EFFECTS OF GRAIN TYPE ON GROWTH AND PERFORMANCE OF STEERS LIMIT-FED GRAIN-BASED DIETS [1]

R. D. Hunter, E. C. Titgemeyer, J. S. Drouillard, and T. Nutsch

Summary

Five hundred fifty two steers were used in a growth experiment designed to evaluate the use of grain sorghum in a limit-feeding program. Dry-rolled corn, dry-rolled grain sorghum, steam-flaked grain sorghum, or combinations of grains totaled 70% (dry matter basis) of the diet. Daily intakes were restricted to 2% of body weight (dry matter basis). Cattle were fed their assigned diet for 95 days followed by a 5-day period on a common diet to compensate for differences in gut fill. Steam-flaked grain sorghum and dry-rolled corn yielded similar gain efficiencies and average daily gains. Dry-rolled grain sorghum, however, had 71% the value of dry-rolled corn and 72% the value of steam-flaked grain sorghum. These values became 80% and 83% when the 5 days on a common diet were considered. No significant associative effects were observed for the combinations of grains. The data clearly indicate that grains that are slowly fermented (i.e. dry-rolled grain sorghum) are less desirable in a limit-feeding program. Differences among grains observed in full-fed, finishing diets will likely be as great or greater with high-grain, limit-fed diets. Consequently, extensive processing of grain sorghum would be as beneficial in a limit-fed ration for growing cattle as it is perceived to be in a full-fed, finishing diet.

(Key Words: Grain Sorghum, Limit Feeding, Grain Processing.)

Introduction

Feeding growing cattle high grain diets at restricted intakes is becoming increasingly popular among commercial cattle feeders. This method offers several advantages. First, feeding diets at restricted dry matter intakes increases the digestibility of the feed. Second, concentrates are generally less expensive per unit of energy than roughages. Third, animals fed grain-based diets produce less manure.

The value of grain sorghum as an energy source in full-fed, finishing diets has been well defined in numerous feeding trials in the past 30 years. It is generally accepted that steam flaking improves the value of grain sorghum more than any other grain type for finishing diets. However, the feeding value of grain sorghum in limit-fed growing diets has not been well defined. Under conditions of limit feeding, the rate of passage of digesta from the rumen may be slower, thus allowing for more time for microbial digestion of the feed. Grain sorghum has a starch-protein matrix that renders it more resistant to breakdown by the microbes than grains like wheat, barley, or corn. Slower passage rates presumably would be better suited to slowly fermented grains like grain sorghum. In addition, combinations of grains with different fermentation rates may be more beneficial than single grains. Because cattle on limit-fed diets consume their feed quickly, they may be predisposed to digestive disturbances. Thus, feeding diets containing combinations of rapidly fermented steam-flaked

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grains and slowly fermented dry-rolled grains may offer advantages.

Experimental Procedures

Five hundred fifty two steers were used in a growth study to compare performance when they were fed diets containing steam-flaked and(or) dry-rolled grain sorghum relative to dry-rolled corn. The steers' average initial weight was 640 lb. Steers were allotted to 24 pens (23 head per pen) on the basis of weight, breed type, and previous diet in order to create pens that were as uniform as possible. The steers were assigned to one of six diets (Table 1).

Diets were fed at 2% of body weight on a dry matter basis. Feed intakes were calculated at the beginning of the study and adjusted once each week assuming that cattle would gain 2 lb/day. The experimental diets were fed for 95 days. A common diet was fed for 5 days at the end of the study in an attempt to equalize gut fill.

The grain sorghum was steam processed at the Kansas State University Beef Cattle Research Center mill using 18 in. × 24 in. rolls corrugated with 16 corrugations/inch and with a 96 cubic foot steam chest. The grain sorghum was conditioned for 90 minutes and flaked to a density of 23 lb/bu.

Results and Discussion

No significant associative effects were observed for the grain combinations, indicating that the grain mixes performed similarly to the average of the two grains fed individually. Consequently, only differences among the three grain types are discussed.

Feed intakes for cattle fed the steam-flaked grain sorghum were about 2% higher than for the other grains because of slight variations in dry matter from the predicted levels. This was true both at the end of the treatments and after feeding the common diet.

Daily gains of cattle fed dry-rolled corn and steam-flaked grain sorghum were similar. However, steers fed dry-rolled grain sorghum grew slower than steers fed dry-rolled corn or steam-flaked grain sorghum. Steers on dry-rolled grain sorghum gained only 72% as fast as cattle fed dry-rolled corn and 71% as fast as cattle fed steam-flaked grain sorghum. The trend remained after the 5-day gut fill equalization period, with dry-rolled grain sorghum leading to gains of 80% of those from dry-rolled corn and 83% of those from steam-flaked grain sorghum. Similarly, efficiency of gain was poorest for cattle fed the dry-rolled grain sorghum.

Differences between dry-rolled sorghum and other grains were much larger than expected, based on data from finishing trials. Possibly the rate of passage is not slowed in limit feeding and, in fact, may be increased because limit-fed animals consume their daily allotments of feed in a few hours. This could explain the wider margin between the grains in this study.

Feeding management becomes very critical with steam-flaked grain sorghum diets. Consistent feeding is also more critical with limit-fed rations. When these two are combined, severe problems can occur if feeding time or ration changes. We experienced more pen deaths with the diets containing steam-flaked grain sorghum, although most were explained by poor weather and pen conditions inducing pneumonia. At least one animal fed steam-flaked grain sorghum died from a digestive problem. Whether diet impacted the occurrence of pneumonia is unknown.

We also expected to see benefits from combining slowly fermented dry-rolled grain with processed grain. However, no associative effects were observed, which indicates that some of our ideas of ruminal conditions with limit-fed high grain diets may be incorrect. If passage rate is actually faster for limit-fed than for full-fed cattle, we may not see benefits from grain combinations.

Table 1. Experimental Diets (% of Dry Matter)

	Grain type					
Ingredient	DRC	DRM	SFM	½DRM ½DRC	½SFM ½DRC	½SFM ½DRM
Alfalfa	15.0	15.0	15.0	15.0	15.0	15.0
Dry-rolled corn (DRC)	70.2	—	—	35.1	35.1	—
Dry-rolled grain sorghum (DRM)	—	70.2		35.1	—	35.1
Steam-flaked grain sorghum (SFM)	—	—	70.2	—	35.1	35.1
Soybean meal	8.0	8.0	8.0	8.0	8.0	8.0
Molasses	4.0	4.0	4.0	4.0	4.0	4.0
Urea	0.9	0.9	0.9	0.9	0.9	0.9
Ammonium sulfate	0.2	0.2	0.2	0.2	0.2	0.2
Limestone	0.9	0.9	0.9	0.9	0.9	0.9
Calcium phosphate	0.2	0.2	0.2	0.2	0.2	0.2
Vitamins/minerals[a]	0.6	0.6	0.6	0.6	0.6	0.6

[a] Formulated to add to the diet (dry basis): 1200 IU/lb vitamin A, 10 IU vitamin E, 0.35% salt, 0.05 ppm Co, 10 ppm Cu, 0.6 ppm I, 0.2 ppm Fe, 60 ppm Mn, 0.25 ppm Se, 60 ppm Zn, 30 g/ton monensin, and 10 g/ton tylosin.

Table 2. Effect of Grain Type on Performance of Steers Limit-Fed Grain-Based Diets

	Grain Type						
Item	DRC	DRM	SFM	½DRM ½DRC	½SFM ½DRC	½SFM ½DRM	SEM
Daily gain, lb/day							
0-95 days	2.13[b]	1.53[a]	2.17[b]	1.78	2.23	1.99	0.091
0-100 days	2.36[b]	1.89[a]	2.28[b]	2.01	2.41	2.18	0.097
Feed intake, lb/day							
0-95 days	14.27[a]	14.30[a]	14.60[b]	14.16	14.27	14.42	0.09
0-100 days	14.43[a]	14.43[a]	14.78[b]	14.31	14.42	14.56	0.091
Feed:gain[c]							
0-95 days	6.71[b]	9.35[a]	6.71[b]	7.94	6.37	7.25	
0-100 days	6.10[b]	7.63[a]	6.49[b]	7.14	5.99	6.67	

DRC=dry-rolled corn, DRM=dry-rolled grain sorghum, SFM=steam-flaked grain sorghum. All performance characteristics were calculated with dead animals removed from the analysis. Cattle were fed treatments for 95 days and then switched to a common diet for 5 days to equalize gut fill.
[a,b]Single grain types with different superscripts differ (P<.05). For the characteristics in this table, none of the grain combinations differed significantly from the average of the two grains fed singly.
[c]Statistically analyzed as gain:feed, but the inverse is reported here.