03	12	0.72	13	2.01	12	0.58	13	0.02	0.16	0.14	0.12
NPN[a]	0.016	12	0.020	13	0.018	12	0.019	13	-0.002	0.001	0.001	0.001
Ash	0.30	12	0.36	13	0.37	12	0.32	13	-0.07[c]	0.03	0.04[c]	0.02
Lactose[b]	1.04	11	1.73	12	1.30	11	1.69	12	-0.26	0.15	0.04	0.14

[a]Non-protein nitrogen
[b]By difference
[c]$P<.05$

Table 8. Production of milk and its components

	Cracked sorghum grain						Steamed sorghum grain					
	Day 4	No. samples	Day 7	No. samples	Day 14	No. samples	Day 4	No. samples	Day 7	No. samples	Day 14	No. samples
	(lb)		(lb)		(lb)		(lb)		(lb)		(lb)	
Production	48.94	13	52.25	13	57.55	12	45.72	13	53.19	13	53.92	12
Total solids	7.31	13	7.35	13	7.81	12	6.86	13	7.46	13	7.09	12
Milk fat	2.59	13	2.54	13	2.58	12	2.40	13	2.46	13	2.35	12
Solids not fat	4.72	13	4.81	13	5.23	12	4.46	13	5.00	13	4.74	12
Total protein	2.06	13	1.95	13	1.88	12	2.00	13	2.02	13	1.76	12
Casein	1.54	13	1.50	13	1.45	12	1.47	13	1.54	13	1.36	12
Albumin & Globulin	0.40	13	0.33	13	0.33	12	0.41	13	0.38	13	0.31	12
NPN[a]	0.019	13	0.017	13	0.015	12	0.018	13	0.016	13	0.014	12
Ash	0.40	13	0.42	13	0.43	12	0.38	13	0.42	13	0.39	12
Lactose[b]	2.26	13	2.44	13	2.91	12	2.08	13	2.56	13	2.59	12

[a]Non-protein nitrogen
[b]By difference

Table 9. Group differences - milk and components (cracked - steamed)

	Day 4	Standard error	Day 7	Standard error	Day 14	Standard error
	(lb)		(lb)		(lb)	
Production	3.22	1.75	-0.94	1.93	3.63	2.51
Total solids	0.45	0.28	-0.11	0.33	0.72	0.35
Milk fat	0.19	0.21	0.08	0.20	0.23	0.21
solids not fat	0.26	0.20	-0.19	0.20	0.49*	0.22
Total protein	0.06	0.07	-0.07	0.09	0.12	0.08
Casein	0.07	0.06	-0.04	0.08	0.09	0.07
Albumin & Globulin	-0.01	0.04	-0.05	0.02	0.02	0.02
NPN	0.001	0.001	0.001	0.001	0.001	0.001
Ash	0.02	0.01	0.00	0.01	0.04*	0.02
Lactose	0.18	0.16	-0.12	0.13	0.32	0.16

*$P < .05$

More solids-not-fat and ash were produced on the fourteenth day by the cows conditioned with the cracked sorghum grain. No other significant difference was observed.

The results obtained are in disagreement with those previously reported that heated rations decrease the percentage of milk fat as stated by Shaw et al. (1937, 1939) with ration composed primarily of bread, and Balch et al. (1954, 1955) with ration containing flaked corn and increase the percentage of solids-not-fat (Balch et al. 1954). The results obtained in this experiment may be due to the fact that after the sixth day of lactation all cows were fed the same kind of grain and previously hay was fed fairly liberally.

Milk yield. The actual milk production was converted to 4% fat corrected milk using the Gaines (1928) formula, 4% FCM = 0.4 Milk + 15 Fat. The results for individual cows are shown in Table 16 in the Appendix. The average production of 4% FCM for the groups is presented in Table 10.

Table 10. Milk yield of experimental groups.

	Days	4% FCM
	(no)	(lb)
Cracked milo group	27	1596.5
Steamed milo group	27	1523.2
Difference		73.3
Standard error		78.7

The differences due to treatments were not statistically significant. The average daily milk production, 4% FCM, for the cows that received cracked sorghum grain during the dry period was 59.1 lb and for the group that received steamed sorghum grain was 56.4 lb. Apparently, the difference in ration during the dry and calving periods did not affect subsequent production.

Feed consumption. Data regarding the effect of the cracked and heated sorghum grain on the amount of hay refused during the dry period and on the consumption of alfalfa hay during lactation are shown in Table 17 in the Appendix and are summarized in Table 11.

Table 11. Feed consumption.

	Dry period (50 days)			Lactation (30 days)	
		Hay		Rolled	
	Grain	Consumed	Refused	Grain	Hay
	(lb/day)	(lb/day)	(lb/day)	(lb/day)	(lb/day)
Cracked milo group	10.95	18.92	1.62	18.37	22.12
Steamed milo group	10.58	18.41	1.48	17.34	22.68
Difference	0.37	0.51	0.14	1.03	-0.56
Standard error	0.38	0.58	0.56	0.97	1.21

The average daily differences in the pounds of grain consumed, hay fed and refused during the dry period, and the amount of grain and hay consumed during the lactation, were not statistically significant between treatments.

SUMMARY

An experiment was conducted to study the body gains during the dry period when cracked sorghum grain and alfalfa hay or steamed sorghum grain and alfalfa hay were fed in the ratios of 0.8 lb grain to 1.5 lb hay per hundred pounds of body weight, respectively.

Twenty-six cows of three breeds were paired and assigned to two groups of thirteen cows each. Effects on VFA, composition and production of colostrum and milk for the first 30 days of lactation, incidence of udder edema and/or congestion, body weight changes, and feed consumption were studied.

Neither body weight gains during the dry period, weight loss at calving time, nor loss during the first 30 days of lactation varied significantly between treatments.

No consistent statistically significant differences were found in colostrum and milk production, and production of the components, total solids, milk fat, solids-not-fat, total protein, casein, albumin-globulin, non-protein nitrogen, ash, and lactose. Cows fed cracked sorghum grain produced significatively less ($P<.05$) ash in colostrum the first day and significatively more ash and casein the second day and also statistically significant more ash and solids-not-fat on the fourteenth day than did cows fed steamed sorghum grain during the dry period.

The proportion of VFA in the rumen fluid, feed consumption during the dry and lactation periods, and incidence of udder congestion and/or edema did not differ significantly between treatments.

From these results it may be concluded that no extra benefit is derived from steaming sorghum grain over cracked sorghum grain for feeding dairy cows during the dry period.

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APPENDIX

Table 12. Body weight changes.

Cow	Dry period gains			At calving		Lactation	
	(lb)	(days)	(lb/day)	(lb)	(lb)	(days)	(lb/day)
Steamed sorghum group							
103C	11	56	0.2	-152	-31	27	-1.1
179B	115	56	2.1	-170	-140	30	-4.7
167C	147	58	2.5	-139	-109	29	-3.8
362C	135	62	2.2	-112	-52	30	-1.7
224C	169	56	3.0	-121	-107	29	-3.7
170C	176	61	2.9	-174	-48	27	-1.8
139C	186	64	2.9	-249	-129	31	-4.2
227C	112	53	2.1	-83	-87	27	-3.2
337C	98	55	1.8	-87	-69	28	-2.5
127C	144	59	2.4	-190	-176	27	-6.5
156C	169	62	2.7	-194	+5	28	+0.2
160C	134	61	2.2	-184	-27	28	-1.0
157C	115	64	1.8	-112	-113	27	-4.2
Cracked sorghum group							
122C	173	60	2.9	-197	-104	25	-4.2
183B	326	61	5.3	-341	-43	29	-1.5
177C	142	60	2.4	-118	-57	30	-1.9
354C	71	54	1.3	-85	-78	28	-2.8
1R	114	63	1.8	-109	-109	29	-3.8
171C	179	63	2.8	-165	-131	28	-4.7
159B	76	64	1.2	-165	-166	27	-6.1
223C	93	60	1.6	-89	-111	28	-4.0
360C	131	60	2.2	-65	-23	28	-0.8
145C	174	63	2.8	-193	-43	23	-1.9
176B	213	62	3.4	-302	-75	22	-3.4
139C	142	60	2.4	-179	-77	26	-3.0
143C	92	49	1.9	-175	-58	29	-2.0

Table 13. Volatile fatty acids in rumen fluid.

Cow	Acetic acid (%)	Propionic acid (%)	Butyric acid (%)	Valeric and higher acids (%)
		PREEXPERIMENT		
Cracked sorghum group				
122C	66.3	16.1	13.5	4.1
183B	70.6	14.0	11.7	3.7
177C	72.0	13.5	10.0	4.5
354C	61.0	18.5	13.2	7.3
1R	64.4	18.2	12.7	4.7
171C	61.3	17.8	13.9	7.0
159B	54.0	26.9	15.5	3.6
223C	65.6	18.5	12.9	3.0
360C	66.1	17.7	13.1	3.1
145C	57.6	21.3	14.6	6.5

Table 13. (cont.) Volatile fatty acids in rumen fluid.

Cow	Acetic acid (%)	Propionic acid (%)	Butyric acid (%)	Valeric and higher acids (%)
176B	63.3	17.6	15.6	3.5
159C	62.4	18.7	15.1	3.8
143C	68.6	16.8	12.0	2.6
Steamed sorghum group				
103C	60.3	11.1	21.5	7.1
179B	71.9	13.6	10.3	4.2
167C	66.7	14.5	12.1	6.7
362C	69.8	14.7	11.0	4.5
224C	67.3	14.1	12.8	5.8
170C	67.0	15.0	13.1	4.9
139C	64.8	16.4	13.5	5.3
227C	70.1	16.4	9.7	3.8
337C	72.4	13.4	7.7	6.5
127C	63.2	21.3	11.2	4.3
156C	66.4	18.4	12.9	2.3
160C	63.4	20.7	12.8	3.1
157C	64.7	17.4	13.6	4.3
		AFTER CALVING		
Cracked sorghum group				
122C	60.2	15.3	15.1	9.4
183B	58.5	18.1	15.8	7.6
177C	62.2	16.9	15.6	5.3
354C	70.1	15.6	10.1	4.2
1R	65.9	17.7	13.5	2.9
171C	61.4	18.1	15.0	5.5
159B	63.8	19.7	12.9	3.6
223C	66.6	17.4	11.6	4.4
360C	63.9	18.2	15.4	2.5
145C	64.6	15.7	17.2	2.5
176B	65.1	16.5	15.5	2.9
159C	67.8	14.8	14.8	2.6
143C	66.9	16.4	14.1	2.6
Steamed sorghum group				
103C	65.3	17.7	10.6	6.4
179B	69.1	15.1	11.2	4.6
167C	54.0	19.8	19.8	6.4
362C	63.3	17.7	16.1	2.9
224C	67.7	17.3	9.7	5.3
170C	76.2	13.1	5.4	5.3
139C	66.6	17.1	11.0	5.3
227C	70.8	16.1	10.7	2.4
337C	66.3	17.9	14.0	3.6
127C	64.8	17.2	16.4	1.6
156C	67.7	15.3	14.3	2.7
160C	69.2	17.6	8.4	4.8
157C	66.2	19.7	11.0	3.1

Table 14. Yield of colostrum and its constituents

Cow	Day	Production	Total solids	Milk fat	Solids not fat	Total protein	Casein protein	Albumin and globulin protein	NPN[a]	Ash	Lactose[b]
		(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)
Cracked sorghum group											
122C	1	62.5	15.21	4.02	11.19	8.29	3.84	4.29	0.025	0.60	2.30
	2	45.0	7.24	2.66	4.58	2.30	1.44	0.72	0.024	0.38	1.92
183B	1	36.8	9.29	3.11	6.18	4.66	1.42	3.10	0.022	0.35	1.19
	2	50.0	8.00	2.88	5.12	2.52	1.60	0.74	0.031	0.45	2.16
177C	1	28.1	5.32	0.95	4.37	2.97	1.40	1.45	0.018	0.28	1.12
	2	29.7	4.63	1.57	3.06	1.46	1.00	0.34	0.017	0.28	1.32
354C	1	20.4	5.18	1.07	4.11	3.31	1.35	1.89	0.011	0.22	0.57
	2	24.4	3.52	0.83	2.69	1.39	0.93	0.39	0.010	0.20	1.10
1R	1	22.3	6.00	1.83	4.17	3.42	1.69	1.64	0.014	0.27	0.48
	2	35.4	5.56	1.56	4.00	2.15	1.33	0.70	0.017	0.33	1.52
171C	2	38.7	5.05	1.20	3.85	1.73	1.06	0.52	0.021	0.31	1.81
159B	1	23.0	4.43	0.63	3.80	2.87	0.97	1.82	0.012	0.23	0.69
	2	40.2	5.37	0.88	4.49	2.41	1.26	1.03	0.020	0.35	1.72
223C	1	34.8	6.72	1.86	4.86	3.29	1.67	1.51	0.018	0.32	1.25
	2	40.6	6.37	2.35	4.02	1.86	1.34	0.39	0.019	0.34	1.81
360C	1	13.2	2.53	0.27	2.26	2.17	0.95	1.17	0.007	0.13	----
	2	35.7	----	1.34	----	2.57	1.66	0.82	0.014	0.30	----
145C	1	35.7	8.22	1.88	6.34	4.96	2.68	2.16	0.019	0.37	1.01
	2	50.9	7.58	2.44	5.14	2.47	1.79	0.55	0.019	0.43	2.24
176B	1	28.6	7.34	1.23	6.11	4.86	2.63	2.12	0.016	0.33	0.93
	2	45.8	7.33	1.63	5.70	3.94	2.34	1.43	0.028	0.50	1.26
159C	1	23.7	5.18	1.14	4.04	3.07	1.49	1.49	0.013	0.28	0.69
	2	49.9	7.88	2.00	5.88	3.50	2.17	1.18	0.022	0.49	1.89
143C	1	48.0	6.58	1.77	4.81	3.31	1.52	1.66	0.017	0.27	1.22
	2	45.6	7.19	2.60	4.59	2.21	1.54	0.52	0.023	0.36	2.02

[a]Non-protein nitrogen
[b]By difference

Table 14. (cont.) Yield of colostrum and its constituents

Cow	Day	Production	Total solids	Milk fat	Solids not fat	Total protein	Casein protein	Albumin and globulin protein	NPN	Ash	Lactose
		(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)
Steamed sorghum group											
103C	1	55.5	9.82	1.56	8.26	5.85	2.60	3.07	0.026	0.46	1.95
	2	33.5	4.75	1.22	3.53	1.67	0.83	0.73	0.018	0.28	1.38
179B	1	46.5	9.30	1.95	7.35	4.96	2.00	2.84	0.022	0.41	1.97
	2	37.0	5.86	1.89	3.97	1.94	1.25	0.57	0.018	0.32	1.72
167C	1	24.7	5.25	1.08	4.17	2.90	1.03	1.79	0.012	0.23	1.04
	2	35.3	5.00	1.20	3.80	1.94	1.06	0.77	0.019	0.29	1.57
362C	1	29.3	5.56	1.05	4.51	3.07	1.40	1.58	0.014	0.30	1.14
	2	24.6	3.64	1.09	2.55	1.16	0.80	0.30	0.010	0.20	1.19
224C	1	36.0	6.36	1.12	5.24	3.52	1.82	1.54	0.025	0.39	1.33
	2	42.1	6.04	1.64	4.40	2.07	1.39	0.54	0.023	0.38	1.95
170C	2	37.2	5.16	1.38	3.78	1.61	1.07	0.40	0.023	0.32	1.86
139C	1	27.2	7.70	2.28	5.42	4.41	1.61	2.71	0.012	0.33	0.68
	2	29.9	4.44	1.66	2.78	1.56	0.91	0.57	0.013	0.26	0.96
227C	1	30.3	5.65	0.92	4.73	3.43	1.70	1.61	0.017	0.31	0.99
	2	35.0	5.34	1.42	3.92	1.96	1.34	0.51	0.018	0.32	1.65
337C	1	14.3	3.67	0.62	3.05	2.52	1.12	1.35	0.007	0.17	----
	2	21.6	----	0.70	----	1.46	0.91	0.48	0.012	0.21	----
127C	1	38.0	8.32	2.16	6.16	4.97	2.80	2.07	0.015	0.46	0.74
	2	49.2	8.35	2.95	5.40	3.20	2.01	1.04	0.024	0.47	1.73
156C	1	44.3	8.28	2.07	6.21	4.16	2.45	1.58	0.019	0.44	1.61
	2	44.8	6.60	2.15	4.45	2.11	1.37	0.40	0.024	0.41	1.93
160C	1	41.9	8.92	2.38	6.54	4.45	2.52	1.77	0.024	0.49	1.61
	2	52.6	8.00	2.58	5.42	2.35	1.71	0.47	0.027	0.44	2.62
157C	1	37.0	7.70	1.49	6.21	4.61	2.31	2.18	0.017	0.40	1.20
	2	36.2	5.66	1.67	3.99	2.10	1.27	0.74	0.016	0.33	1.57

Table 15. Yield of milk and its constituents

Cow	Day	Production	Total solids	Milk fat	Solids not fat	Total protein	Casein	Albumin and globulin protein	NPN[a]	Ash	Lactose[b]
		(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)
Cracked sorghum group											
122C	4	64.5	9.40	3.16	6.24	2.63	1.94	0.50	0.031	0.51	3.10
	7	70.5	9.57	2.93	6.64	2.93	2.34	0.45	0.023	0.54	3.19
183B	4	66.0	8.72	2.64	6.08	2.48	1.81	0.55	0.022	0.53	3.07
	7	74.1	9.16	2.37	6.79	2.50	1.79	0.52	0.027	0.60	3.68
	14	81.4	10.07	2.93	7.14	2.60	1.93	0.52	0.026	0.65	3.89
177C	4	44.0	7.04	2.44	4.60	1.94	1.51	0.31	0.017	0.38	2.28
	7	49.0	6.87	2.01	4.86	1.91	1.50	0.28	0.019	0.46	2.50
	14	55.2	9.12	2.21	6.91	1.90	1.48	0.31	0.016	0.44	4.57
354C	4	32.3	4.98	1.76	3.22	1.44	1.05	0.31	0.012	0.26	1.52
	7	36.9	5.24	2.21	3.03	1.55	1.23	0.26	0.010	0.29	1.18
	14	40.2	7.41	3.64	3.77	1.54	1.21	0.28	0.010	0.33	1.91
1R	4	43.3	6.46	2.32	4.14	1.80	1.38	0.30	0.016	0.39	1.96
	7	45.5	6.50	2.34	4.16	1.68	1.33	0.23	0.018	0.40	2.07
	14	47.0	6.00	1.95	4.05	1.56	1.14	0.33	0.015	0.36	2.13
171C	4	42.1	5.99	2.26	3.73	1.50	1.15	0.24	0.016	0.32	1.90
	7	48.1	6.66	2.55	4.11	1.66	1.29	0.27	0.014	0.39	2.05
	14	44.8	5.30	1.39	3.91	1.37	1.08	0.23	0.009	0.34	2.21
159B	4	46.2	5.84	1.59	4.25	1.74	1.18	0.44	0.018	0.35	2.16
	7	51.8	6.61	1.97	4.64	1.82	1.26	0.46	0.016	0.40	2.42
	14	55.5	6.92	2.22	4.70	1.70	1.27	0.32	0.014	0.41	2.59
223C	4	48.0	7.01	2.88	4.13	1.99	1.53	0.34	0.017	0.39	1.75
	7	50.5	7.84	3.11	4.73	1.84	1.42	0.29	0.018	0.40	2.50
	14	60.9	8.93	3.65	5.28	1.98	1.55	0.31	0.019	0.45	2.85
360C	4	31.3	4.80	1.57	3.23	1.48	1.16	0.26	0.009	0.26	1.49
	7	33.8	5.41	1.96	3.45	1.44	1.14	0.24	0.010	0.27	1.73
	14	36.3	5.32	1.76	3.56	1.48	1.18	0.23	0.011	0.29	1.79

[a]Non-protein nitrogen
[b]By difference

Table 15. (cont.) Yield of milk and its constituents

Cow	Day	Production	Total solids	Milk fat	Solids not fat	Total protein	Casein protein	Albumin and globulin protein	NPN	Ash	Lactose
		(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)
145C	4	51.0	7.55	2.42	5.13	2.15	1.66	0.36	0.021	0.39	2.59
	7	45.0	7.09	2.90	4.19	1.67	1.32	0.23	0.016	0.36	2.17
	14	59.2	7.48	2.19	5.29	1.89	1.51	0.30	0.014	0.40	3.00
176B	4	52.3	8.99	3.71	5.28	2.57	1.73	0.70	0.022	0.47	2.23
	7	53.3	7.99	3.25	4.74	1.87	1.33	0.41	0.019	0.44	2.44
	14	67.9	8.83	3.11	5.72	2.13	1.56	0.48	0.016	0.54	3.06
159C	4	56.3	9.53	4.05	5.48	2.62	2.02	0.47	0.020	0.48	2.37
	7	65.4	8.78	3.01	5.77	2.38	1.88	0.37	0.017	0.50	2.88
	14	64.8	7.82	2.46	5.36	1.94	1.53	0.33	0.014	0.49	2.92
143C	4	58.9	8.72	2.89	5.83	2.44	1.92	0.38	0.022	0.45	2.95
	7	55.4	7.77	2.44	5.33	2.08	1.70	0.28	0.016	0.39	2.86
	14	77.4	10.50	3.44	7.06	2.52	2.02	0.35	0.020	0.51	4.02
Steamed sorghum group											
103C	4	54.0	7.89	2.38	5.51	2.27	1.58	0.52	0.024	0.45	2.79
	7	59.0	8.06	2.60	5.46	2.22	1.62	0.49	0.020	0.47	2.77
179B	4	50.5	6.66	2.20	4.46	2.32	1.67	0.52	0.020	0.41	1.73
	7	63.5	8.13	2.41	5.72	2.43	1.78	0.49	0.023	0.50	2.79
	14	65.0	8.02	2.41	5.61	2.11	1.49	0.46	0.023	0.52	2.98
167C	4	48.0	6.57	1.90	4.67	2.11	1.50	0.49	0.021	0.39	2.17
	7	56.4	8.04	2.54	5.50	2.09	1.58	0.39	0.016	0.42	2.99
	14	61.0	7.78	2.20	5.58	1.98	1.56	0.31	0.018	0.41	3.19
362C	4	26.5	4.13	1.52	2.61	1.22	0.91	0.25	0.009	0.23	1.16
	7	34.4	5.21	1.92	3.29	1.49	1.14	0.29	0.009	0.30	1.50
	14	33.6	5.11	2.02	3.09	1.24	0.96	0.22	0.008	0.26	1.59
224C	4	47.1	6.65	1.91	4.74	2.04	1.56	0.36	0.020	0.42	2.27
	7	53.0	7.11	2.23	4.88	1.96	1.52	0.30	0.021	0.40	2.52
	14	50.5	6.19	1.69	4.50	1.64	1.29	0.26	0.014	0.36	2.50
170C	4	47.6	7.24	2.55	4.69	1.91	1.43	0.37	0.020	0.39	2.39
	7	53.9	8.02	2.96	5.06	1.82	1.37	0.31	0.019	0.44	2.79
	14	36.8	5.02	1.75	3.27	1.13	0.87	0.21	0.009	0.28	1.87

Table 15. (cont.) Yield of milk and its constituents

Cow	Day	Production	Total solids	Milk fat	Solids not fat	Total protein	Casein	Albumin and globulin protein	NPN	Ash	Lactose
		(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)
139C	4	47.6	7.49	3.05	4.44	1.94	1.43	0.42	0.016	0.39	2.12
	7	54.7	7.71	2.46	5.25	2.02	1.50	0.45	0.013	0.40	2.82
	14	55.4	7.02	2.05	4.97	1.80	1.34	0.39	0.011	0.39	2.78
227C	4	44.4	6.21	1.84	4.37	1.81	1.44	0.23	0.016	0.36	2.20
	7	50.4	6.27	1.59	4.68	1.80	1.45	0.26	0.015	0.39	2.49
	14	52.2	6.87	2.24	4.63	1.57	1.23	0.23	0.014	0.38	2.68
337C	4	28.1	4.56	1.69	2.87	1.31	1.02	0.23	0.008	0.23	1.33
	7	34.2	5.37	1.92	3.45	1.50	1.22	0.24	0.008	0.29	1.66
	14	39.9	5.50	1.82	3.68	1.55	1.27	0.23	0.010	0.32	1.82
127C	4	42.1	7.26	3.33	3.93	2.15	1.37	0.67	0.017	0.38	1.41
	7	58.3	8.48	3.03	5.45	2.42	1.82	0.48	0.019	0.47	2.37
	14	64.4	8.61	2.96	5.65	2.02	1.56	0.33	0.017	0.46	3.17
156C	4	53.7	7.96	2.74	5.22	2.36	1.85	0.38	0.022	0.45	2.41
	7	49.7	6.35	1.89	4.46	1.87	1.46	0.32	0.015	0.41	2.18
	14	60.9	8.30	2.95	5.35	1.91	1.48	0.31	0.019	0.41	3.03
160C	4	53.2	8.44	3.03	5.41	2.27	1.73	0.41	0.023	0.45	2.69
	7	65.5	9.30	2.95	6.35	2.38	1.84	0.42	0.020	0.52	3.45
	14	69.4	8.38	3.17	5.21	2.30	1.77	0.44	0.017	0.51	2.39
157C	4	51.6	8.17	3.10	5.07	2.24	1.68	0.46	0.014	0.41	2.43
	7	58.5	8.90	3.45	5.45	2.24	1.72	0.45	0.014	0.46	2.75
	14	57.9	8.23	2.90	5.33	1.92	1.52	0.33	0.012	0.44	3.02

Table 16. Milk yield.

Cow	Milk production, Days 4 to 7	Milk production, Days 8 to 14	Milk production, Days 15 to 30	Milk fat, Days 4 to 7	Milk fat, Days 8 to 14	Milk fat, Days 15 to 30	4% Fat corrected milk, Days 4 to 7	4% Fat corrected milk, Days 8 to 14	4% Fat corrected milk, Days 15 to 30	4% Fat corrected milk, Total
	(lb)	(lb)	(lb)	(%)	(%)	(%)	(lb)	(lb)	(lb)	(lb)
Cracked sorghum group										
122C	267.0	500.0	1096.6	4.5	3.6	3.3	287.0	470.0	981.5	1738.5
183B	273.7	562.4	1328.8	3.6	3.4	3.2	257.3	511.8	1169.3	1938.4
177C	180.9	357.9	795.5	4.8	4.1	3.8	202.6	363.3	771.6	1337.5
354C	141.3	252.6	561.7	5.7	7.5	7.7	177.3	385.2	873.4	1435.9
1R	175.7	332.3	819.1	5.3	4.7	3.9	210.0	367.2	806.8	1384.0
171C	168.6	329.4	835.2	5.3	4.2	3.1	201.5	339.3	722.4	1263.2
159B	199.1	389.5	800.3	3.6	3.9	3.7	187.2	383.7	764.3	1335.2
223C	204.9	375.1	944.0	6.1	6.1	5.3	269.4	493.3	1128.1	1890.8
360C	124.3	250.3	613.3	5.4	5.3	5.0	150.4	299.1	711.0	1160.5
145C	206.6	387.6	1084.1	5.6	5.1	2.9	256.2	451.6	905.2	1613.0
176B	203.9	424.3	1010.7	6.6	5.3	4.3	283.4	507.0	1056.2	1846.6
159C	242.5	448.8	938.2	5.9	4.2	3.6	311.6	462.3	881.9	1655.8
143C	242.5	509.7	1252.9	4.7	4.4	4.5	268.0	540.3	1346.9	2155.2
Steamed sorghum group										
103C	215.5	472.5	1108.1	4.4	4.1	3.7	228.4	479.6	1058.2	1766.2
179B	213.5	434.0	1019.1	4.1	3.8	3.6	216.7	421.0	958.0	1595.7
167C	213.2	433.4	873.2	4.2	4.1	3.7	219.6	439.9	833.9	1493.4
362C	124.8	262.2	543.0	5.7	5.8	5.6	156.6	333.0	673.3	1162.9
224C	201.3	358.7	758.6	4.1	3.8	3.6	204.3	347.9	713.1	1265.3
170C	202.3	375.0	962.8	5.4	5.1	4.1	244.8	436.9	977.2	1658.9
139C	198.9	387.4	930.9	5.5	4.1	4.0	243.7	393.2	930.9	1567.8
227C	192.3	361.9	874.1	3.7	3.7	4.0	183.6	345.6	874.1	1403.3
337C	119.4	226.9	454.7	5.8	5.1	4.5	151.6	264.3	488.8	904.7
127C	196.0	420.2	955.5	6.6	4.9	4.0	272.4	476.9	955.5	1704.8
156C	194.5	347.9	982.7	4.5	4.3	4.5	209.1	363.6	1056.4	1629.1
160C	240.3	471.2	1088.8	5.1	4.5	4.2	280.2	506.5	1121.5	1908.2
137C	219.5	404.5	881.0	6.0	5.5	4.6	285.4	495.5	960.3	1741.2

Table 17. Feed consumption by periods.

Cow	Dry period (50 days)						Lactation (30 days)			
	Grain		Hay				Grain		Hay	
			Consumed		Refused					
	Total	Per day	Total	Per day	Total	Per day	Total	Per day	Total	Per day
	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)	(lb)
Cracked sorghum group										
122C	650.5	13.0	1099.7	22.0	118.7	2.4	680.8	22.7	691.1	23.0
183B	585.5	11.7	1056.4	21.1	41.3	0.8	822.5	27.4	747.0	24.9
177C	450.1	9.0	835.7	16.7	7.2	0.1	439.2	14.6	687.5	22.9
354C	416.2	8.3	726.8	14.5	53.6	1.1	430.9	14.4	555.9	18.5
1R	529.8	10.6	943.2	18.9	49.3	1.0	441.9	14.7	760.1	25.3
171C	541.9	10.8	863.5	17.3	153.9	3.1	444.8	14.8	538.3	17.9
159B	680.0	13.6	979.0	19.6	295.7	5.9	470.5	15.7	815.7	27.2
223C	505.9	10.1	880.3	17.6	69.7	1.4	512.6	17.1	628.6	21.0
360C	349.5	7.0	654.9	13.1	0	0	441.6	14.7	630.4	21.0
145C	558.4	11.2	1041.1	20.8	10.7	0.2	590.7	19.7	617.8	20.6
176B	654.7	13.1	1135.6	22.7	91.2	1.8	571.7	19.1	592.1	19.7
139C	560.2	11.2	969.2	19.4	80.8	1.6	570.6	19.0	628.1	20.9
143C	634.2	12.7	1109.7	22.2	80.7	1.6	747.1	24.9	738.0	24.6
Steamed sorghum group										
103C	578.2	11.6	971.1	19.4	113.7	2.3	643.6	21.5	738.0	24.6
179B	660.5	13.2	1148.4	23.0	94.7	1.9	588.0	19.6	792.5	26.4
167C	475.6	9.5	875.6	17.5	16.2	0.3	528.7	17.6	597.1	19.9
362C	385.8	7.7	713.6	14.3	7.6	0.2	412.5	13.8	522.1	17.4
224C	474.3	9.5	840.1	16.8	49.0	1.0	428.5	14.3	687.0	22.9
170C	512.0	10.2	918.4	18.4	44.1	0.9	542.2	18.1	675.1	22.5
139C	624.5	12.5	1023.8	20.5	146.3	2.9	530.6	17.7	799.1	26.6
227C	436.3	8.7	782.7	15.7	36.1	0.7	485.8	16.2	707.0	23.6
337C	344.5	6.9	565.3	11.3	82.7	1.7	336.1	11.2	429.1	14.3
127C	679.7	13.6	1024.1	20.5	253.2	5.1	561.2	18.7	702.9	23.4
156C	535.5	10.7	999.1	20.0	4.8	0.1	526.7	17.6	863.0	28.8
160C	614.0	12.3	1148.1	23.0	3.4	0.1	641.4	21.4	754.8	25.2
157C	557.2	11.1	946.8	18.9	98.4	2.0	531.1	17.7	580.1	19.3

SOME EFFECTS OF FEEDING HEATED GRAIN TO DAIRY COWS DURING THE DRY PERIOD

by

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Sorghum is grown extensively in the central and southern plains area of the United States. Because of its drought resistance it produces more grain in dry areas than corn. Recent studies with cattle and sheep have shown that feeding heated grain results in increased body weight gain and feed efficiency. Since one of the objectives of the dry period is the preparation of the cow for the next lactation, a ration that produces the greatest body weight gain is the most desirable.

An experiment was conducted to study the body gains during the dry period when cracked sorghum grain and alfalfa hay or steamed sorghum grain and alfalfa hay were fed in the ratios of 0.8 lb grain to 1.5 lb hay per one hundred pounds of body weight, respectively. Twenty-six cows of three breeds were paired and assigned to two groups of thirteen cows each. Effects on volatile fatty acids, composition and yield of colostrum and milk for the first 30 days of lactation, incidence of udder edema and/or congestion, body weight changes, and feed consumption were recorded.

Neither body weight gains during the dry period, weight loss at calving time, nor loss during the first 30 days of lactation varied significantly due to treatment.

No consistent significant differences were found in colostrum and milk production, and production of the components, total solids, milk fat, solids-not-fat, total protein, casein, albumin-globulin, non-protein nitrogen, ash, and lactose. Cows fed cracked sorghum grain produced significatively less ($P<.05$) ash in colostrum the first day and significatively more ash and casein the second day and also statistically significant more ash and solids-not-fat on the fourteenth day than did cows fed steamed sorghum grain during the dry period.

The proportion of volatile fatty acids in the rumen fluid, the feed consumption during the dry and lactation periods, nor degree of udder congestion and/or edema did not differ significantly due to treatment.

From these results it may be concluded that no extra benefit is derived from steaming sorghum grain over cracked sorghum grain for feeding dairy cows during the dry period.