Effects of Barley Processing for Backgrounding Diets on Performance in Beef Steers

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The objectives of this study were to evaluate the effect of increased degree of barley processing and mixing barley particle sizes and how this affects performance of beef steers fed a 50% roughage diet. Feed efficiency was increased with fine processing of barley. Mixing barley of different particle sizes was not advantageous.

Introduction

North Dakota leads the United States in barley production (NDASS, 2003). Feeding whole barley results in poor animal performance due to low digestibility and increased incidence of bloat (Mathison, 1996). The extent of barley processing for optimal performance in backgrounding cattle diets has not been researched extensively. Reed, et al. (2004) reported an improvement in steer performance with finer processing of sprout-damaged barley in backgrounding diets. Bengochea, et al. (2005) indicated that finer processing of sound (nonsprout-damaged) barley in growing diets increased steer performance.

In high-grain finishing diets, starch digestibility increased linearly with increased degree of processing using temper-rolled barley (Beauchemin, et al., 2001). When diets are adequate in effective fiber, Koenig, et al. (2003) suggested barley grain can be more extensively rolled. The objectives of this study were to evaluate 1) the effects of increased degree of barley processing, resulting in decreased particle size, and 2) mixing barley particle sizes on performance of beef steers fed a 50% roughage diet.

Procedure

One hundred forty-three crossbred beef steers (609 ± 42 lbs. initial BW) were used in a randomized complete block design to evaluate the degree of processing (particle size) barley in backgrounding diets. Steers originated from south-central North Dakota and were shipped approximately 150 miles, where they were housed at the North Dakota State University Animal Research Center in concrete-floored pens with access to a barn. Steers were fed in concrete fenceline bunks and had ad libitum access to water.

During the receiving period, all steers received common transition diets of hay, silage, supplement and de-sugared molasses. A booster vaccination against bovine rhinotracheitis virus diarrhea, parainfluenza3, respiratory syncitial virus and Haemophilus somnus was administered. Steers were treated with Dectomax (Pfizer, Exton, Pa.) for control of internal and external parasites, dehorned if needed, and ear tagged. Steers were stratified by weight and allotted randomly to one of four dietary treatments (six pens/treatment).

Target particle sizes were 2,700 micrometers for coarsely-rolled barley, 2,000 micrometers for medium-rolled barley, 1,300 micrometers for finely-rolled barley and 2,000 micrometers for the mixed barley, which was produced by mixing finely-and coarsely-rolled barley to assimilate medium barley. Diets contained (DM basis) 41.8% barley, 35% pressed beet pulp, 15% grass/alfalfa hay, five percent de-sugared molasses and 3.2 percent supplement. Diets were formulated to contain a minimum of 12.5

percent CP, 0.6 percent Ca, 0.3 percent P, 0.6 percent K and 25 grams/ton of Rumensin (Elanco, Greenfield, Ind.).

Steers were implanted with Synovex S (Fort Dodge Animal Health, Fort Dodge, Iowa) on day 66. Initial and final weights were an average of two-day consecutive weights. Steers were fed for 93 days. Feed offered was adjusted daily, based on bunk reading prior to feeding. Orts were weighed weekly and dietary ingredient samples were composited and subsampled for analysis of particle size and lab analysis. Barley was sampled and composited weekly for density and particle size analysis. Particle size was analyzed following the procedure of ASAE (1993) using a sieve shaker (Ro-Tap W. S. Tyler, Mentor, Ohio).

Results and Discussion

The effects of barley processing for beef steers fed backgrounding diets are shown in Table 1. No differences were found among treatments for final weight (P = 0.51) or average daily gain (P = 0.43). This is similar to results from Bengochea, et al. (2004), who reported similar performance for steers fed barley processed to either 1,390-micrometer particle size or 2,130-micrometer particle size. However, this is in contrast to Reed, et al. (2005), who reported an increase in ADG with increased degree of processing. Reed, et al. (2005) fed dry-rolled barley with a particle size of either 2,630 micrometers or 2,000 micrometers. Dry matter intake was greatest (P < 0.01) for steers fed the coarse and mixed barley, and least for the fine barley, with the medium barley not different than the fine, coarse or mixed barleys.

Table 1. Effect of processing barley for beef steers fed backgrounding diets.

	Treatment					
Item	Coarse	Medium	Fine	Mixed	St Error	P Value
Final weight, lbs.	862	876	878	871	42	0.51
Daily gain, lbs.	2.68	2.84	2.86	2.77	0.07	0.43
DMI, lbs./day	22.5^{y}	21.7^{xy}	21.0^{x}	22.4^{y}	0.8	0.01
Gain:Feed, lbs./cwt	12.0^{x}	13.1^{yz}	13.6^{z}	12.4^{xy}	0.5	0.01
Feed:Gain	8.33	7.64	7.35	8.06	--	--
Dietary NEm, Mcal/cwt	67.3^{x}	71.4^{y}	73.2^{y}	68.6^{x}	0.9	<0.001
Dietary NEg, Mcal/cwt	40.0^{x}	44.1^{y}	45.9^{y}	41.4^{x}	0.9	<0.001

^{x,y,z}Within a row means lacking a common superscript letter differ (P < 0.05).

Previous research in our laboratory (Reed, et al., 2005; Bengochea, et al., 2004) indicated similar intakes among treatments. The fine and medium treatments had the greatest (P < 0.01) feed efficiency (ADG/DMI). The mixed treatment was intermediate, while the coarse treatment had the poorest feed efficiency. Reed, et al. (2005) and Bengochea, et al. (2004) reported increased feed efficiency with decreased particle size.

In the present experiment, the fine treatment had a 13% improvement in gain efficiency above the coarse treatment and a nine percent improvement in gain efficiency from the medium to the coarse treatment. Apparent dietary NEm and NEg were greater for the fine and medium treatments, compared with the coarse-rolled and mixed barley.

Bengochea, et al. (2004) reported increased dietary NEm and NEg with increased degree of processing. Increasing the degree of processing to medium and fine levels improved gain efficiency above the coarse treatment, and no benefit was found to mixing barley of different particle sizes.

Implications

Medium and fine processing improved gain efficiency of backgrounding steers. This study indicates that barley can be processed to a medium or finer degree, compared with a coarse degree, to improve gain efficiency. Further research is needed to determine optimum particle size and how it interacts with roughage level and CP level in backgrounding diets.

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