Effect of Various Processing Techniques on Sorghum Utilization

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Story in Brief

Three sorghum processing techniques were compared with dry rolled sorghum in a 136 day feeding trial with finishing heifers. The treatments compared were: 1) dry rolled (DR), 2) steam flaked (SF), 3) high moisture harvested (HMH), and 4) head chop (HC). Forty eight feeder heifers weighing an average of 504 lb were fed once daily on a free choice basis.

Performance and carcass traits were significantly effected by treatment. Those performance traits effected were: 1) average daily gain ($P<.01$), 2) consumption ($P<.01$) and 3) feed efficiency ($P<.01$). Treatment averages for average daily gain were: 2.82, 2.82, 2.54 and 2.28 lb; average daily feed intake (DM basis): 17.20, 14.56, 14.19 and 17.20 lb; and feed/lb of gain: 6.14, 5.19, 5.62 and 7.63 lb on the DR, SF, HMH and HC treatments, respectively. Both consumption and feed efficiency are expressed on a dry matter basis.

The carcass traits showing significant treatment effects were: 1) dressing percent ($P<.01$), 2) conformation ($P<.05$) and 3) percent kidney, heart, and pelvic fat ($P<.05$). The respective treatment averages for DR, SF, HMH, and HC were: 1) dressing percent: 63.48, 63.86, 63.55 and 61.15%; 2) conformation: 11.08, 11.33, 11.83 and 10.92; and 3) percent kidney, heart and pelvic fat: 2.90, 2.29, 2.53, 2.13.

Introduction

Cereal grains commonly comprise up to 80 percent of feedlot finishing rations. The type of cereal grain to be used depends upon price and availability as well as its feeding value. Milo is the major feed grain in the southwest plains feeding area. Although the performance of dry ground milo has been somewhat below some other cereal grains, properly processed milo has the nutrient and energy potential to compete favorably with many other cereal grains. Previous research has shown that some type of processing is necessary to obtain the maximum feeding value from milo. Various processes have been examined, and some have

In cooperation with USDA Agricultural Research Service, Southern Region. Appreciation is extended to Roger Johnson for assistance in statistical analysis of the data.

been shown to consistantly improve various feedlot performance traits. Steam flaking has increased daily gain and feed efficiency over dry rolling. High moisture harvesting has produced equal gains as grinding with a significant increase in feed efficiency. Head chop has been suggested as a means to increase finished beef production per acre.

Although there are reports of increased utilization with various types of processing, there are few, if any, studies comparing different processing techniques. The purpose of this study was to compare four major sorghum processing techniques for finishing cattle.

Materials and Methods

Forty eight Angus, Hereford, and Angus X Hereford feeder heifers averaging 504 lb were selected and given a three week preliminary period to adapt to a 90 percent concentrate ration. Following this period, they were randomly allotted to one of four treatments and then blocked by pen location within two barns. There were four pens per treatment and three animals per pen, making a total of twelve animals per treatment. The processed sorghum treatments were as follows: 1) dry rolled (DR), 2) steam flaked (SF), 3) high moisture harvested (HMH), and head chop (HC).

The ration compositions are shown in Table 1. Sorghum used in the DR and SF treatments was harvested at approximately 14 percent moisture and stored in a conventional grain bin. The SF milo was steamed for 25 minutes at atmospheric pressure prior rolling. Both a SF and DR milo were rolled using an 18 X 24" heavy duty roller with a roller spacing of .003 inch. The high moisture harvested grain was harvested containing approximately 30 percent moisture and stored in an oxygen

Table 1. Ration Composition[1]

	DR	SF	HM	HC
	%	%	%	%
Sorghum	84	84	84	94
Cottonseed hulls	5.0	5.0	5.0	0.0
Alfalfa meal	5.0	5.0	5.0	0.0
Soybean meal	4.2	4.2	4.2	4.0
Urea	0.6	0.6	0.6	0.6
Salt	0.3	0.3	0.3	0.3
Dicalcium phosphate	0.4	0.4	0.4	0.4
Calcium carbonate	0.4	0.4	0.4	0.4
Aurofac-50, mg/kg	123	123	123	150
Vitamin A (30,000 IU/ g), mg/kg	110	110	110	99

[1] Dry matter basis.

limiting silo. Just before feeding it was rolled using the same roller and roller spacing mentioned previously.

The milo HC was harvested using a self propelled field chopper equipped with an adjustable cutter head. The cutter head was raised to cut the milo at a height at which all of the heads could be harvested with a minimum of stubble included. The HC was cut, therefore, at approximately flag leaf height. The harvested HC material was then processed through a hammermill containing a recutter as it was blown into an oxygen limiting silo. It was then fed with no further processing. All rations were fed once daily on a free choice basis to permit availability of feed until the next feeding. The supplements were mixed with the SF, HM and HC grains on a daily basis prior to feeding.

All heifers were initially implanted with 200 mg of testosterone propionate and 20 mg of estradiol benzoate and reimplanted on day 71. Once during this trial, rumen samples were taken from each animal; pH values were taken immediately, and a small sample was kept for VFA analysis.

Initial and final weights were taken full with a 4 percent pencil shrink.

Results and Discussion

The proximate analysis data are given in Table 2 and particle size of each treatment, except head chop, is given in Table 3. The particle size of the head chop ration was not determined due to the roughage content. There was some difference in the particle size of HMH and DR milo, but the SF grain had the largest particle size.

Table 4 contains the feedlot performance data for each treatment. As shown there were significant treatment differences for average daily gain ($P<.05$), feed consumption ($P<.01$) and feed efficiency ($<.01$). The DR and SF treatments produced the same average daily gain (2.82

Table 2. Proximate Analysis

Grain	Dry Matter	Crude Protein[1,2]	Ash[1]	Ether Extract[1]	CHO[1,3]
DR	85.26	10.54	0.97	1.46	87.03
SF	80.59	10.67	0.74	1.39	87.20
HM	67.44	11.95	1.32	2.39	84.34
HC	47.53	11.56	5.58	3.32	79.54

[1] Values expressed on 100% dry matter basis.
[2] 6.25 X percent nitrogen.
[3] 100 — (sum of figures for crude protein, ash and ether extract).

Table 3. Particle Size

Grain[1]	Screen Size[2]						
	4000	2000	1000	500	250	125	Pan
	% retained						
DRM	-0-	3.99	79.07	9.42	2.24	1.29	3.99
SFM	7.59	58.48	21.27	6.33	2.03	1.01	3.29
HMM	-0-	32.45	37.76	9.44	5.90	4.42	10.03

[1] Grains dried to contain 90% dry matter.
[2] Microns.

Table 4. Feedlot Performance and Carcass Merit

	DR	SF	HM	HC
No. heifers	12	12	12	12
Initial live shrunk wt, lb	502	500	503	512
Final live shrunk wt,	886	884	853	822
Daily feed, lb[1/5, 5]	17.20[d]	14.56[e]	14.19[f]	17.20[d]
Daily gain, lb[5]	2.82[d]	2.82[d]	2.54[de]	2.28[e]
Feed/kg gain, lb [1·5]	6.14[a]	5.19[b]	5.62[c]	7.63[d]
Dressing percent[5]	63.48[d]	63.86[d]	63.55[d]	61.15[e]
Conformation[2]	11.08[a]	11.33[ab]	11.83[b]	10.92[c]
Marbling[3]	13.67	12.75	11.92	11.08
Ribeye area, sq. in.	11.81	11.68	11.27	11.23
Fat thickness, in	.80	.86	.96	.76
KHP fat, percent[5]	2.90[d]	2,29[e]	2.35[de]	2.13[e]
Carcass grade[2]	9.00	8.92	9.08	8.75
Cutability, percent[4]	48.94	49.16	48.23	49.90
Abscessed livers	0	4	3	0

[1] Dry matter basis.
[2] U.S.D.A. grade converted to the following numerical designations: 8=avg good, 9=high good, 10=low choice, 11=avg choice, 12=high choice.
[3] Marbling scores: 11=slight, 14=small, 17=modest.
[4] Percent boneless trimmed retail cuts=52.66–5.38 (fat thickness)–0.979 (KHP %) + 0.008 (chilled carcass wt.)
[5] abc: Values with different superscripts differ significantly (P .05).
def: Values with different suprescripts differ significantly (P .05).

lb) both of which were significantly higher than HC 2.28 lb. However, there was no significant difference between the HMH and any of the other three treatments. Average daily feed consumption (DM basis) on the DR (19.17 lb) and HC (19.17) rations were significantly higher than on either the SF (16.22 lb) or the HMH (15.78 lb) treatment. There was a difference ($P<.01$) between the steam flaked and high moisture treatments. Feed efficiencies (feed/unit gain) were: DR, 6.82 lb, SF 7.77 lb, HM, 6.24 lb, and HC, 8.48 lb. Each was significantly different from

each other at the .05 level. At first glance the head chop ration seems to be consistently inferior to the other three rations. However, if its high roughage content is taken into consideration, the performance is very acceptable.

Some carcass characteristics were also significantly effected by treatment; these were: 1) dressing percent ($P<.01$), 2) conformation ($<.05$) and 3) percent kidney, heart, and pelvic fat ($P<.05$). There was no difference in dressing percent between the DR, SF, or HMH treatments (63.48, 63.86, and 63.55 percent, respectively), but each of these was significantly higher ($P<.01$) than the head chop treatment (61.15 percent). Conformation scores were lowest on the HC treatment.

The average percent kidney, heart, and pelvic fat for each of the four treatments were 2.90, 2.29, 2.52 and 2.13 percent on the DR, SF, HMH, and HC, respectively. Treatment differences were observed between DR and SF ($P<.05$), as well as between DR and HC ($P<.01$).

The lower dressing percent and kidney, heart and pelvic fat noted on the HC treatment are a reflection of the lower gains since the days on feed were the same for all treatments. These carcasse differences suggest only that a longer feeding period is required for the higher roughage diet. Logically, the HC treatment would appear to have more utility in a growing program. If it is used in the terminal stages of a finishing program, additional grain should be added to raise the caloric density of the total ration to promote more rapid fattening and a higher carcass grade.
