Effects of increasing levels of distillers grains in barley-based diets on growing and finishing feedlot performance, carcass traits and nutrients in manure

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Abstract
A feedlot growing trial and a finishing trial were conducted with separate groups of calves to evaluate the effects of increasing levels of dry distillers grains with solubles (DDGS) in barley-based diets.

Treatments in both trials included distillers grains at 0, 12, 24, and 36 percent of dietary dry matter (DM). Growing diets were formulated at 55 Mcal/lb net energy for gain (NEg) and fed for 56 days after weaning. Finishing diets were 62 Mcal/lb NEg, fed for 90 days prior to market.

The growing trial was conducted with 162 newly-weaned, spring-born steer calves (initial weight 628.21 ± 56.93 lbs). Dry matter intake increased with DDGS ($P < 0.07$) in the diet and gains increased as well ($P < 0.01$). Feed efficiency was not affected ($P = 0.63$). Nutrients in manure were similar for the dietary treatments even though protein levels increased from 13.82 to 16.56 percent (DM basis) with increasing DDGS in the ration.

One hundred-thirty heavy yearling steers (initial weight 980 lbs ± 14.5 lbs) were used in the finishing trial. DM intake increased linearly ($P < 0.01$) with the level of distillers grains during the first two months on feed and overall tended to show a positive linear response ($P = 0.09$). Gains were greater ($P < 0.01$) with distillers grains in the diet and improved linearly ($P < 0.01$) with increasing levels of distillers grains. No differences in feed efficiency were observed ($P = 0.86$).

Carcass traits reflected the increased rate of gain with linear increases in dressing percentage ($P < 0.01$), fat thickness ($P < 0.01$), marbling scores ($P < 0.02$), yield grade ($P < 0.01$), and internal fat (KPH, $P < 0.01$). The percentage of USDA Choice carcasses was 31, 53, 66 and 69 percent, respectively, for 0, 12, 24, and 36 percent DDGS treatments. The use of distillers grains with barley increased carcass value above the control by $30.83 for 12 percent distillers grains, $83.34 for 24 percent distillers grains, and $70.98 for 36 percent distillers grains, due primarily to the higher percentage of USDA Choice carcasses but also to greater carcass weight.

From this data, it appears that steers fed barley with DDGS at any of the tested levels positively affected growing performance, and DDGS fed at 24 percent of the finishing diet provides excellent performance for finishing yearling cattle by improving carcass quality traits and yielding greater return.

Introduction
Barley is used throughout the world in many livestock rations. North Dakota ranks first in barley production in the U.S. Both six-row and two-row barley are high in starch, low in fat, and contain modest amounts of crude fiber and crude protein.

Because DDGS contains significant amounts of fiber and essentially no starch, adding this commodity to barley-based diets may have a stabilizing influence on rumen pH and reduce the potential for acidosis when fed at modest levels in feedlot diets. There has been little research evaluating barley-based feeds supplemented with DDGS.

Both starch and protein components of barley are rapidly fermented in the rumen. Maximum performance of feeder cattle on barley-based diets may only be achieved when sufficient rumen undegradable protein (RUP), also referred to as escape or by-pass protein, is provided to complement the highly degradable starch and protein of feed barley. Dried distillers grains plus solubles (DDGS) contain 10 to 15 percent fat, 40 to 45 percent NDF, 28 to 30 percent crude protein, and 5 percent ash (NRC, 1996). Dried distillers grains contain a high proportion of RUP (55 to 60%, NRC, 1996). Few other feeds commercially available can economically supply RUP in beef feedlot diets.

Materials and Methods

All animals in these studies were managed according to best management practices and the projects were approved by the NDSU Institutional Animal Care and Use Committee. In both trials, steers were housed and fed at the Carrington Research Extension Center Livestock Unit. Animals were provided a minimum of one foot per head of fenceline bunk space, 350 square feet of pen space per head, and continual access to frost-free fenceline automatic water fountains. Calves were fed totally-mixed rations once daily, to appetite based on morning bunk readings, with feed intake adjusted and recorded daily.

Bin-run, six-row feed barley (test weight 47 lbs/bu) was dry rolled using a 24-inch, single-stage roller mill with eight grooves per inch set to crack or break the kernels into three to four particles but not create significant amounts of fines.

Barley is a common feed ingredient.

Feed intake, gain, and feed efficiency were summarized for each of the approximately 28-day weigh periods and overall for the 56-day growing study and the 90-day finishing trial. Feed samples were taken monthly and composited for laboratory analysis by a certified commercial laboratory (Stearns DHIA Laboratories, Sauk Center, MN).

Growing Trial

The receiving trial was conducted with 162 newly-weaned crossbred steer calves (initial weight 628.21 ± 56.93 lbs) consigned to the Carrington Research Extension Center from 42 ranches participating in the Dakota Feeder Calf Show. Steers had been vaccinated against IBR, BVD, PI3, BRSV and clostridia (7-way) on their respective ranches prior to shipment and received booster vaccines at the gathering point in Turtle Lake, ND, prior to shipment to Carrington. Calves were allowed to rest one day after arrival, weighed individually, blocked by weight and randomly allotted to one of four treatments within each of the four weight blocks. Ten or 11 calves were assigned to each of the 16 pens and four pens assigned to each treatment in the randomized complete block design.

Treatment diets were formulated with DDGS (included at 0, 12, 24, and 36% of the dietary DM) (Table 1) in approximately 55 Mcal/lb NEg diet formulations. Nutrient content of the DDGS purchased from Blue Flint Ethanol, Washburn, ND, averaged 28.64 percent crude protein, 12.74 percent acid detergent fiber, 1.07 Mcal/lb net energy maintenance (NEm), 0.71 Mcal/lb NEg, 0.05 percent calcium, 0.97 percent phosphorous, 12.39 percent fat, and 0.78 percent sulfur on a dry matter basis. Canola meal was used as the control protein supplement. Decoquinate (Deccox, Alpharma Animal Health, Bridgewater, NJ) was fed for 28 days after arrival at 22.7 mg per 100 lbs body weight as a preventive for coccidiosis. The ionophore monensin sodium (Rumensin, Elanco Animal Health, Greenfield, IN) was fed at 240 mg per head per day throughout the study.

Table 1. Barley-based growing diets with increasing levels of dry distillers grain.

	Treatment			
	0% DDGS	12% DDGS	24% DDGS	36% DDGS
Ingredient	Percent, Dry matter basis			
Barley, dry-rolled	56.02	49.55	38.17	27.76
Dry distillers grains w/ solubles	1.18	13.51	25.94	36.74
Corn silage	21.44	20.80	20.94	20.76
Oat hay	12.57	12.33	12.43	12.40
Canola meal	6.32	1.49	0.16	0.04
Supplement (ionophore, vitamins, minerals)	1.74	1.63	1.66	1.62
Calcium carbonate	0.73	0.68	0.70	0.68
Total	100	100	100	100
Nutrient Content				
Dry matter, %	66.88	67.35	67.24	67.38
Net energy gain, Mcal/lb	54.54	56.07	56.52	56.82
Crude protein, %	13.82	13.98	15.18	16.56
Degradable protein, ratio[1]	1.21	1.17	1.15	1.16
Metabolizable protein, ratio[1]	0.93	1.03	1.19	1.34
Calcium, %	0.63	0.57	0.58	0.57
Phosphorous, %	0.36	0.34	0.33	0.33
Potassium, %	0.82	0.80	0.82	0.84

[1]Ratios calculated based on published values for degradable and metabolizable protein included in ISU Ration balancing program based on NRC, Nutrient Requirements of Beef Cattle, 7th Revised Edition, 1996.

Calves were fed totally-mixed rations once daily, to appetite based on morning bunk readings, with feed intake recorded daily. Manure sampling was conducted during the growing trial with samples of 10 fresh patties collected from each pen, comingled, and then analyzed for a pen average. Sampling and analysis was done three times. Analysis was conducted by AGVISE Laboratories, Northwood, ND, using standard testing for fertilizer nutrients. This trial was conducted from late October until mid-December. Wind protection and bedding were provided to all pens equally.

Four pens were assigned to each treatment investigating the effect of increasing levels of DDGS in barley-based diets.

Finishing Trial

One hundred-thirty Angus crossbred feeder steers (average weight 980 ± 14.5 lbs) were purchased at public auction and fed a common diet (55 Mcal/lb NEg) for 28 days prior to the start of the trial, at which time steers were weighed individually, blocked by weight, and randomly allotted to one of four treatments within each of the four weight blocks. Eight or nine calves were assigned to each of the 16 pens and one pen in each weight block was assigned to each treatment in the randomized complete block design. This trial was conducted from June 16 to September 11.

Treatment diets were formulated with DDGS included at target levels of 0, 12, 24, and 36 percent of the dietary DM with canola meal used as the control protein supplement. Diets were formulated to contain equal amounts of energy, but protein increased with the increasing level of DDGS (Table 2). Dried DGS were procured from Blue Flint Ethanol, Washburn, ND, and averaged 86.94 percent DM, 29.92 percent crude protein, 18.36 percent ADF, 14.69 percent crude fiber, 0.97 Mcal NEm, 0.64 Mcal NEg, 0.13 percent calcium, 0.82 percent phosphorous, and 12.53 percent fat. The ionophore monensin sodium (Rumensin, Elanco Animal Health, Greenfield, IN) was fed at 300 mg per head per day throughout the study.

Table 2. Barley-based finishing diets with increasing levels of dry distillers grain.

	Treatment			
	0% DDGS	12% DDGS	24% DDGS	36% DDGS
Ingredient	Dry matter basis, %			
Barley, dry-rolled	76.96	68.40	52.28	44.40
DDGS	0.00	12.07	24.04	36.06
Corn silage	16.43	16.71	16.86	16.77
Canola meal	3.98	0.00	0.00	0.00
Calcium carbonate	0.78	0.94	0.95	0.94
Suppl. (ionophore, vitamins, minerals)	1.95	1.88	1.90	1.89
Nutrients				
Crude protein, %	13.50	13.90	15.40	16.90
Metabolizable protein ratio[1]	92	106	123	140
Degradable protein ratio[1]	144	135	133	131
Net Energy gain, Mcal/lb	61	61	62	62

[1] Ratios calculated based on published values for degradable and metabolizable protein included in ISU ration balancing program based on NRC, Nutrient Requirements of Beef Cattle, 7th Revised Edition, 1996.

Steers were vaccinated against IBR, BVD, PI3, BRSV and clostridia (7-way) four weeks prior to the initiation of the trial. All steers were implanted with Synovex Plus (Pfizer Animal Health, New York, NY) (200 mg trenbolone acetate, 24 mg estradiol benzoate) at the initiation of the trial.

Blood samples were taken by venipuncture from six steers in each treatment group prior to slaughter to assess blood urea nitrogen (BUN) as a measure of the potential effects of high protein diets, especially the 24 and 36 percent DDGS diets, on circulating nitrogen. Whole blood was centrifuged; the serum was decanted, frozen and submitted to a commercial laboratory for quantification of BUN.

Cattle were marketed at Tyson Foods, Inc., Dakota City, NE, when it was estimated that 60 percent of the animals would grade as low Choice or higher by visual observation. Carcass traits and USDA yield and quality grades were determined by USDA Graders and NDSU Meat Scientists after a 24-hour chill.

Statistical Analysis

Data were analyzed using SAS Mixed Procedures (SAS Institute, Crary, NC). Blocks were considered replicates and pen was the experimental unit. P values are provided so the reader can make a value determination of the significance of the results. These coefficients are indicators of the effectiveness of experimental treatments on respective variables.

Results

Growing Trial

Dry matter intake (Table 3) for the recently-weaned calves tended to increase ($P < 0.07$) for DDGS compared to no DDGS with a P value of 0.14 observed for a linear increase in intake during the entire trial period. Gains favored any treatment with DDGS ($P < 0.01$; linear response $P < 0.02$) during the first 28-day period and overall ($P < 0.01$, and $P < 0.06$) for DDGS versus none and linear response, respectively. Feed efficiency was greater ($P < 0.03$) during period 1 for cattle fed DDGS versus none, but overall, efficiencies were not different ($P = 0.63$).

Table 3. Effects of increasing dry distillers grain in barley-based growing diets on feedlot performance.

Treatment	0% DDGS	12% DDGS	24% DDGS	36% DDGS	Std Error	P Value	Contrasts DDGS vs. None	Linear	Quad.
No. Head	40	41	41	40					
No Pens	4	4	4	4					
Weight, lbs									
Initial Wt. (Oct 19)	605.0	613.4	610.0	610.7	9.67	0.85	0.42	0.66	0.58
Period 1 (Nov 19)	723.0	745.4	745.1	743.3	12.10	0.19	0.03	0.12	0.16
Period 2 (Dec 18)	837.8	864.2	862.1	859.3	13.90	0.21	0.04	0.16	0.14
Dry Matter Intake, lb/hd/day									
Period 1	14.55	15.06	15.69	15.72	0.52	0.13	0.05	0.03	0.53
Period 2	17.95	19.48	19.21	19.77	0.71	0.11	0.02	0.04	0.35
Overall	16.31	17.35	17.04	17.40	0.58	0.27	0.07	0.14	0.43
Average Daily Gain, lb/hd/day									
Period 1	4.218[a]	4.718[b]	4.822[b]	4.745[b]	0.22	0.03	0.01	0.02	0.07
Period 2	3.955	4.090	4.038	4.000	0.19	0.91	0.57	0.89	0.52
Overall	4.083	4.405	4.422	4.373	0.15	0.08	0.01	0.06	0.08
Feed Efficiency, DM/gain									
Period 1	3.46	3.20	3.26	3.33	0.10	0.10	0.03	0.29	0.03
Period 2	4.56	4.76	4.79	4.94	0.21	0.40	0.15	0.11	0.88
Overall	4.00	3.94	3.86	3.98	0.17	0.86	0.63	0.80	0.49
Gain Efficiency, gain/DM									
Period 1	0.29	0.32	0.31	0.30	0.01	0.05	0.02	0.28	0.01
Period 2	0.22	0.21	0.21	0.20	0.01	0.37	0.16	0.10	1.00
Overall	0.25	0.26	0.26	0.26	0.01	0.55	0.25	0.37	0.32

[a,b] Values with different superscripts are significantly different at P < 0.05.

Finishing Trial

During the first two months on the treatment diets, dry matter intake (DMI) increased with any amount of DDGS in the diet (P <0.01) and a significant linear effect (P <0.01) was observed with increasing DDGS in the diets. However, during the final feeding period of the 90-day trial, no significant differences were observed resulting in a tendency (P = 0.14) for improved DMI with any level of DDGS and some indication of a linear response (P = 0.09) from level of DDGS (Table 4). Average daily gains (ADG) responded positively to DDGS as well with increased ADG (P < 0.01) from any amount of DDGS in the diet and a linear effect (P < 0.01) observed for increasing DDGS level (Table 4). Feed efficiency did not differ (P > 0.10) and is reported in Table 4 as both feed (DM) per unit gain and gain per unit feed (DM).

Table 4. Effects of increasing dry distillers grain in barley-based finishing diets on feedlot performance.

	0% DDGS	12% DDGS	24% DDGS	36% DDGS	Std Error	P Value	Contrast: DDGS vs. None	Contrast: Linear
No. Head	32	33	32	33				
No Pens	4	4	4	4				
Weight, lbs								
Initial wt. (Jun 15)	983.6	977.2	992.5	967.7	14.50	0.56	0.76	0.57
Period 1 (Jul 13)	1068.9	1065.8	1104.5	1077.0	12.00	0.10	0.33	0.25
Period 2 (Aug 10)	1176.1 [a]	1188.9 [a]	1248.6 [b]	1196.6 [a]	13.70	0.01	0.03	0.05
Period 3 (Sep 13)	1297.4[a]	1293.0[a]	1358.4[b]	1311.1[ab]	15.50	0.02	0.20	0.13
Dry Matter Intake, lb/hd/day								
Period 1	22.91[a]	24.00[ab]	26.63[c]	25.6[bc]	0.58	0.01	0.01	0.01
Period 2	22.13[a]	22.68[a]	25.89[b]	23.65 [ab]	0.42	0.01	0.01	0.01
Period 3	29.54	27.97	31.50	29.43	1.91	0.64	0.97	0.72
Overall	24.75	24.96	27.92	26.24	0.88	0.09	0.14	0.09
Average Daily Gain, lb								
Period 1	2.864[a]	2.996[a]	3.816[b]	3.698[b]	0.21	0.01	0.01	0.01
Period 2	3.827[a]	4.395[ac]	5.145[bc]	4.272[ac]	0.18	0.01	0.01	0.01
Period 3	4.529[a]	3.720[b]	4.173[ab]	4.227[ab]	0.21	0.05	0.04	0.62
Overall	3.683[a]	3.722[a]	4.34[b]	4.04[ab]	0.12	0.01	0.01	0.01
Feed Efficiency, DM/gain								
Period 1	8.59	8.27	7.07	7.16	0.91	0.57	0.32	0.21
Period 2	5.87	5.24	5.06	5.60	0.30	0.28	0.13	0.47
Period 3	6.57	7.53	7.73	7.07	0.59	0.54	0.23	0.54
Overall	6.54	6.5	6.23	6.31	0.26	0.82	0.55	0.43
Gain Efficiency, Gain/DM								
Period 1	0.125	0.126	0.144	0.146	0.016	0.69	0.48	0.28
Period 2	0.172	0.193	0.199	0.181	0.010	0.31	0.14	0.49
Period 3	0.155	0.134	0.134	0.144	0.011	0.48	0.18	0.51
Overall	0.154	0.154	0.161	0.159	0.006	0.81	0.57	0.44

[a, b, c] Values with different superscripts are significantly different at $P < 0.05$.

Carcass traits and value

All the carcass traits (Table 5) except ribeye area responded positively to any level of DDGS and linearly increasing levels of DDGS. Ribeye area exhibited a quadratic response. Marbling scores improved with DDGS for a greater percentage USDA Choice carcasses for treatments with DDGS. Relative carcass value was calculated based on actual feed costs and a $12 price differential from USDA Select to Choice grades. The increase in value for carcasses from the respective treatments above the control treatment was $30.83 for 12 percent DDGS, $83.34 for 24 percent DDGS, and $70.98 for 36 percent DDGS. In this scenario, barley was valued at $3.00 per 48 lb bushel, canola meal at $160 per ton, and DDGS at $140 per ton. The increased percentage of USDA Choice combined with a higher price for Choice grade were the primary reasons for the increased carcass value.

Table 5. Effects of increasing distillers grain in barley-based finishing diets on carcass traits.

	Treatment						Contrast	
	0% DDGS	12% DDGS	24% DDGS	36% DDGS	Std Error	P value	DDGS vs. None	Linear
Hot Carcass Wt., lb	754.5[a]	759.6[a]	806.4[b]	781.3[ab]	11.1	0.01	0.01	0.01
Dressing percent, %	60.92[a]	61.54[ab]	62.18[abc]	62.49[c]	0.03	0.01	0.01	0.01
REA, sq in	13.41[ab]	13.12[ab]	13.65[ab]	12.94[b]	0.17	0.03	0.41	0.27
Fat Thickness, in	0.36[a]	0.44[ab]	0.49[ab]	0.52[b]	0.03	0.01	0.01	0.01
Marbling Score*	389[a]	426[ab]	432[ab]	446[b]	16.25	0.09	0.02	0.02
Yield Grade	2.91[a]	3.11[ab]	3.23[b]	3.30[b]	0.07	0.01	0.01	0.01
KPH, %	2.25[a]	2.31[ab]	2.38[ab]	2.48[b]	0.05	0.01	0.01	0.01
USDA Choice, %	31	53	66	69				

[a,b,c] Values with different superscripts are significantly different (P<0.05).

* Marbling score: 300 to 399 = Select; 400+ = Choice

Serum Blood Urea Nitrogen

Serum BUN levels were similar (P = 0.27) with means of 15.0, 13.9, 15.9, and 18.3 mg/dl for 0, 12, 24, and 36 percent DDGS, respectively. The normal maximum for BUN in cattle is 20-30 mg/dl so all the animals sampled were within the normal range even though dietary protein exceeded published requirements.

Nutrients in Manure

Manure was analyzed for multiple soil fertility components including several minerals; values are reported in pounds per ton “as is” in Table 6. Nitrogen levels appear to be similar for all treatments and generally higher than expected considering the samples did not include urine. High protein diets may produce more nitrogen in animal waste than traditional diets with lower protein.

Table 6. Nutrients in manure from barley-based growing diets with increasing dry distillers grains.

	Treatment						Contrasts		
Item, Unit	0% DDGS	12% DDGS	24% DDGS	36% DDGS	Std Error	P value	DDGS vs. None	Lin	Quad
Dry Matter, %	17.50	17.58	18.08	17.83	0.50	0.84	0.56	0.50	0.74
Ash, %	2.27	2.10	2.23	2.33	0.19	0.86	0.82	0.73	0.49
pH	6.41	6.21	6.44	6.49	0.09	0.13	0.78	0.22	0.16
Salts, mmhos/cm	4.95	5.08	4.88	5.06	0.22	0.91	0.84	0.90	0.90
	Pounds per ton, as is								
Calcium (Ca)	4.02	3.79	3.43	3.83	0.33	0.65	0.39	0.54	0.35
Copper (Cu)	0.02	0.02	0.03	0.02	0.01	0.95	0.87	0.74	0.75
Iron (Fe)	0.32	0.32	0.33	0.32	0.05	0.99	0.97	0.99	0.92
Magnesium (Mg)	2.40	2.17	2.68	2.83	0.18	0.05	0.44	0.03	0.29
Manganese (Mn)	0.13	0.08	0.10	0.09	0.02	0.40	0.10	0.24	0.39
Ammonia N	0.34	0.37	0.40	0.45	0.02	0.05	0.05	0.01	0.61
Total N	9.08	9.43	10.28	9.68	0.32	0.07	0.06	0.07	0.14
Phosphate (P)	6.07	5.74	6.32	5.49	0.39	0.47	0.63	0.51	0.53
Potassium (K)	4.03	4.19	3.85	3.83	0.17	0.41	0.74	0.24	0.60
Sodium (Na)	0.57	0.48	0.76	0.81	0.15	0.36	0.51	0.14	0.63
Sulfur (S)	0.98	0.96	1.09	1.04	0.04	0.15	0.35	0.13	0.71
Zinc (Zn)	0.07	0.07	0.08	0.07	0.01	0.66	0.84	0.90	0.51

Sequestering nitrogen, however, is a challenge as more than half can volatilize before manure is spread on the land. Sequestering nutrients in manure is accomplished by adding bedding in the form of crop residue (Anderson and Wiederholt, 2007) which adds carbon to create a more ideal C:N ratio. Bedding animals also increases animal comfort, the percentage of choice carcasses and animal performance. More research is needed to refine the bedding and composting process to reduce volatilization and optimize the fertility value of manure.

Discussion

With increasing demand from multiple users and resultant higher prices for corn, feeders are looking for other more competitively priced grains. The increasing supply of DDGS has stimulated interest in feeding higher levels of DDGS than previously recommended. Extensive research has demonstrated the effectiveness of DDGS when used as a protein or energy feed in corn-based diets (Review paper by Klopfenstein et al., 2008).

Increased feed intake, gain, and efficiency is generally observed when DDGS is added to corn-based diets at up to 15 percent to 25 percent of the dietary DM, but a linear decrease in gain, intake, and efficiency was observed when DDGS was included at levels of 40 percent to 75 percent of the diet DM. Current recommendations are for a maximum of 20 percent to 25 percent DDGS in corn-based feedlot diets; consideration must be given to the sulfur content of DDGS when included in formulations higher than 20 percent to 25 percent.

The maximum level of dietary sulfur recommended by NRC (1996) in high-grain diets is 0.4 percent. Sulfur toxicity causes polioencephalomalacia (PEM) which exhibits symptoms of blind staggers or imbalance, but often, the only indication is a mortality loss. NRC (1996) reports the sulfur level in

DDGS at 0.4 percent, but field reports have observed sulfur as high as 1.4 percent in some batches of DDGS. Sulfur content in corn and barley are both reported at 0.14 percent per NRC (1996), and high sulfate levels in drinking water also contribute to the total sulfur in the diet. Multiple sulfur sources must be considered when determining the total amount of DDGS to feed.

Research conducted at the Carrington Research Extension Center (Anderson and Schoonmaker, 2005) demonstrated that ADG and DMI increased linearly when modest amounts of wet and/or dry distillers grains were added to barley-based diets at up to 14 percent of the diet DM in growing diets and 8 percent of diet DM in finishing diets. In that study, any combination of wet and/or dry distillers grains appears to support improved DMI and ADG over the control diet that included urea as a nitrogen source.

Additional research with wet distillers grains in barley-based diets is needed. Hot carcass weights reflected the improved gain but no other effects were observed on carcass traits. Pamp et al. (2004) also observed improved gain when barley-based diets were supplemented with rumen undegradable protein sources of feather meal and blood meal.

Implications

From this data, it appears that cattle fed barley-based diets may have greater feed intake and faster gains when DDGS are added to rations. Improved carcass quality traits and value were also observed. Feeding DDGS at 24 percent of diet DM appears to be the optimum of the treatments examined in finishing diets.

The relative cost of DDGS or WDGS needs to be considered in formulating diets. Logistics considerations for distance from ethanol plant(s), cost of trucking, rate of use, and storage area are also important. According to this study, with current prices for feed commodities and carcass beef, greater profit can be achieved when DDGS is fed with barley, compared to feeding barley without DDGS.

Wet distillers grains should provide as good or possibly greater performance. The feedlot industry in North Dakota is confronted with high-priced corn grain, but a larger supply of DDGS or WDGS with feed barley may be a viable and economical alternative. Animal performance and improved carcass value suggest these two feeds could be the foundation of a profitable feedlot industry in the Northern Plains.

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