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## Effects of processing sorghum grain on dairy calf performance

### Abstract

Two trials evaluated the effect of processing sorghum grain on performance of young dairy calves. In trial 1, newborn Holstein calves (49 heifers and 27 bulls) were blocked by age and sex and assigned randomly to each of three calf starters containing either raw, roasted (Jet-Pro®) at 280 degrees F, or conglomerated (Jet-Pro®) sorghum grain. The conglomeration process consisted of grinding the grain, adding water, and pelleting the mixture, then roasting it. Raw and roasted sorghum grains were ground through a .125-inch screen and included in complete pellet starters, whereas conglomerated sorghum grain pellets were mixed with the other ingredients of the starter, which were pelleted. Starters were offered ad libitum from birth to 8 wk of age. The raw sorghum grain starter was palatable and supported acceptable growth rates, but processing did not further enhance calf performance. In trial 2, roasted and conglomerated sorghum grains were ground through a .125- inch screen and included in pelleted starters fed ad libitum to Holstein calves (21 heifers and 28 bulls) from birth to 8 wk of age. Feed consumption and body weight gain were not affected by method of grain processing. However, 22% of calves on the conglomerated sorghum grain starter bloated sometime during the post-weaning period, which may have resulted in reducing feed intake. Measures to ensure maintenance of the rumen environment may be necessary, if a potential benefit of conglomerating sorghum grain for young dairy calves is to be realized.; Dairy Day, 1994, Kansas State University, Manhattan, KS, 1994;

### Keywords

Dairy Day, 1994; Kansas Agricultural Experiment Station contribution; no. 95-141-S; Report of progress (Kansas Agricultural Experiment Station); 716; Sorghum grain; Processing; Calf starters

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# EFFECT OF PROCESSING SORGHUM GRAIN ON DAIRY CALF PERFORMANCE

*I.E.O. Abdelgadir and J. L. Morrill*

## Summary

Two trials evaluated the effect of processing sorghum grain on performance of young dairy calves. In trial 1, newborn Holstein calves (49 heifers and 27 bulls) were blocked by age and sex and assigned randomly to each of three calf starters containing either raw, roasted (Jet-Pro®) at 280 degrees F, or conglomerated (Jet-Pro®) sorghum grain. The conglomeration process consisted of grinding the grain, adding water, and pelleting the mixture, then roasting it. Raw and roasted sorghum grains were ground through a .125-inch screen and included in complete pellet starters, whereas conglomerated sorghum grain pellets were mixed with the other ingredients of the starter, which were pelleted. Starters were offered ad libitum from birth to 8 wk of age. The raw sorghum grain starter was palatable and supported acceptable growth rates, but processing did not further enhance calf performance. In trial 2, roasted and conglomerated sorghum grains were ground through a .125-inch screen and included in pelleted starters fed ad libitum to Holstein calves (21 heifers and 28 bulls) from birth to 8 wk of age. Feed consumption and body weight gain were not affected by method of grain processing. However, 22% of calves on the conglomerated sorghum grain starter bloated sometime during the post-weaning period, which may have resulted in reducing feed intake. Measures to ensure maintenance of the rumen environment may be necessary, if a potential benefit of conglomerating sorghum grain for young dairy calves is to be realized.

(Key Words: Sorghum Grain, Processing, Calf Starters.)

## Introduction

Extensive research had investigated methods for processing sorghum grain to improve its utilization by ruminants. The feeding value of sorghum grain is improved by steam flaking, reconstitution, micronizing, and popping. Processing disrupts the organization of starch and the association between protein and starch in the grain endosperm. In general, these methods have the potential for improving the utilization of the grain by 12 to 15%. Although these benefits were recognized widely for feedlot cattle, less information is available on the value of raw and processed sorghum grain for dairy calves.

The objective of this study was to evaluate the effects of feeding calf starters containing either raw, roasted, or conglomerated sorghum grain on the performance of dairy calves from birth to 8 wk of age.

## Procedures

The study consisted of two feeding trials. In trial 1, newborn Holstein calves (49 heifers and 27 bulls) were moved to 4×4 ft wood hutches bedded with straw. They were blocked by sex and age, and calves within each sex block were assigned randomly to each of three isonitrogenous starters (Table 1) that contained either raw, roasted (Jet-Pro Co., Atchison, KS) at 280 degrees F, or conglomerated (Jet-Pro Co., Atchison, KS) sorghum grain. For the conglomeration process, the grain was ground, water was added, and the mixture was formed into pellets using a unique pellet-forming process, then roasted. The degrees of gelatinization (mg maltose equivalents/g sample) of raw, roasted, and conglomerated grain were 28.5, 66.9, and 198.6, respectively. Raw and roasted sorghum grains were ground through a

.125-inch screen and each included in a complete pellet starter, whereas conglomerated sorghum pellets were mixed with the complementary ingredients of the starter, which were pelleted. Starters were offered ad libitum from birth to 8 wk of age. Calves were fed milk at 4% of birth weight twice daily and weaned when they consumed 1.5 lb of starter per day for 3 consecutive days, provided that they were not less than 3 wk of age and had gained greater than or equal to 10 lb of body weight since birth.

In trial 2, roasted and conglomerated sorghum grains were compared in two iso-nitrogenous calf starters (Table 2) fed to Holstein calves (21 heifers and 28 bulls) from birth to 8 wk of age. Both grains were ground through a .125-inch screen and each included in a complete pellet starter.

In both trials, calves were observed daily for general appearance and consistency of their feces. Starter consumption and body weight gain were determined weekly. Heart girth and wither height were measured at the beginning and end of the experiments.

## **Results and Discussion**

### ***Trial 1***

Weekly feed intake (Figure 1), weekly body weight gain (Figure 2), and overall performance (Table 3) were not improved by sorghum grain processing. The raw sorghum grain starter was palatable and supported acceptable growth rates. Calves on the conglomerated sorghum grain starter consumed less feed and tended to gain less weight. The hardness of pellets as measured by the pellet durability index method was similar across

diets (93-94%), indicating that palatability rather than the hardness of the conglomerated sorghum grain pellets might be the reason for reduced starter consumption. Rumen fluid pH, which may serve as an indicator of rumen fermentation activity, was unexpectedly high (Table 3) for calves on the conglomerated grain starter, despite the high degree of gelatinization of the conglomerated sorghum grain starch. This may have been due to either low feed intake, the pellets being less available for the rumen microorganisms, or both.

### ***Trial 2***

Weekly feed intake (Figure 3), body weight gain (Figure 4), and overall performance (Table 4) were not affected by method of sorghum grain processing. However, 22% of calves on the conglomerated sorghum grain starter bloated sometime during the postweaning period. Bloat was more severe when calves were consuming more than 6 lb of starter per day, mostly when they were more than 6 wk of age. Bloat was relieved easily by passage of a stomach tube, and, in all cases no special medication was required. However, bloat, which tended to recur in the same calves (the good eaters), may have resulted in depressed starter consumption and consequently may have prevented a potential enhancement of weight gain by the conglomeration process.

Results from this study indicate that raw sorghum grain can support acceptable growth rates when used in calf starters. Roasting the grain did not improve its feeding value under the conditions of this experiment. If a potential benefit from feeding conglomerated sorghum grain is to be realized in young calves up to 8 wk of age, proper measures to prevent bloat may be necessary.

**Table 1. Composition and Analysis of Calf Starters in Trial 1**

Ingredient	Starter		
	Raw sorghum grain	Roasted sorghum grain	Conglomerated sorghum grain
	-----% as fed-----		
Sorghum grain	40.05	38.95	38.5
Soybean meal	16.01	16.31	16.45
Oats	14.76	15.03	15.11
Alfalfa hay, ground	19.46	19.82	19.97
Molasses	7	7.13	7.19
Coccidiostat	1.31	1.33	1.33
Vit-mineral premix	1.41	1.43	1.45
Analysis			
DM, %	88.3	88.8	90
	-----% of dry matter-----		
CP	19.5	19.8	20.2
NDF	23.3	22.8	20.7
ADF	11.2	11.5	11.3
Ether extract	2.8	2.6	2.4
Ash	7.1	6.8	6.6

**Table 2. Composition and Analysis of Calf Starters in Trial 2**

Ingredient	Starter	
	Roasted sorghum grain	Conglomerated sorghum grain
	-----% as fed-----	
Sorghum grain	39.33	39.01
Soybean meal	16.18	16.5
Oats	15	15
Alfalfa hay, ground	20	20
Molasses	7	7
Coccidiostat	1.32	1.32
Vit-mineral premix	1.17	1.17
Analysis		
DM, %	89.1	88.5
	-----% of dry matter-----	
CP	19	19.6
NDF	20.2	20.1
ADF	11.4	11.3
Ether extract	2.6	2.4
Ash	7.1	6.6

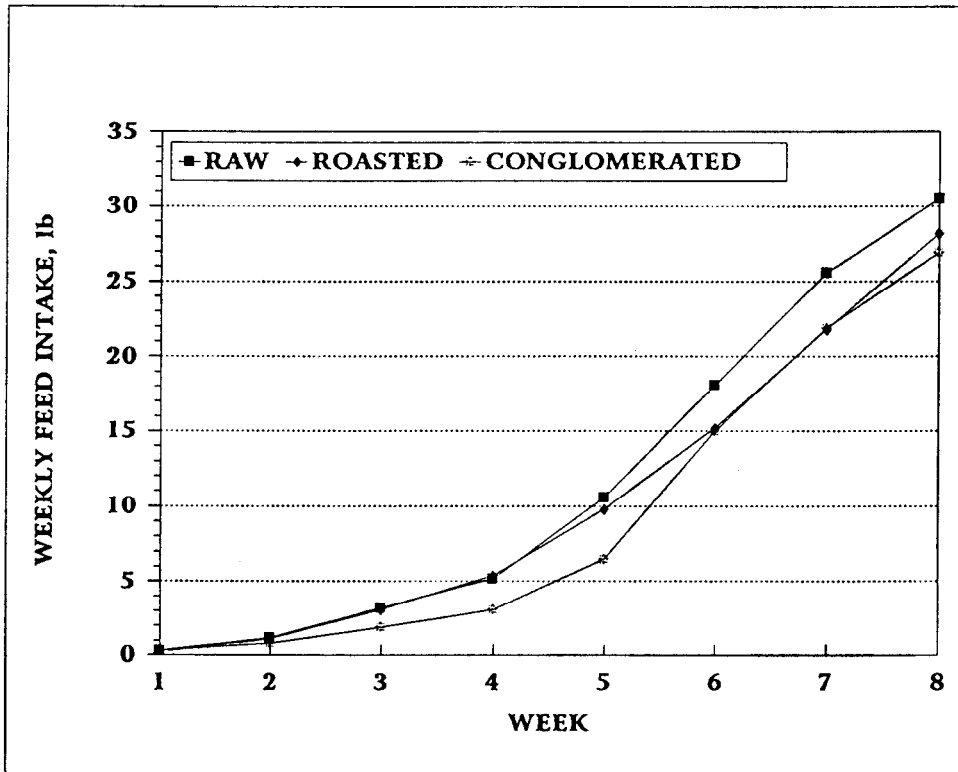


Figure 1. Weekly Feed Intake of Calves in Trial 1

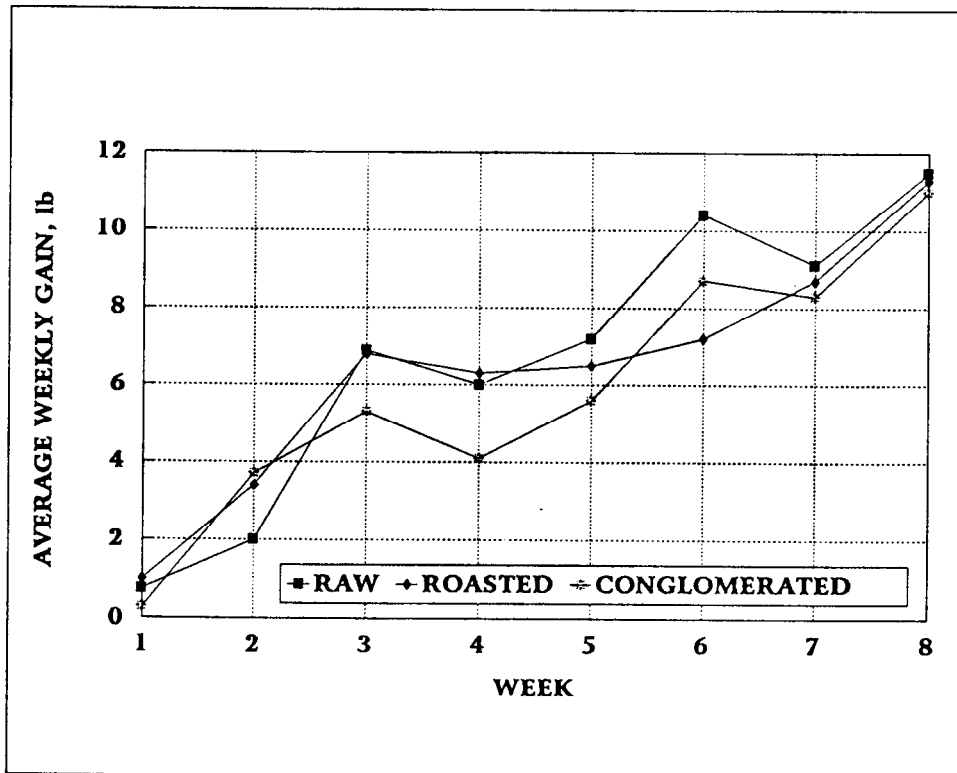


Figure 2. Weekly Body Weight Gain of Calves in Trial 1

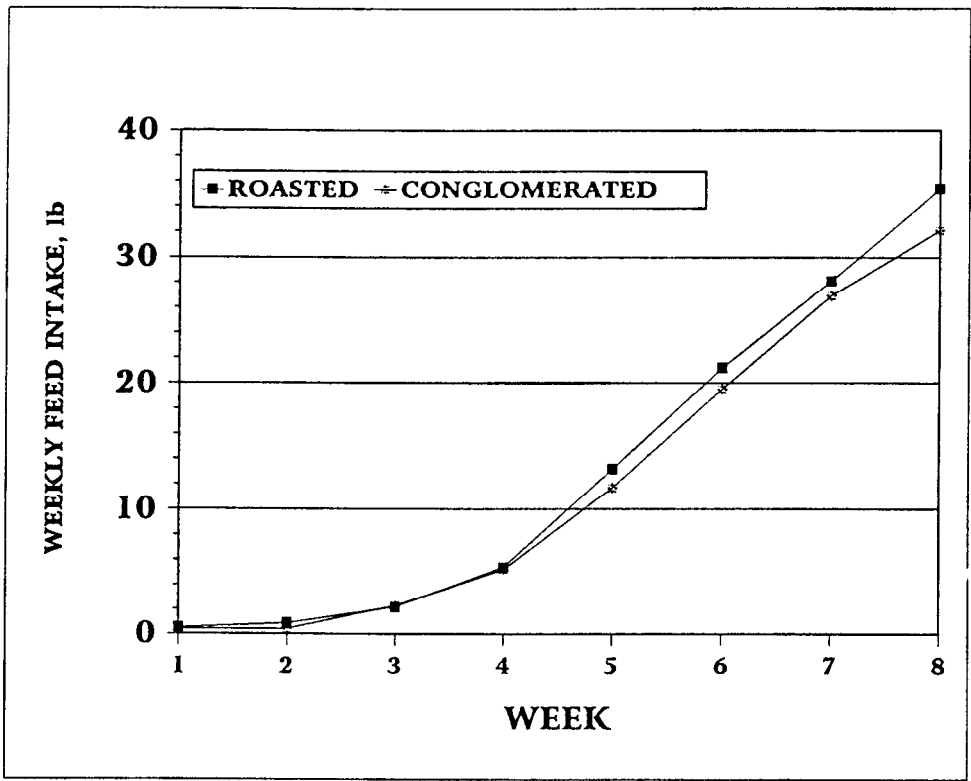


Figure 3. Weekly Feed Intake of Calves in Trial 2 (22% of Calves on the Conglomerated Sorghum Starter Bloated during Wk 6 to 8.)

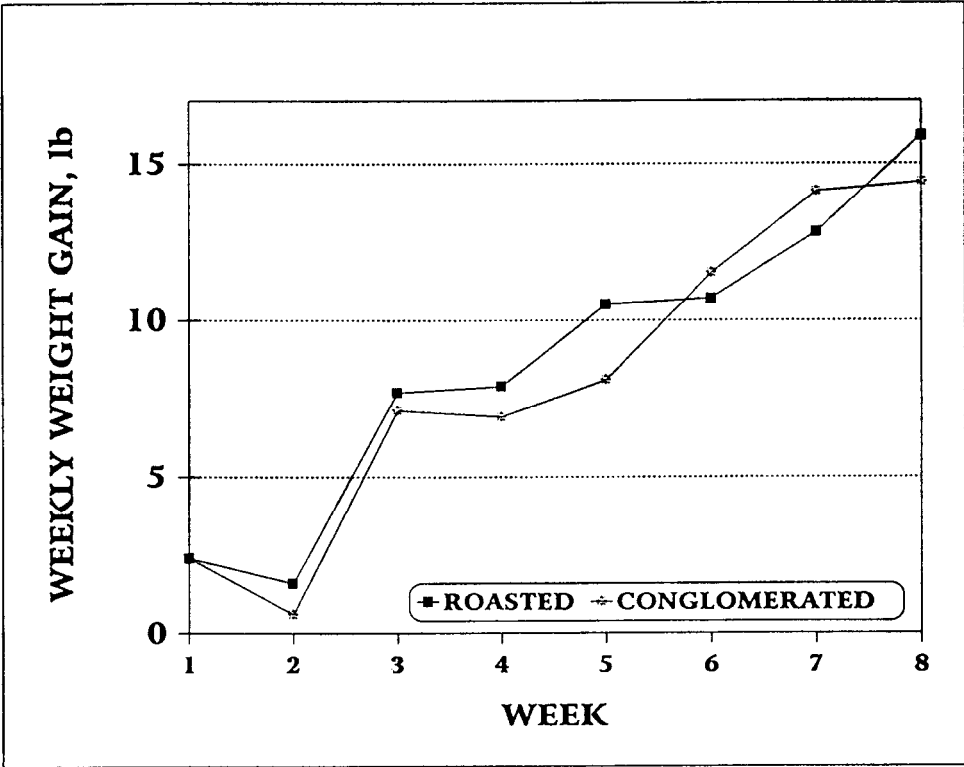


Figure 4. Weekly Body Weight Gain of Calves in Trial 2 (22% of Calves on the Conglomerated Sorghum Grain Starter Bloated during Wk 6 to 8.)

**Table 3. Overall Calf Performance in Trial 1**

Item	Starter diet			SEM
	Raw	Roasted	Conglomerated	
Weight gain, lb	52.3	51.2	46.5	3.5
Feed intake, lb	94.7 <sup>a</sup>	84.9 <sup>a</sup>	76.4 <sup>b</sup>	8.4
Gain:feed, (lb/lb) <sup>1</sup>	.37	.39	.41	.03
Girth gain, in	5.2	5.1	4.6	.33
Height gain, in	2.7	2.7	2.7	.22
Average age at weaning, days	32.2	34.7	33.6	1.3
Rumen fluid pH <sup>2</sup>	5.79 <sup>b</sup>	5.36 <sup>b</sup>	6.11 <sup>a</sup>	.22

<sup>a,b</sup>Means within a row lacking a common superscript letter differ ( $P < .10$ ).

<sup>1</sup>Determined for the postweaning period (wk 6 to wk 8).

<sup>2</sup>Measured at wk 8.

**Table 4. Overall Calf Performance in Trial 2**

Item	Starter diet		SEM
	Roasted	Conglomerated	
Weight gain, lb	68.9	65.6	3.3
Feed intake, lb	106.8	98.7	6.1
Gain:feed, (lb/lb) <sup>1</sup>	.46	.48	.11
Girth gain, in	5.6	5.1	.3
Height gain, in	3	2.99	.2
Average age at weaning, days	31.8	31.8	.9
Rumen fluid pH <sup>2</sup>	5.87	5.7	.14

<sup>1</sup>Determined for the postweaning period (wk 6 to wk 8).

<sup>2</sup>Measured at wk 8.