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Effect of Grain Prep® Processing Aid on Processing and Utilization of Barley by Beef Cattle

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Introduction:

Barley is the predominant feed grain used for commercial cattle feeding in Western Canada and the Northwestern United States. Compared to other feed grains there is little data available to guide feed mill operators in its processing for feedlot cattle rations.

This study was undertaken to address three basic questions arising in the processing of barley for beef cattle rations:

1. What effect does particle size have on animal performance in the feedlot?
2. What role does moisture play in processing and digestion of barley?
3. Does the addition of Grain Prep Processing Aid provide a benefit over water alone in conditioning grain for processing?

Experimental Procedure:

1. Perform laboratory scale processing trials to evaluate the effect of Grain Prep Processing Aid on cold processed barley.
2. Perform *In Vivo* digestion studies of rations prepared from barley processed having moisture contents of 8% (as received), 10%, 12%, 14%, 16%, 18%, 20%, and 22%. Multiple levels of Grain Prep Processing Aid were also evaluated; 0, 60. 120, 240, 480, and 960 ppm of the grain dry matter. Incubation periods were 2, 4, 6, 8, 12, 18, 24 and 48 hours.
3. Data from the *In Vivo* digestion studies were used to select the grain processing to be used in a feedlot cattle study. The feeding study was a 2 X 3 factorial design with 2 roller settings (shown to be optimum for dry and tempered barley respectively), and three moisture treatments; untreated (D), tempered with water only (W), and tempered with a water-Grain Prep Processing Aid solution (GP). The moisture contents were 9%, 20% and 20% respectively.

   One hundred thirty eight British-cross newly weaned steers were randomly allocated to the six treatments. The average weight was 324 kg (St. Dev. = 20 kg). They were individually penned and fed which provided 23 replications for each grain treatment.

Results and Discussion:

1. A processing index (PI) was used to describe the degree of processing achieved by rolling the grain. The PI was defined to be the ratio of the bulk density of the rolled grain to the bulk density of the unprocessed grain. This ratio provides a simple method to monitor processing of grain having normal variations in kernel sizes.

   Tempered barley was softer and required tighter roll settings than did dry barley (2.032 mm vs. 2.413 mm) to achieve equivalent PIs.

   The addition of Grain Prep Processing Aid hastened moisture absorption over the first 2 hours, but had no major effect on particle size or size distribution of the rolled barley.

2. The highest effective degradability (%) occurred in the ration containing barley tempered to 20% moisture content with a water-Grain Prep Processing Aid solution and having a PI of 0.7. Following is a summary of these data:

Grain Tempering	% Degraded	Ave.	SE	GP	W	GP X W
Water (W)	44.7[a]	51.0[a]	0.82	L*	NS	***
Grain Prep (GP)	59.4[b]	55.8[b]	0.97			

   L = linear effect of Grain Prep
   [a,b] Effect of Grain Prep; Means in a column with different superscripts differ (P<0.05)
   * (P<0.1), *** (P<0.001)

The "Ave" column shows the average degradability for all treatments in the study, while the "% Degraded" column is only the 20% moisture barley data.

If the processing index (PI) varied by more than about ±0.1 from 0.7, digestion was significantly affected. Above 0.7, the grain was under processed and below 0.7, too many fine particles were being produced.

3. The feeding trial clearly demonstrated the importance of precisely controlling grain processing in feed manufacturing. Following is a summary of the data generated:

Tempering Process	Dry	Water	Grain Prep	SEM
Dry Matter Intake (kg/hd/day)	7.69[a]	7.60[a]	7.85[ab]	0.04
ADG (kg/hd/day)	0.97[a]	1.06[b]	1.13[b]	0.04
Feed Efficiency (F/G)	8.22[c]	7.41[b]	6.93[a]	0.16
Warm Carcass (kg)	305[a]	313[ab]	330[c]	6.04
Fat (mm)	13[f]	14[g]	12[e]	1.18
Rib Eye (cm^2)	78[b]	75[ab]	83[c]	2.13

[a,b,c,d] Numbers in a row having different superscripts differ (P<0.05)
[e,f,g] Numbers in a row having different superscripts differ (P<0.06)

4. Following are the Canadian carcass grades:

	Tempering Process Used		
Beef Quality Grade	Dry	Water	Grain Prep
AAAA		1	1
AAA	12	14	8
AA	10	8	14
A	1		
Average	2.5	2.7	2.4
(A=1, AA=2, AAA=3, & AAAA=4)			
Yield Class			
A3	3	6	
A2	15	15	14
A1	5	2	9
Average	A1.9[b]	A2.2[c]	A1.6[a]

[a,b,c] Averages in a row with different superscripts differ (P < 0.005)

5. Definitions of Grading System

Beef Quality Grade	Definition
AAAA	Large Marbling
AAA	Small Marbling
AA	Slight Marbling
A	Trace Marbling
Yield Classes	
A1	Greater than 59% Lean
A2	between 54 and 58% lean
A3	53% or less lean