Western Beef Development Centre
Division of PAMI

Effects of Supplementing Beef Cows Grazing Crop Residue with Dried Distillers' Grains

By: Amanda Van De Kerckhove, Dept. of Animal & Poultry Science and
Dr. Bart Lardner, Western Beef Development Centre

Introduction

Efforts to lower feeding costs have led to increased use of low quality forages in beef cow diets. These types of forages, which are characterized by high fibre and low protein content, require supplementation in order to meet cow requirements, especially during the second and third trimester of pregnancy (McCartney et al. 2006). With expansion in the North American ethanol industry, there is an increasing supply of the distiller's co-products. Dried distillers' grains with solubles (DDGS), the most common co-product, has potential as a supplement for beef cows consuming low quality forages. DDGS are nutritionally dense and high in crude protein. DDGS are also considered high in energy due to their highly digestible fibre and high fat content, particularly in corn DDGS (Schingoethe 2006). The near absence of starch may eliminate the incidence of subacute ruminal acidosis, thus feeding DDGS has little to no negative associated effects (Larson et al. 1993). There are some concerns when feeding DDGS, as the high levels of crude protein and available phosphorus pose the risk of increased nitrogen and phosphorus excretion if DDG's are fed in excess. Additionally, the high sulfur content of DDGS may increase the risk of polioencephalomalacia if sulfur from other feed or water sources is not considered when formulating rations (Walker 2003).

Objectives

This study evaluated DDGS as a supplement for beef cows grazing barley straw-chaff piles in the field. The objectives of this study were to (1) determine the effects of supplementation on beef cow performance; and (2) evaluate grazing costs for cows supplemented with DDGS, rolled barley, or 50% DDGS and 50% rolled barley.

Study Site Description

A two-year study was conducted at the Western Beef Development Centre's Termuende Research Ranch located at Lanigan, SK during 2007 and 2008. Forty-eight dry pregnant Black Angus cows (BW = 1400 ± 33 lbs; BCS = 2.6 ± .31 units) extensively field grazed barley straw-chaff piles from November 17, 2007 to January 2, 2008.

Trial Management

The cows were randomly allocated using body weight and days pregnant to maintain homogeneity within replicate groups. The standard system used by the ranch, managing dry cows on crop residue, served as control and included access to barley straw-chaff piles. The treatment groups were supplemented with either (i) 100% dried distillers' grains with solubles (DDGS), (ii) 50% DDGS:50% rolled barley (50:50), or (iii) 100% rolled barley grain - control or industry standard (CON). Straw-chaff and supplement samples were collected and results were used to formulate diets of cows according to NRC (2000) requirements **(Table 1).** The straw-chaff averaged 46.8% TDN, 8.8% CP, and 73.3% NDF on a dry matter basis. Supplemental treatments were chosen to supply additional energy. Supplements were fed on a daily basis to minimize rumen digestive upsets at a level to meet energy requirements (average 9 lbs/hd/day). Medium-quality hay was also supplied starting November 29, 2007 and continued until the end of the study due to extremely cold weather and low straw-chaff intake (average 22.8 lbs/head/day). Hay was fed on top of the piles to encourage straw-chaff intake. All rations for the trial were formulated using Cowbytes® ration balancing program.

Table 1: Feed Ingredients and chemical composition of beef cow rations

	Treatment		
Item[z]	DDGS	50:50	CON
Ingredients (% as fed)			
Barley straw-chaff	32.2	36	32.3
Hay	55	49	55.2
Dry distillers grains + solids	25.4	13	-
Rolled barley	-	13	25.5
2:1 mineral	0.5	0.5	0.4
Limestone	0.5	0.5	0.3
Salt	0.3	0.3	0.3
Chemical Composition (% DM)			
Total digestible nutrients	59	58.5	58.8
Crude protein	16.8	13.8	10.6
Neutral detergent fibre	52.5	52.3	51

[z]2:1 mineral contained 20.0% Ca, 10.0% P, 10 000 mg/kg Zn, 200 mg/kg I, 9000 mg/kg MN, 3000 mg/kg Co, 1 000 000 IU/kg vitamin A, 150 000 IU/kg vitamin D, and 1000 IU/kg vitamin E; Limestone contained 38.0% Ca; Fortified salt contained 38.0% Na, 150 mg/kg I, 100 mg/kg Co

The field study site was divided into six 10-acre paddocks using temporary electric fencing. There was an average of 40 barley straw-chaff piles per acre throughout the field. The cows had *ad libitum* access to mineral supplements and cobalt-iodized salt prior to the trial. During the trial, mineral and limestone were top-dressed on the supplement and cobalt-iodized salt was available *ad libitum*. Water was supplied in troughs until adequate snow was available, after which water was supplied on alternate days for the remainder of the trial. Portable wind breaks were provided in each paddock and moved with the animals in each paddock over the course of the trial.

At the start and end of the trial all cows were weighed, ultrasonically measured for backfat at the rib and rump locations, and body-condition scored (BCS) using the Scottish system where 1=emaciated and 5=grossly fat (Lowman et al. 1976). Additionally, cow body weights were taken approximately every 14 days throughout the trial. Weights were taken in the morning following early grazing to avoid “gut fill” variability. Guidelines for animal care (Canadian Council on Animal Care 1993) were followed at all times.

RESULTS

Animal Performance:

The cows grazed barley straw chaff piles for 46 days and all treatment groups gained body weight and condition. Body weight ($P < 0.05$) and rump fat ($P < 0.05$) were greater at the end of the supplementation period for cows in the DDGS system **(Table 2)**.

Cows supplemented with 100% DDGS, or 50% DDGS and 50% rolled barley, gained 26 and 17 lbs respectively. Cows supplemented with barley lost 5 lbs over the 45 days; however, BCS and ultrasound fat measures all increased for these cows. This suggests the body weight change may be due to gut fill capacity. Body weight change for the CON cows was different ($P<0.05$) than body weight change for the 100% DDGS and 50:50 treatments groups **(Table 2).**

This difference is reflected in the body weights as the trial progressed. Also, the change in rump fat for the 100% barley supplemented cows was (CON) different ($P < 0.05$) than the 100% DDGS supplemented cows, but not the 50:50 supplemented cows. No changes in BCS or rib ultrasound measurements were detected ($P > 0.05$). These results suggest DDGS can be used effectively as a supplement in extensive wintering systems to meet nutrient requirements without negative effects on cow performance. The second year (2008-09) of this study is still in progress, therefore, body weights, BCS, and fat measures are not included.

Table 2: Effect of supplementation on cow performance grazing crop residue.

Item		Treatment		
		DDGS	50:50:00	BARL
Cow Body Weight[z] lbs	Average	1381	1361	1343
	Day 0	1377	1372	1368
	Day 12	1338	1313	1304
	Day 26	1407*a*	1370*ab*	1339*b*
	Day 46	1403*a*	1389*ab*	1363*b*
	Change	26*a*	17*a*	-5*b*
Cow BCS	Day 0	2.6	2.5	2.7
	Day 46	2.7	2.7	2.8
	Change	0.1	0.2	0.2
Ultrasound Rib (mm)	Day 0	4.7	4.6	5.1
	Day 46	5.8	6	5.7
	Change	1.1	1.4	0.6
Ultrasound Rump (mm)	Day 0	4.8	6.6	6.3
	Day 46	7.8	8.4	7.2
	Change	3.1*a*	1.9*ab*	1.0*b*

[a-b] Means with different letters in the same row are significantly different ($P<0.05$).
[z] Cow body weights adjusted for conceptus weight

Project Costs:

The costs associated with the study include infrastructure establishment and removal (fencing), feed, and yardage (which included labour, fuel, equipment use, maintenance, and depreciation). The cost of straw-chaff was estimated to be $0.02 per pound of dry matter. A rate of $15.00 per hour was used for labour. Equipment rates were obtained from the Saskatchewan Ministry of Agriculture rate guide. There were no veterinary costs associated with this trial. The total production costs for DDGS, 50:50, and CON were $2.63, $2.66, and $2.71 per cow per day, respectively (**Table 3**). The marked difference between the cost of weight change between the DDGS and barley supplemented cows is a result of the higher gains achieved by cows supplemented with DDGS relative to the gains achieved by cows supplemented with the same amount of rolled barley. This would suggest the high nutrient density of DDGS results in more gain per unit of cost.

Table 3. Costs of wintering cows on straw-chaff forage

Item	$/hd/day		
	DDGS	50:50:00	CON
Feed Costs			
Dry distillers' grains + solids[z]	$0.59	$0.30	-
Barley grain	-	$0.33	$0.65
Hay	$0.41	$0.41	$0.41
Mineral	$0.08	$0.08	$0.06
Limestone	$0.01	$0.01	$0.01
Salt	$0.01	$0.01	$0.01
Barley straw-chaff	$0.31	$0.30	$0.35
Yardage Costs			
Machinery cost (incl. fuel)	$0.98	$0.98	$0.98
Labour	$0.21	$0.21	$0.21
Bedding	$0.02	$0.02	$0.02
Total Production Costs	$2.63	$2.66	$2.71

[z]DDGS supplement priced at $140/tonne; Rolled barley priced at $155/tonne

Western Beef Development Centre
Division of PAMI

Conclusions

Grazing crop residues is one method to extend the grazing season and manage winter feed costs. However, proper supplementation is necessary to meet nutritional requirements of pregnant cows, especially in the second and third trimester of pregnancy. Cows supplemented with DDGS showed greater weight and body condition changes than cows supplemented with the same amount of rolled barley. This is likely due to the greater nutrient (energy and protein) density of DDGS. Replacing rolled barley with DDGS also reduced feeding costs per cow per day. These results indicate the potential to use DDGS as a supplement for beef cows consuming low quality forages.

Acknowledgements

The authors wish to sincerely thank George Widdifield (Ranch Manager), Leah Pearce (Research Technician), Jonathan Pearce (Assistant Ranch Manager), and the rest of the Termuende Research Ranch staff for their extensive help and support with these trials. The DDGS for this research was donated by Husky Energy in Lloydminster. Funding was made available by the Agriculture Development Fund and Saskatchewan Ministry of Agriculture.

References

Canadian Council on Animal Care. 1993. Guide to the Care and Use of Experimental Animals. Vol. 1. 2nd Ed. E.D. Olfert, B.M. Cross and A.A. McWilliam, eds. Canadian Council on Animal Care, Ottawa, ON.

Larson, E. M., Stock, R. A., Klopfenstein, T. J., Sindt, M. H., and Huffman, R. P. 1993. Feeding Value of Wet Distillers' By-Products for Finishing Ruminants. J. Anim. Sci. 71: 2228-2236.

Lowman, B.G., Scott, N.A., and Sommerville, S.H. 1976. Condition Scoring For Cattle. East of Scotland College of Agriculture Bull. No. 6, November. Edinburgh School of Agriculture, Edinburgh, 31 pp.

McCartney, D. H., Block, H. C., Dubeski, P. L., and Ohama, A. J. 2006. Review: The Composition and Availability of Straw and Chaff from Small Grain Cereals for Beef Cattle in Western Canada. Can. J. Anim. Sci. 86: 443-445.

Schingoethe, D. J. 2006. Feeding Ethanol By-Products to Dairy and Beef Cattle. Pages 49-63 in Proc. 2006 California Animal Nutrition Conference, May 10-11, Fresno, CA.

Walker, A. M. 2003. Case Study of Tetany-Like Symptoms in Beef Cows. B. S. A. thesis, University of Saskatchewan, Saskatoon, SK.

For more information contact:
Western Beef Development Centre
Box 1150
Humboldt SK S0K 2A0
Phone (306) 682-3139 Fax (306) 682-5080
www.wbdc.sk.ca