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Summary

One hundred forty-four steer calves were fed growing diets that contained either 1) 50% ground alfalfa hay (ALF), 2) 25% ground alfalfa hay and 25% ground, ammoniated oat hulls (ALF/GOH), 3) 50% ground, ammoniated oat hulls (GOH) or 4) 50% unground, ammoniated oat hulls (UGOH). Oat hulls were treated with ammonia at 3.3% by weight and enough water to raise the moisture content to approximately 20%. They were allowed to react for 32 days prior to feeding. Daily gains were greater for calves consuming the ammoniated oat hull diets, regardless of form ($P<.10$). Daily gain differences occurred in spite of the fact that dry matter intake was lower for GOH-fed calves than for the others ($P<.10$). As a result, feed efficiency was better for the GOH diet than ALF and ALF/GOH ($P<.10$) but did not differ from UGOH ($P>.10$). Ammoniated oat hulls, whether ground or unground, are a viable substitute for more conventional roughages in feedlot growing diets.

Key Words: Oat hulls, Ammoniation, Growing Diets

Introduction

Oats have been an important crop in South Dakota for many years. Oat hulls are a by-product of oat processing. Previous research at SDSU demonstrated that ammoniated, unground oat hulls have a feed energy value at least 20% greater than that of brome hay in calf growing diets. Unground oat hulls were used in the earlier work because of their larger particle size and decreased dustiness compared to ground hulls. However, ground oat hulls are usually less expensive, in large part due to lower handling and freight costs.

The objective of this study was to determine if, and to what extent, ground, ammoniated oat hulls could replace unground, ammoniated oat hulls in growing calf diets.

Materials and Methods

Ground and unground oat hulls were purchased and treated as in previous work at this facility. Briefly, the oat hulls were mixed in a mixer wagon with enough water to bring the moisture content up to approximately 20% and then piled on bare ground. The piles were covered with 6-mil plastic and sealed around the edges. Plastic tubing under the pile was used to inject anhydrous ammonia (3.3% of the weight of the oat hulls) at two sites in each pile. The oat hulls, ammonia and water were allowed to react for 32 days prior to feeding.

One hundred forty-four steer calves with an average initial weight of 606 lb were vaccinated (IBR, BVD, BRSV, Lepto and 7-way clostridium), dewormed (Ivermectin[3]), implanted (Synovex-S[4]) and ear tagged shortly after arrival at the feedlot. The calves were blocked by source and allotted within block to pens (9 head per pen, 4 pens per treatment) and fed diets containing either 1) 50% ground alfalfa hay (ALF), 2) 25% ground alfalfa hay and 25% ground, ammoniated oat hulls (ALF/GOH), 3) 50% ground, ammoniated oat hulls (GOH) or 4) 50% unground, ammoniated oat hulls (UGOH). The

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balance of the diets consisted of rolled corn, molasses and supplement. Diet compositions are presented in Table 1.

Initial and final weights were taken after overnight removal of feed and water. The calves were fed for 79 days. Pen data were analyzed in a manner appropriate for a randomized complete block design.

Table 1. Test diet compositions (dry matter basis)

Ingredient	Diet			
	ALF	ALF/GOH	GOH	UGOH
	Percent			
Rolled corn	45.04	37.62	29.32	29.32
Molasses	4.00	4.00	4.00	4.00
Alfalfa hay	50.00	25.00		
Unground NH_3 oat hulls				50.00
Ground NH_3 oat hulls		25.00	50.00	
Soybean meal		7.00	14.50	14.50
Limestone		.35	1.00	1.00
Dicalcium phosphate	.30	.35	.35	.35
Trace mineral salt	.50	.50	.50	.50
Premix[a]	.16	.18	.33	.33
Analysis				
Dry matter	84.1	83.4	82.8	80.5
Crude protein	11.3	14.5	16.2	16.1

[a]Provided 190 mg Rumensin and 52,000 IU vitamin A per day.

Results and Discussion

Two injection sites were used for ammonia application in each approximately 20-ton pile. This appeared to be quite effective for the unground oat hulls, as the degree of treatment was fairly even throughout the pile. However, there was considerable variation in the ground oat hulls, apparently due to the fact that they became rather tightly packed as the pile settled which, in turn, could have reduced the distance the ammonia could migrate. Crude protein content of the unground oat hulls was fairly consistent and averaged 12.5% while that of the unground hulls averaged 12.9% but ranged from 6.0% to 17.1%.

The diets were originally formulated to contain 12% crude protein from natural sources (i.e., from feeds rather than ammonia or urea) for the purpose of finding treatment differences that were the result of digestibility and intake rather than crude protein source. Oat hull diets would otherwise not need such high levels of soybean meal. Diet crude protein levels were somewhat lower than 12% due to the lower crude protein of the light test weight corn prevalent at the time of the study (8.4% of dry matter). However, they were still in excess of expected requirements and were assumed to have not affected the results of the study.

Daily gains were almost .3 lb/day greater for calves consuming the ammoniated oat hull diets than those consuming the ground alfalfa hay-based diet, regardless of form of the oat hulls ($P<.10$; Table 2). Daily gain differences occurred in spite of the fact that dry matter intake was lower for GOH-fed calves than for the others ($P<.10$). As a result, feed efficiency was better for the GOH diet than ALF and ALF/GOH ($P<.10$) but did not differ from UGOH ($P>.10$). Based on cattle performance and published values, NE_m and NE_g estimates for the ground and unground ammoniated oat hulls are 73.5 and 47.4 Mcal and 59.7 and 37.0 Mcal/cwt dry matter, respectively. These are in good agreement with previously reported estimates and at least 20% greater than the medium quality alfalfa used in this study (average 17.7% crude protein).

In conclusion, ammoniated oat hulls, whether ground or unground, are a viable substitute for more conventional roughages in feedlot growing diets. However, ammonia application technique may have to be altered for ground oat hulls.

Table 2. Performance data for steers fed growing diets containing either alfalfa hay (ALF), alfalfa and ground, ammoniated oat hulls (ALF/GOH), ground, ammoniated oat hulls (GOH) or unground, ammoniated oat hulls (UGOH)

	Diet				
Item	ALF	ALF/GOH	GOH	UGOH	SE
No. of steers	36	36	36	36	
Initial wt, lb	605	611	602	605	3.4
Final wt, lb	805	832	823	827	7.5
Wt gain, lb/day	2.53[b]	2.80[a]	2.80[a]	2.81[a]	.083
Dry matter intake, lb/day	19.2[a]	20.1[a]	17.5[b]	19.3[a]	.66
Feed:gain	7.59[a]	7.21[a]	6.25[b]	6.88[ab]	.319

[a,b]Means with different superscripts differ ($P<.10$).