

Evaluation of a Pelleted Barley Product for Growing and Finishing Cattle

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Introduction:

Barley grain is favored in Canada as a cereal grain for several reasons. Most importantly it provides cattle with a relatively inexpensive source of energy and protein. Cattle fed barley are widely known to produce a carcass that has excellent eating quality, including a hard, white fat content. Canadian and international consumers find the meat to be very tender and appealing. The fact that barley is a non-GMO grain is also very important to consumers around the world.

Barley grain needs to be processed prior to feeding to cattle. In particular, the outer husk needs to be broken in order for the animal to utilize it properly. Most Canadian feedlots feed barley as a rolled product. When feeding the product, Canadian feedlot managers are careful as to how they feed the grain in order to minimize digestive upsets. As such, nutritional management is important with respect to feeding barley to cattle.

If Japanese cattle producers are going to take advantage of the non-GMO status of barley and its excellent feeding and carcass qualities in barley fed cattle, then Japan will need to import Canadian barley. From a practical and economic perspective, it is advantageous to import a processed product such as a pelleted barley product with a protein supplement such as canola meal added, to enhance its protein content. Pelleted barley grain, however requires more care when feeding in order to prevent digestive disturbances. It is for this reason that there has not been a great deal of research conducted with finishing cattle fed pelleted barley as the sole grain source. Pelleted barley has been fed to lactating dairy cows. The result has been a reduced milk fat test due to higher levels of propionic relative to acetic acid produced in the rumen. In finishing beef cattle this has the potential to be an advantage promoting both superior growth and carcass quality.

There is a need to demonstrate to international barley customers the feeding management of pelleted barley rations and the performance and carcass quality of the cattle fed these diets.

Objectives:

To evaluate the backgrounding and finishing performance and carcass quality of cattle fed a pelleted barley, canola meal pellet in combination with barley silage relative to cattle fed a total mixed diet based on rolled barley, canola meal and barley silage.

Materials and Methods:

Backgrounding Phase:

Three hundred and forty eight recently weaned calves (323 kg) were supplied by Pound-Maker Agventures of Lanigan, Saskatchewan and fed at the University of Saskatchewan Beef Cattle Research Station. The cattle were randomly assigned to one of 12 pens (29 head per pen). The pens were randomly assigned to one of two backgrounding treatments. These include a total mixed ration with barley silage as the forage and:

- a. Treatment 1: Pelleted barley/canola meal mixture
- b. Treatment 2: Rolled barley / canola meal mixture

The ratio of barley to canola meal in the pellet during this phase was 85:15. The same ratio was used for the cattle fed the rolled barley ration. The composition of the 2 diets is given in Table 1. Diets were formulated to the same energy (1.55 and 0.95 Mcal / kg DM of NEm and NEg, respectively) and protein (13% CP) content. Mineral, vitamin, rumensin and tylan levels were equal across treatments. Cattle were implanted upon arrival with an estrogen-based implant (Synovex-S). During this phase, the goal of the feeding program was to target a daily gain of 0.9 to 1.0 kg per day for approximately 135 days or until the cattle reached 385 kg. Data collected included animal weights every 3 weeks, daily pen feed intake values and feed efficiency (feed:gain ratio) and ultrasound measurements of fat and loin muscle.

Finishing Phase:

Following completion of the backgrounding phase, the cattle were maintained on their original treatments and in the same pens and moved onto a finishing program. At this point the cattle were re-implanted with the same implant. The animals were assigned to one of two finishing diets (Table2). The diets were formulated to contain the same energy (minimum 1.95 and 1.30 Mcal NEm and NEg per kg DM, respectively) and protein content (minimum 12% CP). Treatments included:

- a. Treatment 1: Pelleted barley / canola meal mixture
- b. Treatment 2: Rolled barley / canola meal mixture

The ratio of barley to canola meal in the pellet during the finishing phase was 94:6. The same ratio was used for the cattle fed the rolled barley ration. As well mineral, vitamin, rumensin and tylan levels will be equal across treatments.

The target of the finishing phase is to have the cattle gain as fast as possible targeting a slaughter weight of 640 kg or 12 mm of backfat as measured by ultrasound, which ever is arrived at first. Performance data collected included animal weights every 3 weeks, daily pen feed intake values and feed efficiency (kg feed dry matter per kg gain). At slaughter, liver abscesses scores and carcass data (carcass weight, ribeye area, fat thickness and marbling score) were collected by Federal Graders. Detailed carcass analysis (percentage rib fat, lean and bone, ribeye and fat color, hardness and marbling fat content) was carried out on 14 head of each treatment. Animal health data was also collected.

Results and Discussion:

The ingredient composition of the experimental diets is given in Table 1. Diets in both the backgrounding and finishing periods are typical of what would be fed to growing and finishing cattle in western Canada. It should be noted that cattle fed both forms of barley gained at very high rates (1.8 to 2.0 kg per day during finishing), highlighting the value of barley as a feed for growing and finishing cattle. Cattle fed the pelleted barley product consumed less feed during each phase of the trial (Table 2). Over the entire trial, this difference amounted to 1.16 kg less feed dry matter per day consumed by the cattle fed the pelleted barley. Average daily gain was similar for both treatments during the backgrounding period but higher for cattle fed the rolled barley treatment during the finishing phase (Table 2). The efficiency of feed utilization (kg feed per kg gain) was, however, superior for cattle fed the pelleted barley treatment (Table 2). Due to the slightly reduced gain, the cattle fed the pelleted barley required 10 days longer to finish. Cattle fed the pelleted barley, canola meal combination had similar carcass weights and carcass quality characteristics as cattle fed the rolled barley treatment (Table 3). Overall the results show that cattle fed the pelleted barley treatment performed extremely well with finishing daily gains of 1.8 kg per day. The slightly lower gains of the cattle fed the pelleted barley ration relative to those fed the rolled barley can be explained by the lower dry matter intake of the cattle fed the pelleted barley. During the backgrounding period, particularly over days 8 through 40 of the trial, cattle fed the pelleted barley treatment exhibited greater variation in feed intake. This may indicate more stress on the cattle fed the pelleted barley in adapting to the diet. This would explain the lower dry matter intakes of these cattle during this period. This variation was not as evident in the finishing period, indicating the cattle adapted to the barley pellet the longer they were on feed. These results however, show the need for proper feeding management when feeding cereal grains such as barley, wheat or corn to cattle.

The fact that feed efficiency was superior for cattle fed the pelleted barley indicates superior digestibility and metabolism of the barley pellet relative to rolled barley. The cattle received more digestible nutrients from the pelleted barley than from the rolled barley. Carcass quality was excellent for both groups with no differences between treatments other than slightly higher average fat thickness over the *l.dorsi* (ribeye) muscle for cattle fed the rolled barley (Table 3). Carcasses met Canadian yield and quality grade standards. Carcass fat was a firm white fat as desired by Canadian and Japanese consumers.

Conclusions:

The results of this trial show that cattle fed the processed barley, canola meal pellet exhibited slightly lower feed intake and gains relative to cattle fed rolled barley. Slightly lower intakes of the cattle fed the barley pellet may be related to increased daily variability in pen feed intake, possibly due to problems adapting to the readily available starch in the pellet. This indicates the need for proper feeding management. Cattle fed the pelleted barley ration however, adapted and exhibited superior feed efficiency over the trial relative to the cattle fed rolled barley. Carcass quality was similar between treatments and met Canadian quality and yield grade standards. Overall the cattle fed

both forms of barley in this trial gained at superior levels (i.e. 1.8 to 2.0 kg per day) with the most efficient gains from cattle fed the pelleted barley ration.

Table 1: Ingredient Composition of Diets Fed During Backgrounding and Finishing Phase

Ingredients (% As Fed)	Treatment	
	Pelleted Barley	Rolled Barley
<u>Backgrounding</u>		
Barley Straw	3.0	3.0
Barley Silage	42.0	42.0
Rolled Barley Grain	-	25.5
Canola Meal	-	4.5
Pelleted Barley / Canola Meal *	30.0	-
Grass Hay	21.5	21.5
Supplement	3.5	3.5
<u>Finishing</u>		
Barley Silage	20.0	20.0
Rolled Barley Grain	-	70.5
Canola Meal	-	4.5
Pelleted Barley / Canola Meal **	75.0	-
Supplement	5.0	5.0
* Barley: Canola Meal Ratio	85:15	
** Barley: Canola Meal Ratio	94:6	

Table 2: Performance Of Cattle Fed Barley-Based Rations*

Parameter	Pelleted Barley	Rolled Barley	SEM **
Weight(kg)			
Start	323.4	323.3	0.24
Mid-Point	413.7	409.9	2.50
Finishing	643.7	642.6	2.81
Feed Intake (kg/day)			
Backgrounding	8.02a	8.25b	0.05
Finishing	10.99a	12.45b	0.10
Overall	10.23a	11.39b	0.08
Feed Efficiency (kg Feed:kg Gain)			
Backgrounding	6.24c	6.69d	0.16
Finishing	6.03a	6.21b	0.04
Overall	6.27a	6.64b	0.05
Days On Feed	196a	186b	2.24
Average Daily Gain (kg/day)			
Backgrounding	1.29	1.24	0.03
Finishing	1.80a	2.00b	0.02
Overall	1.60a	1.70b	0.01

* a,b : Means with different letters differ significantly (P<0.05)
c,d: Means with different letters differ (P<0.10)

**SEM = Standard Error of the Mean

Table 3: Carcass Characteristics of Cattle Fed Barley - Based Diets

Parameter	Pelleted Barley	Rolled Barley	SEM*****
Carcass Weight (kg)	372.3	368.7	2.44
Dressing Percentage (%)	59.6	59.3	0.21
Lean Meat Yield (%)*	60.8	60.1	0.22
L. dorsi (ribeye) area (cm ²)	93.1	92.5	1.12
Fat Thickness (mm)	10.7a	11.2b	0.15
Marbling Score **	7.7	7.7	0.03
Carcass Composition (%)			
Lean	57.7	57.5	0.54
Fat	25.2	25.3	0.57
Bone	17.1	17.2	0.25
Fat Distribution (%)			
Subcutaneous	30.8	28.4	0.88
Between- muscle	57.4a	60.0b	0.79
Body Cavity	11.9	11.7	0.45
Liver Abscess Score ***	0.5	0.2	0.12

a, b: Means with different letters differ (P<0.05)

* Estimated from ultrasound

**Marbling Score (Range 1 to 10);

*** Liver Abscess Score: 0 = No abscesses; 3 = severe and / or multiple abscesses.

*****SEM = Standard Error of the Mean