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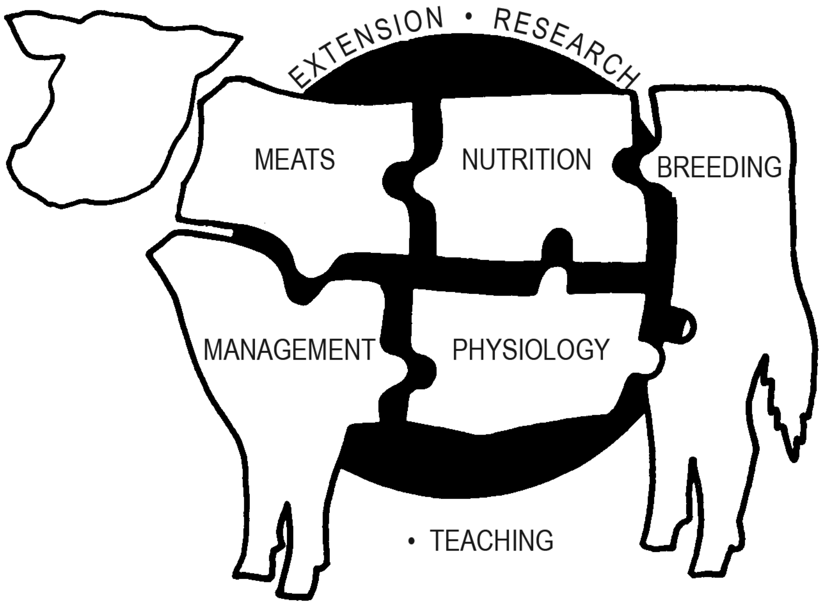

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IANR

Response to Increasing Concentrations of De-oiled Modified Distillers Grains Plus Solubles in Beef Feedlot Diets

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Summary

A 154-day finishing study, utilizing 378 calf-fed steers, was conducted to evaluate the response to feeding increasing concentrations of de-oiled modified distillers grains plus solubles (MDGS) on cattle performance and carcass characteristics. Two additional diets were fed to compare de-oiled MDGS to normal MDGS at either 15 or 30% inclusion. Increasing concentration of de-oiled MDGS in the diet resulted in a linear improvement in F:G. When comparing 30% de-oiled to normal MDGS, there was a tendency for 3.4% improvement in F:G for cattle fed normal MDGS diets over those fed de-oiled MDGS.

Introduction

Ethanol plants are centrifuging oil from the thin stillage constituent and selling this oil to non-ruminant feed sectors and the biofuel industry. Jolly-Breithaupt et al., *2014 Nebraska Beef Report,* pp. 81-82, compared feeding de-oiled (7.9% fat) wet distillers grains plus solubles (WDGS) to normal (12.4% fat) WDGS at 35, 50, or 65% concentrations in the diet. Dry matter intake was significantly greater ($P < 0.01$) in cattle consuming de-oiled WDGS diets over normal WDGS diets. Numerically, F:G was improved in cattle consuming normal WDGS by 2.6% ($P = 0.58$). Increasing WDGS in the diet caused a quadratic response to DMI ($P < 0.01$) and a linear improvement in F:G ($P < 0.01$). Previous research from Huls et al., *2008 Nebraska Beef Cattle Report,* pp.41-42, illustrated that increasing the concentration of normal fat modified distillers grains plus solubles (MDGS) from 0 to 50% caused a linear improvement in F:G ($P < 0.01$), thus the objective of this study was evaluate the effects of feeding de-oiled (MDGS) at increasing concentrations in the diet on cattle performance and carcass characteristics.

Procedure

Three hundred and seventy-eight crossbred steer calves (initial BW = 800 ± 38 lb) were utilized in a 154-day finishing trial conducted at the University of Nebraska–Lincoln Agricultural Research and Development Center (ARDC) near Mead, Neb. Five days prior to the start of the trial, steers were limit-fed at 2.0% BW a 50% alfalfa hay and 50% Sweet Bran® diet. Steers were then weighed on two consecutive days to obtain an accurate initial BW. Using day 0 BW, steers were blocked into three weight blocks (heavy, medium, or light) and within block assigned randomly to pens. Forty-two pens were then assigned randomly to one of seven treatments with nine steers per pen. There were six replications per treatment with two replications per block. Treatments (Table 1) consisted of de-oiled MDGS being fed at 0, 15, 30, 45, or 60% of the diet (DM basis). Two additional diets were evaluated where normal MDGS was fed at 15 or 30% of diet DM to allow for an embedded 2 × 2 factorial analysis with their de-oiled counterparts. In all diets, as distillers grains was added to the ration, the 1:1 blend of high-moisture corn and dry-rolled corn was substituted. Twelve percent corn silage and 5% of a formulated supplement comprised the remainder of all diets (DM basis). Diets containing 0 or 15% distillers grains were supplemented with urea to meet or exceed the ruminally degradable protein (RDP) and thus the MP requirements of the steers.

Steers were implanted with Revalor®-XS on day 0. On day 154 of the study, steers were shipped to the commercial abattoir (Greater Omaha Pack Co., Omaha, Neb.) where they were harvested the following morning. On the day of harvest, HCW measurements were recorded. After a 48-hour chill, camera measurements were collected for LM area, fat depth, and marbling scores. Yield grade was calculated using the USDA YG

Table 1. Dietary composition on a DM basis fed to finishing steers.

	De-oiled MDGS[1] (%, DM Basis)					Normal MDGS[1] (%, DM Basis)	
MDGS Concentration[2]	0[3]	15[3]	30	45	60	15[3]	30
Ingredient							
De-oiled MDGS[1]	0.0	15.0	30.0	45.0	60.0	—	—
Normal MDGS[1]	—	—	—	—	—	15.0	30.0
Corn silage	12.0	12.0	12.0	12.0	12.0	12.0	12.0
High-moisture corn	41.5	34.0	26.5	19.0	11.5	34.0	26.5
Dry-rolled corn	41.5	34.0	26.5	19.0	11.5	34.0	26.5
Supplement[3]	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Dietary Composition ,%							
Fat	3.24	3.78	4.32	4.86	5.40	4.50	5.76

[1] MDGS = modified distillers plus solubles for both de-oiled and normal varieties.
[2] Formulated to provide 360 mg/head/day or Rumensin® and 90 mg/head/day Tylan® in supplement.
[3]Urea was included in diets containing 0 and 15% MDGS diets to meet the MP requirements of the steers.

equation: [YG = 2.5 + 2.5 (fat thickness, in) – 0.32 (LM area, in^2) + 0.2 (KPH fat, %) + 0.0038 (HCW, lb)]. Final BW, ADG, and F:G were calculated using HCW adjusted to a common dressing percentage of 63%.

Data were analyzed using a MIXED procedure of SAS (SAS Institute, Inc., Cary, N.C.) as a randomized complete block design with pen as the experimental unit. Linear and quadratic contrasts were made on performance and carcass data from cattle fed increasing levels of de-oiled MDGS. The embedded 2 × 2 factorial was analyzed for an oil (de-oiled vs. normal) by inclusion level (15% vs. 30%) interaction. Pre-planned, pair-wise comparisons were made for both the 15% and 30% inclusions.

The feeding value of de-oiled MDGS relative to normal MDGS was calculated as the difference between the G:F observed for de-oiled MDGS and normal MDGS divided by the G:F value of the normal MDGS diet. This value was then divided by the proportion of MDGS in the corresponding diet. This value plus one, and multiplied by 100, gives feeding value relative to the DRC and HMC blend replaced. Calculated feeding values for this comparison are found in Table 3. Treatment NEm and NEg values were also calculated, using equations found in the 1996 NRC, on a per pen basis. These energy values were also analyzed using the GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, N.C.) so that treatment averages could be determined.

Table 2. Performance and carcass data for steers fed increasing inclusions of de-oiled MDGS.

	De-oiled MDGS[1], % Diet DM						*P*-value	
Item	0	15	30	45	60	SEM	Lin	Quad
Performance								
Initial BW, lb	793	794	792	792	794	1	0.40	0.86
Final BW, lb[3]	1291	1334	1331	1326	1325	14	0.02	0.57
DMI, lb/day	23.2	24.1	24.0	23.1	23.1	0.4	0.59	0.32
ADG, lb	3.25	3.53	3.52	3.44	3.48	0.08	0.02	0.57
F:G[4]	7.13	6.81	6.81	6.71	6.67		<0.01	0.86
Net Energy Values[5]								
NE maintenance, Mcal/lb	0.83	0.84	0.84	0.86	0.86	0.01	<0.01	0.41
NE gain, Mcal/lb	0.54	0.55	0.55	0.57	0.57	0.01	<0.01	0.38
Carcass Characteristics								
HCW, lb	813	840	839	835	835	8.2	0.02	0.57
LM area, in^2	12.80	12.95	12.53	12.72	12.75	0.21	0.17	0.85
12^{th}-rib fat, in	0.49	0.54	0.62	0.58	0.57	0.03	<0.01	0.69
Marbling score[6]	490	527	535	523	506	12	0.05	0.17

[1]Modified distillers grains plus solubles.
[2]Lin = *P*-value for the linear response to de-oiled MDGS inclusion: Quad = *P*- value for the quadratic response to de-oiled MDGS inclusion.
[3]Final BW was calculated from HCW using a common dressing percentage of 63%.
[4]Analyzed as G:F, the reciprocal of feed conversion (F:G).
[5]Values calculated by pen, using 1996 NRC equations.
[6]Marbling Score: 400 - small°, 500 = modest°.

Table 3. Performance, carcass data, and feeding value of de-oiled MDGS for embedded 2 × 2 factorial.

	15% MDGS[1]		30% MDGS[1]			*P*-value[2]	
Item	De-oiled	Normal	De-oiled	Normal	Int.[3]	15	30
Performance							
Initial BW, lb	794	792	792	793	0.37	0.37	0.72
Final BW, lb[4]	1334	1314	1331	1342	0.26	0.31	0.57
DMI, lb/day	24.1	23.6	24.0	23.6	0.85	0.37	0.59
ADG, lb	3.53	3.41	3.52	3.59	0.28	0.32	0.59
F:G[5]	6.80^{ab}	6.90^{a}	6.80^{ab}	6.58^{b}	0.07	0.48	0.07
Net Energy Values[6]							
NE Maintenance, Mcal/lb	0.84	0.84	0.84	0.86	0.12	0.75	0.06
NE Gain, Mcal/lb	0.55	0.55	0.55	0.57	0.10	0.73	0.05
Feeding Value[7]	109%	—	89%	—			
Carcass Characteristics							
HCW, lb	840	828	839	845	0.26	0.30	0.57
LM area, in^2	12.95	12.68	12.53	12.55	0.49	0.36	0.95
12^{th}-rib fat, in	0.54	0.54	0.52	0.60	0.92	0.82	0.71
Marbling Score[8]	527	516	535	525	0.97	0.53	0.56

[1]Modified distillers grains plus solubles.
[2]15 = *P*-value for pair-wise contrast between de-oiled and normal MDGS at 15% concentration; 30 = *P*-value for pair-wise contrast between de-oiled and normal MDGS at 30% concentration.
[3]Int. = *P*-value for interactions between concentration of MDGS and oil content of MDGS.
[4]Final BW was calculated from HCW using a common dressing percentage of 63%.
[5]Analyzed as G:F, the reciprocal of feed conversion (F:G).
[6]Values calculated by pen, using 1996 NRC equations.
[7]Feeding Value Calculation = divide treatment G:F value by the normal fat MDGS G:F value within each diet concentration, take that value and subtract 1, and then divide by the concentration of de-oiled MDGS in the diet.
[8]Marbling Score: 400 = small°, 500 = modest °.

Results

De-oiled MDGS was 7.2% fat and 35.5% CP, whereas normal MDGS was 12.0% fat and 32.6% CP. As de-oiled MDGS increased, final BW, ADG, and F:G improved linearly (Table 2, $P \leq 0.02$) with no linear or quadratic trends observed in DMI between treatments ($P \geq 0.32$). Both NE_m and NE_g improved linearly with increasing inclusion of de-oiled MDGS

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($P = 0.01$, for both energy values). Hot carcass weight followed final BW as it linearly increase as de-oiled MDGS was added to the diet ($P = 0.02$). *Longissimus* muscle area was not statistically different between treatments ($P \geq 0.17$); however, linear increases in 12th-rib fat depth ($P < 0.01$) and marbling scores ($P = 0.05$) were observed as de-oiled MDGS concentration in the diet increased. Linear improvements in 12th-rib fat thickness and marbling scores are likely related to the linear improvements observed for ADG. Cattle performance and carcass characteristics values are similar to what has been observed in previous research conducted on normal fat distillers grains (Huls et al., *2008 Nebraska Beef Cattle Report,* pp. 41-42).

Analysis of the embedded 2 × 2 factorial showed a tendency for a interaction between oil content and concentration of MDGS in the diet on F:G ($P = 0.07$; Table 3). Cattle consuming normal MDGS diets at 30% inclusion were numerically 3.4% more efficient than their de-oiled MDGS counterparts. Numerical improvements in F:G were not as profound at 15% inclusion in the diet because cattle consuming the normal MDGS diet were only 1.4% more efficient than those consuming the de-oiled MDGS diet. The main effect of concentration illustrated a tendency for improvement in F:G when MDGS were fed at 30% of the diet ($P = 0.07$). In 30% MDGS diets, NE_m and NE_g had a tendency to be greater for the normal MDGS diet ($P = 0.12$ and $P = 0.10$, respectively) compared to the de-oiled MDGS diet. However, numerical differences in NE_m or NE_g were not observed at 15% concentrations when comparing normal and de-oiled MDGS diets. Twelfth-rib fat depth was significantly greater in cattle consuming 30% MDGS diets ($P = 0.01$). The results of this study suggest increasing the inclusion of de-oiled MDGS in a beef feedlot diet improves F:G similar to previous work with normal MDGS (*2008 Nebraska Beef Cattle Report,* pp. 41-42). Impacts of oil removal appear to be dependent upon dietary inclusion. No significant differences were observed when de-oiled and normal MDGS were fed at 15% of the diet; however, when the concentration of MDGS increased to 30% in the diet, cattle consuming normal MDGS diets were 3.4% more efficient.

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