Comparing Dry, Wet, or Modified Distillers Grains Plus Solubles on Feedlot Cattle Performance

Brandon L. Nuttelman
Will A. Griffin
Josh R. Benton
Galen E. Erickson
Terry J. Klopfenstein[1]

Summary

Three types of distillers grains (DG): 1) wet distillers grains plus solubles (WDGS), 2) dried distillers grains plus solubles (DDGS), or 3) modified distillers grains plus solubles (MDGS), included at 3 levels: 20%, 30%, or 40% the diet DM, and a corn-based control compared the effect of drying distillers grains on feedlot performance. Type of DG had no effect on ADG ($P = 0.30$), but DMI increased for MDGS and DDGS compared to WDGS ($P < 0.01$). Therefore, F:G was improved for WDGS ($P < 0.01$) compared to MDGS and DDGS. Gain was greater and F:G was lower when DG were fed compared to the corn control. The feeding value of WDGS was 35.4% and 17.8% greater than DDGS and MDGS, respectively. The feeding value was 45.7%, 26.5%, and 9.3% more than corn for WDGS, MDGS, and DDGS, respectively.

Introduction

A University of Nebraska–Lincoln pen mean meta-analysis (*2011 Nebraska Beef Cattle Report,* pp. 40-41) determined a feeding value for wet distillers grains plus solubles (WDGS), modified distillers grains plus solubles (MDGS), and dried distillers grains plus solubles (DDGS) relative to dry-rolled corn (DRC) in feedlot diets. The feeding value for WDGS is 143 - 130%, 124 - 117% for MDGS, and 112% for DDGS. However, little research has been conducted comparing WDGS, DDGS, and MDGS in the same study. Therefore, the objective of this study was to compare the effects of drying ethanol co-products produced from the dry milling process on feedlot cattle performance by feeding WDGS, MDGS, and DDGS in the same study.

Procedure

Crossbred, yearling steers (n = 440; 778 ± 42 lb) were utilized in a randomized complete block design. Treatments were arranged in a 3 x 3 + 1 factorial treatment structure, with three types of distillers grains (DG), three inclusions of DG (20%, 30%, or 40% diet DM), and a negative corn-based control (CON). Steers were blocked by BW, stratified within block, and assigned randomly to pen (55 pens; 8 steers/pen). Pens were assigned randomly to one of 10 treatments. The CON treatment was repeated within replication (10 replications), whereas all other treatments had 5 replications.

Basal ingredients consisted of a high-moisture and dry-rolled corn blend (HMC:DRC) fed at a 60:40 ratio (DM basis), 15% corn silage, and 5% dry supplement (DM basis; Table 1). Distillers grains replaced HMC:DRC. Steers were adapted to the finishing diet by feeding 37.5%, 27.5%, 17.5%, and 7.5% alfalfa hay (DM basis), replaced with HMC:DRC for 3, 4, 7, and 7 days, respectively. The supplements for diets containing 20% DG contained urea at 0.47% of the diet to ensure there was not a deficiency in degradable intake protein. All diets were formulated to provide a minimum of 13.0% CP, 0.6% Ca, 0.25% P, and 0.6% K. Supplements for all diets were formulated to provide 360 mg/steer daily of monensin (Rumensin, Elanco Animal Health), 90 mg/steer daily of tylosin (Tylan, Elanco Animal Health), and 150 mg of thiamine per steer daily.

Table 1. Nutrient composition of wet, modified, and dry distillers grains.

	WDGS[1]	MDGS[1]	DDGS[1]
% CP	31.1	31.0	30.9
% Sulfur	0.81	0.70	0.71
% Fat	11.9	12.4	11.9
% NDF	34.1	34.4	32.3

[1]WDGS = wet distillers grains plus solubles; MDGS = modified distillers grains plus solubles; DDGS = dried distillers grains plus solubles.

Table 2. Main effects of type of distillers grains on cattle performance and carcass characteristics.

	Type of Distillers Grains[1]				
	WDGS	MDGS	DDGS	SEM	*P*-value
Performance					
Initial BW, lb	767	767	768	1	0.83
Final BW, lb[2]	1400	1409	1392	10	0.51
DMI, lb/day	24.8[a]	26.4[b]	27.1[b]	0.07	< 0.01
ADG, lb	4.11	4.17	4.05	0.3	0.30
F:G[3]	6.06[a]	6.33[b]	6.67[c]	0.01	< 0.01
Carcass Characteristics					
HCW, lb	882	887	877	6	0.52
12th rib fat, in	0.63	0.64	0.60	0.1	0.15
Marbling Score[4]	610	599	602	9	0.69
LM area, in²	13.3	13.2	13.4	0.15	0.50

[a,b,c]Means with different superscripts differ ($P < 0.05$).
[1]WDGS = wet distillers grains plus solubles; MDGS = modified distillers grains plus solubles; DDGS = dried distillers grains plus solubles.
[2]Calculated from hot carcass weight, adjusted to a common dressing percentage of 63.0%.
[3]Analyzed as gain:feed, reciprocal of feed conversion (F:G).
[4]Marbling score: 400 = Slight[0]; 450 = Slight[50]; 500 = Slight[0], etc.

Table 3. Main effect of level on cattle performance and carcass characteristics.

	Level[1]					With 0 level[2]		Without 0 level[3]	
	0	20	30	40	SEM	Lin	Quad	Lin	Quad
Performance									
Initial BW, lb	800	767	799	738	1	0.34	0.18	0.17	0.13
Final BW, lb[4]	1319[a]	1396[b]	1390[b]	1413[b]	15	< 0.01	0.05	0.24	0.25
DMI, lb/day	24.6[a]	26.3[b]	25.9[b]	26.2[b]	0.4	0.01	0.09	0.74	0.36
ADG, lb	3.58[a]	4.08[b]	4.05[b]	4.19[b]	0.07	< 0.04	0.04	0.26	0.25
F:G[5]	6.85[a]	6.41[b,x]	6.37[b,x,y]	6.21[b,y]	0.01	< 0.01	0.04	0.05	0.48
Carcass Characteristics									
HCW, lb	831	879	876	890	7	< 0.01	0.05	0.22	0.25
12^{th} rib fat, in	0.50	0.62	0.62	0.65	0.02	< 0.01	0.08	0.12	0.40
Marbling Score[6]	607	609	599	603	11	0.63	0.99	0.70	0.52
LM area, in^2	13.3	13.2	13.3	13.4	0.1	0.74	0.17	0.18	0.68

[a,b]Means with different superscripts differ ($P < 0.05$) for main effect of 0, 20, 30, and 40% distillers grains inclusion level.
[x,y] Means with different superscripts differ ($P < 0.05$) for main effect of 20, 30, and 40% distillers grains inclusion level.
[1]% inclusion of distillers grains (DM)
[2]Contrast for the linear and quadratic effect of treatment *P* – value with main effects of 0, 20, 30, and 40% distillers grains inclusion level.
[3]Contrast for the linear and quadratic effect of treatment *P* – value with main effects of 20, 30, and 40% distillers grains inclusion level.
[4]Calculated from hot carcass weight, adjusted to a common dressing percentage of 63.0%.
[5]Analyzed as gain:feed, reciprocal of feed conversion (F:G).
[6]Marbling score: 400 = Slight^{0}; 450 = Slight^{50}; 500 = Slight^{0}, etc.

All three types of DG were purchased and stored in a separate silo bag at the feedlot prior to the initiation of the trial to eliminate variation in the supply of distillers grains over the duration of the study. The DDGS and MDGS were produced and purchased from the same plant, and the WDGS was purchased from a different plant. During the bagging process, each DG was sampled and analyzed for CP, fat, S, and NDF (Table 1). The WDGS contained 0.1 percentage units more S than either DDGS or MDGS. Therefore, calcium sulfate was included in supplements for treatments containing DDGS or MDGS to equalize S intake across treatments that contained distillers grains.

Steers were implanted on day 1 of the trial with Component TE-IS, and re-implanted on day 69 with Component TE-S. Cattle were limit fed a common diet at 2.0% BW that contained 47.5% wet corn gluten feed, 47.5% alfalfa hay, and 5.0% supplement for five consecutive days to eliminate variation due to gut fill. Following the limit feeding period, steers were individually weighed on day 0 and day 1, and the average of the two weights was used to obtain an accurate initial BW. Feed refusals were collected and weighed, when needed throughout the trial, and dried in a forced air oven at 60°C for 48 hours to calculate DMI.

Steers were slaughtered on day 154 at a commercial abattoir (*Greater Omaha Pack, Omaha, Neb.)*. Liver scores and HCW were collected on the day of slaughter. Following a 48-hour chill, USDA marbling score, 12^{th} rib fat depth, and LM area were recorded. A common dressing percentage of 63% was used to calculate carcass adjusted performance to determine final BW, ADG, and F:G.

The difference in F:G between the different types of DG was divided by the F:G of the DDGS treatment and the average inclusion level of DG (30% DM) to determine the differences in feeding value between types of DG. The same calculations were used to calculate the improved feeding value of each DG compared to the CON treatment.

Data were analyzed using the MIXED procedure of SAS. Pen was the experimental unit and treatments were analyzed as a randomized complete block design. Initially, the 3x3 factorial was tested for an interaction. If no significant interaction was observed, then main effects of distillers type were evaluated. Also, orthogonal polynomial contrasts were constructed to evaluate a response curve (linear and quadratic) for distillers grains level. If an interaction occurred, then simple effects of different inclusions of each distillers type were evaluated. Orthogonal polynomial contrasts also were constructed to determine a response curve (linear, quadratic, and cubic) to compare the level of distillers grains against the CON. Proc IML was used to obtain appropriate coefficients for unbalanced inclusion levels.

Results

Cattle Performance

There were no type x level interactions ($P > 0.16$) for the 3 x 3 factorial. Therefore, the main effects of DG type, DG level, and DG level compared against CON are presented.

Type of Distillers Grains

Performance and carcass characteristics for type of DG are presented in Table 2. There were no differences observed for ADG ($P = 0.30$) between WDGS, MDGS, and DDGS. Steers fed WDGS had 1.61 and 2.29 lb/day lower ($P < 0.01$) DMI than MDGS and DDGS, respectively. As a result, steers fed WDGS had lower F:G ($P < 0.01$) compared to steers fed MDGS or DDGS. Cattle fed MDGS tended ($P = 0.06$) to have lower F:G than steers consuming DDGS. There were no differences observed between type of DG for carcass traits ($P > 0.15$).

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Level of Distillers Grains

Performance and carcass characteristics for level of DG are presented in Table 3. First, main effects of 20%, 30%, and 40% inclusion level are discussed and then followed with the comparison to CON. There were no differences for final BW, DMI, or ADG between 20%, 30%, and 40% DG inclusion level ($P > 0.24$). Cattle fed 40% DG had a lower ($P = 0.05$) F:G than 20% DG. Carcass characteristics were not different ($P > 0.12$) between levels of DG. When comparing CON to 20%, 30%, and 40% DG, there was a linear ($P = 0.01$) increase in DMI, quadratic ($P = 0.04$) increase in ADG, and linear ($P < 0.01$) decrease in F:G. The increase in ADG and decrease in F:G occurred when DG inclusion increased from 0% to 20% inclusion. Increasing dietary inclusion of DG increased HCW quadratically ($P = 0.05$) and increased fat depth ($P < 0.01$) linearly when CON was included. Although there was a difference observed in fat depth, the 0% level had 0.50 in and is a good indication that all steers achieved acceptable feeding endpoints, regardless of treatment. There were no effects on marbling score or LM area ($P > 0.63$).

Based on F:G, calculated feeding values of DG were greater than HMC:DRC, regardless of type of DG. The feeding value of WDGS, MDGS, and DDGS were 45.7%, 26.5%, and 9.3% greater than HMC:DRC. The feeding value of WDGS was 36.0% and 17.9% greater than DDGS and MDGS, respectively.

This study agrees with previous research that found including DG, regardless of moisture level, up to 40% of the diet (DM basis) will improve F:G compared to corn-based diets. Also, this study suggests that partially or completely drying DG has a negative effect on its feeding value compared to WDGS.

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[1]Brandon L. Nuttelman, research technician; Will A. Griffin, research technician; Josh R. Benton, research technician; Galen E. Erickson, professor; Terry J. Klopfenstein, professor, University of Nebraska–Lincoln Department of Animal Science.