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R. H. Pritchard
South Dakota State University

M. A. Robbins
South Dakota State University

GRAIN SOURCES AND ROUGHAGE LEVELS FOR LIMITED FEEDING BACKGROUNDING PROGRAMS

R. H. Pritchard[1] and M. A. Robbins[2]
Department of Animal and Range Sciences

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Summary

The effects of grain source and roughage level in limited intake feeding programs were evaluated in 622-lb steer calves. Supplemented diets were based on high moisture ear corn (HMEC), whole shelled corn (WSC) + hay to provide similar NDF to the HMEC diet, HMEC diet containing 10% hay and the WSC + hay diet formulated to contain NDF similar to HMEC + hay. Steer calves were blocked by weight and fed to achieve 2.2 lb ADG for a 52-day period. Steers fed HMEC had higher ($P<.01$) ADG and lower ($P<.01$) feed/gain than WSC fed steers. Low crude protein in the hay source caused lower ($P<.01$) crude protein in WSC diets. Lower crude protein intake could have limited steer growth. NE utilization appeared more efficient ($P<.05$) for heavy weight block steers, reflecting NRC equation low sensitivity to modest differences in frame size. Roughage level did not affect performance and did not interact with grain source.

(Key Words: Steers, Energy, Protein, Grain, Backgrounding.)

Introduction

Previous work at SDSU and other stations has shown that feeder calves can be effectively backgrounded by limited feeding of high concentrate diets. This system simplifies bunk management, minimizes roughage handling and allows the feeder to dictate growth rate of the calves. During periods of high roughage costs and low grain prices, limited feeding allows the feeder to minimize the cost of energy in the grower phase.

We have evaluated desirable protein and ionophore levels for this type of program. Questions remain about the effects of fermentability of the grain source and whether dietary fiber levels are important in formulations. This experiment was designed to compare high moisture ear corn and whole shelled corn as rapidly and slowly fermented grains in diets with varying NDF content.

Materials and Methods

Steers calves used in this trial arrived at the research feedlot 2 months prior to initiating this study and were used in a receiving management experiment. Steers were sorted into light and heavy weight blocks at the end of the receiving study before allotment to treatments. Two 8-head pens of light weight calves and three 8-head pens of heavy weight calves were assigned to each treatment.

The high moisture ear corn (HMEC) diet (HMEC-LO) was used as the basis for subsequent formulations (Table 1). The lower roughage whole shelled corn (WSC) diet (WSC-LO) included grass hay to achieve the same NDF content of HMEC-LO. These represent low roughage diets. High roughage diets were produced by adding hay to HMEC (HMEC-HI) or WSC (WSC-HI) based diets to increase NDF content to 30%. Diets were formulated to contain similar concentrations of other major nutrients and monensin.

Target ADG was 2.2 lb per day. This value and the projected mean weight for each 14-day period were used to estimate required DMI for that period. Feed deliveries were then held constant for the 14-day period. Deliveries were adjusted every 14 days

[1]Associate Professor.
[2]Manager, Beef Cattle and Sheep Nutrition Unit.

TABLE 1. COMPOSITION OF LIMIT FED DIETS[abc]

Grain source	HMEC		WSC		
Fiber level	Low	High	Low	High	SEM
HMEC, %	84.200	76.041			
WSC, %			69.906	63.980	
Hay, %		9.989	20.333	27.500	
Soybean meal, 44%, %	13.370	12.020	7.967	7.000	
Dicalcium phosphate, %	.270	.250	.250	.268	
Calcium carbonate, %	1.210	1.020	.918	.752	
Potassium chloride, %	.450	.180	.126		
Trace mineralized salt, %	.500	.500	.500	.500	
Dry matter, %	68.0[e]	69.1[f]	85.6[g]	85.4[g]	.32
Crude protein, %	14.64[e]	14.34[e]	12.69[f]	12.28[g]	.139
ADF, %	9.5[e]	12.5f	10.2[g]	12.9[f]	.16
NDF, %	23.9	28.6	20.6	25.2	.58
NE_m, Mcal/cwt[d]	87.7	84.9	89.2	84.5	
NE_g, Mcal/cwt[d]	57.6	54.5	57.4	54.8	

[a] All values except DM on DM basis.
[b] All diets included 30 g/T monensin and 1,000 IU/lb supplemental vitamin A.
[c] All values except NE_m and NE_g determined by laboratory analysis.
[d] Estimated from tabular feed values.
[e,f,g] Means within a row with unlike superscripts differ ($P<.05$).

throughout the 52-day feeding period based on current weight.

Individual body weights were determined prior to feeding. Final body weight was the average of weights taken on days 51 and 52. Feed ingredients were sampled weekly for DM, CP, ADF and NDF content. Steers were fed once daily in the morning. NE values were calculated based on mean steer weights and cumulative average daily gain.

Performance data were analyzed on a pen mean basis by procedures appropriate for a 2 x 2 x 2 factorial arrangement of treatments when grain source and roughage levels and weight block were main effects. When interactions were nonsignificant ($P>.15$) in the overall model, they were deleted from the final analysis of variance. Diet composition means were separated by Duncan's new multiple range test.

Results and Discussion

The heavy weight block steers were expected to require more feed for a similar weight gain than the light weight block steers and were accordingly offered more feed. They would also be expected to have a higher feed/gain requirement than light weight block steers. The heavy weight block steers actually had a higher ADG ($P<.05$) and feed intake ($P<.001$) but similar feed/gain as the light weight block steers (Table 2). Accordingly, calculated NE of the diets was higher ($P<.05$) in the heavy weight block steers.

TABLE 2. EFFECT OF WEIGHT BLOCK ON THE FEEDLOT PERFORMANCE OF LIMIT FED STEERS

	Weight block		
	Light	Heavy	SEM
Initial wt[a]	576	653	1.4
Final wt[a]	723	808	2.5
ADG[b]	2.81	2.99	.055
DMI[a]	13.37	14.36	.030
Feed/gain	4.77	4.86	.113
Calculated			
NE_m[c]	106.2	115.5	2.09
NE_g[b]	68.2	71.5	.97

[a] Weight block effect ($P<.001$).
[b] Weight block effect ($P<.05$).
[c] Weight block effect ($P<.01$).

These steers had been managed together for several weeks prior to starting this experiment. Differences in weight groups reflected differences in frame size more than differences in condition. While the heavy weight block steers would still be considered medium framed by NRC standards, the energy utilization data would be consistent with larger frame sizes. These data emphasize the lack of sensitivity of NRC equations to frame size when projecting growth rates in limited feeding programs.

During the course of this experiment, the crude protein content of hay declined. This resulted in lower ($P<.01$) crude protein for the whole shelled corn based diets (Table 1). To achieve the targeted 2.2 lb ADG, the dietary CP indicated by NRC is 12%. This value would increase to 13% CP for 3.0 lb ADG. Previous research here has indicated low dietary protein will result in reduced ADG. This probably contributed to the lower ($P<.05$) ADG on the whole shelled corn diets (Table 3). Ear corn can vary substantially in energy content as grain:cob ratios change. Tabular values may have underestimated the caloric value of the HMEC used in this study, further contributing to the ADG response differences.

Fiber level tested did not affect feedlot performance and no interactions existed between fiber level and grain source. There was no apparent advantage to including higher dietary roughage levels in this management system. Including 7 to 10% hay did not reduce calculated NE values for the diets.

The calculated NE values for these diets are considerably higher than values estimated from tabular feed values. This has been observed in several studies here and at other stations. The limited feeding program apparently increases the efficiency of energy utilization by cattle. Beneficial changes in ruminal fermentation characteristics and/or site and extent of starch digestion may be occurring. Practical application may require increasing the estimate of NE_m and NE_g of diets by 30% and 25%, respectively.

The limited feeding of high concentrate diets is not restricted to specific grain and roughage sources. Dietary crude protein and an accurate assessment of frame size are critical factors for meeting projected rates of gain.

TABLE 3. EFFECT OF DIET ON THE FEEDLOT PERFORMANCE OF LIMIT FED STEERS

Grain source	HMEC		WSC		
Fiber level	Low	High	Low	High	SEM
Initial wt	621	625	621	622	1.8
Final wt[a]	783	788	761	764	3.2
ADG[a]	3.11	3.13	2.69	2.73	.069
DMI[abc]	13.57	14.17	13.89	14.22	.037
Feed/gain[a]	4.36	4.54	5.18	5.22	.142
Calculated					
NE_m, Mcal/cwt[a]	123.8	118.0	103.0	101.9	2.64
NE_g, Mcal/cwt[a]	74.8	72.9	66.8	66.2	1.22

[a] Grain source effect ($P<.01$).
[b] Fiber level effect ($P<.01$).
[c] Grain source x fiber level ($P<.01$).