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Drew Shain

University of Nebraska-Lincoln

Rick Stock

University of Nebraska-Lincoln, rstock3@unl.edu

Terry J. Klopfenstein

University of Nebraska-Lincoln, tklopfenstein1@unl.edu

Mark Klemesrud

University of Nebraska-Lincoln

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Roughage Source and Particle Size in Finishing Diets

Drew Shain
Rick Stock
Terry Klopfenstein
Mark Klemesrud¹

Summary

Two hundred twenty-four crossbred yearling steers were used to evaluate the effect of roughage source and particle size in finishing diets. Treatments consisted of an all-concentrate diet or diets containing equal levels of NDF provided by alfalfa hay or wheat straw with each roughage source ground to pass through a 3/8", 3", or 5" screen. Cattle fed the all-concentrate diet consumed less feed, gained slower, but were similar in efficiency to cattle fed diets containing roughage. Cattle fed diets containing alfalfa hay gained 7.7% faster and 7.7% more efficiently than cattle fed diets containing straw. As roughage particle size increased, daily gain tended to decrease and feed conversion tended to increase with no differences in dry matter intake. Roughage sources used in high grain finishing diets may not respond similarly when used at equal NDF levels. Decreasing roughage particle size may enhance performance.

Introduction

When compared to an all concentrate diet, roughage addition (5 to 15% of diet DM) stimulates intake, chewing, rumination and possibly particulate and liquid outflow from the rumen. Roughage addition, therefore, reduces acidosis by diluting concentrate intake and/or increasing salivation and buffering capacity of the rumen.

Alfalfa hay is a commonly fed roughage source. If the use of the fiber fraction within alfalfa roughage is to simply dilute concentrate intake and help prevent acidosis, then any fiber source fed

at a similar NDF level should respond similarly to alfalfa hay.

Particle size plays a major role in determining ruminal retention time. The smaller the particle size the faster the passage rate from the rumen. If roughage added to a finishing diet consists of small particles, then the dilution effect desired from roughage addition to finishing diets may be negligible. However, if roughage particle size is too large, total intake and energy consumed may decrease due to an increase in ruminal retention. Objectives of our research were to evaluate the effect of alfalfa hay and wheat straw with differing particle sizes on performance of steers fed a high-concentrate finishing diet.

Procedure

Two hundred twenty-four crossbred yearling steers (744 lb) were blocked by weight and randomly allotted within block to one of seven treatments. Treatments consisted of an all-concentrate diet or diets containing alfalfa hay or wheat straw ground to pass through a 3/8-, 3-, or 5-inch screen. All diets were balanced to contain 12% crude protein, .7% calcium, .35% phosphorous, .7% potassium, 25 g/ton Rumensin, and 10 g/ton Tylan. Diets containing roughage were balanced to provide equal NDF levels and contained (DM basis) 10% alfalfa hay (42.8% NDF) or 5.2% wheat straw (82.0% NDF). Calculated NE_g contents of the all concentrate, alfalfa and straw diets was .67, .63, and .64 Mcal/lb, respectively. All diets contained dry rolled corn as the concentrate source and urea as the source of supplemental protein, with 5% molasses and 5% supplement included in all treatments.

All cattle received common adaptation diets while adapting to their final treatment diets. Dietary treatments were implemented following a 27-day, five-

step grain adaptation period. Cattle received the final diet for an average of 76 days and were fed once daily. Cattle were implanted with Compudose at the start of the trial and then implanted with Finaplex on day 28. The trial was conducted from August 23 to December 16, 1994.

Initial weights were the average of two weights taken on consecutive days before feeding. Hot carcass weight adjusted for 62% dressing percentage was used to estimate final live weight. Hot carcass weight, 12th rib fat thickness, liver score, quality and yield grade were recorded. Data were analyzed as a randomized complete block design with treatment and replication included in the model. Orthogonal contrasts were used to analyze treatment effects of roughage type and particle size.

Results

Cattle receiving alfalfa or straw diets consumed more feed ($P<.05$) and gained faster ($P<.05$) than cattle receiving the all-concentrate diet (Table 1). No difference in feed efficiency was noted when comparing cattle receiving alfalfa, straw, or all-concentrate diets. Cattle fed the alfalfa or straw diets had heavier hot carcass weights ($P<.10$) and greater 12th rib fat thickness ($P<.05$) than cattle fed the all-concentrate diet. No differences were noted in quality grade or yield grade among treatments.

No differences were noted in dry matter intake between cattle receiving alfalfa or straw in the finishing diet. However, cattle fed alfalfa finishing diets gained faster ($P<.05$), were more efficient ($P<.05$), and had greater 12th rib fat thickness ($P<.10$) than cattle fed the straw diets (Table 1). Although diets containing roughage were balanced to provide equal levels of forage NDF, it appears that NDF content may not act similarly between alfalfa and wheat straw when fed as a roughage

Table 1. Effect of roughage type and particle size on finishing performance.

Roughage Source:		Alfalfa			Wheat Straw		
Screen size:		3/8 in	3 in	5 in	3/8 in	3 in	5 in
Item	All Concentrate						
Dry matter intake, lb/day ^a	23.00	25.45	26.08	25.13	26.00	25.93	25.18
Daily gain, lb ^{ab}	3.36	3.92	3.81	3.74	3.58	3.63	3.44
Feed/gain ^{bc}	6.86	6.50	6.84	6.72	7.27	7.14	7.32
Carcass Characteristics							
Hot carcass weight, lb ^{bd}	679	715	708	704	694	698	682
Fat thickness, in ^{ae}	.28	.36	.37	.32	.32	.30	.33
% Choice	56.3	56.3	59.4	43.7	50.0	40.6	40.6

^aAll-concentrate vs other treatments, P<.05.

^bAlfalfa vs straw, P<.05.

^cFeed/gain was analyzed as gain/feed. Feed/gain is reciprocal of gain/feed.

^dAll-concentrate vs other treatments, P<.10.

^eAlfalfa vs straw, P<.10.

source for dry rolled corn finishing diets.

No particle size by roughage source interaction was observed. Therefore, further discussion of results will examine differences among particle sizes of the alfalfa and straw treatment groups.

Current theory for the addition of roughage to a high-grain finishing diet is to provide a “scratch factor” that may stimulate rumination, increase salivation and thereby reduce the severity of

acidosis. However, cattle receiving either straw or alfalfa ground through a 5-inch screen had numerically lower daily gains and higher feed conversions. In contrast, cattle receiving the 3/8-inch grind alfalfa diet gained 8% faster than the fastest gaining straw treatment and were 9% more efficient than the most efficient straw treatment.

Results from this study indicate that the addition of roughage to a high-grain finishing diet increased feed intake and

daily gain by diluting energy concentration of the diet and reducing subacute acidosis. However, feed efficiency was not improved by roughage addition. Furthermore, it appears that different roughage sources used in a high-grain finishing diet may not respond similarly.

¹Drew Shain, Mark Klemesrud, research technicians, Rick Stock, Terry Klopfenstein, Professors, Animal Science, Lincoln,

Effect of Energy Source and Escape Protein on Receiving and Finishing Performance and Health of Calves

Rob McCoy
Rick Stock
Terry Klopfenstein
Mark Klemesrud
Gene White¹

Summary

One receiving trial and one finishing trial evaluated the effect of energy source and protein supplement on performance and health of large-frame calves. In the receiving trial, diets were comprised (DM basis) of 45% alfalfa hay, and either 55% dry rolled corn, molasses, and supplement or 55%

wet corn gluten feed and supplement. Diets contained a supplement without or with escape protein. Calves fed wet corn gluten feed consumed less dry matter, had a lower metabolizable protein supply, were more efficient, but gained similarly to calves fed dry rolled corn. Calves supplemented with escape protein had a greater metabolizable protein supply than calves not supplemented with escape protein. Health was not affected by dietary treatment. In the finishing trial, energy sources included dry rolled corn, dry rolled corn/wet corn gluten feed, high moisture corn, high moisture corn/wet corn gluten feed, and dry

rolled corn/high moisture corn. Diets contained a supplement without or with escape protein. An energy source × protein supplement interaction was observed for daily gain and feed/gain. Results suggest wet corn gluten feed, fed in combination with dry rolled corn or high moisture corn, has an energy value similar to those grains fed individually.

Introduction

Large-frame calves are well suited to a production system in which finishing begins shortly after weaning.

(Continued on next page)