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Summary

Sixty individually fed steers were used to determine the effects of feeding de-oiled modified distillers grains plus solubles (MDGS) on steer performance in an 84-day forage-based growing study. De-oiled MDGS did not significantly alter performance when compared to normal MDGS if fed at the same concentration in growing diets. Inclusion of either de-oiled or normal MDGS at 40% of the diet resulted in improved ending BW, DMI, ADG, and F:G as compared to inclusion of 20% MDGS in the diet.

Introduction

Recently, it has become increasingly common for ethanol plants to remove oil from the thin stillage component of the distillers grain product. Ethanol plants have been finding market value in the corn oil produced from the ethanol process, and thus have begun to remove the oil from the thin stillage constituent via centrifugation. Previous research suggests fat content of modified distillers grains plus solubles (MDGS), when fed at 40% of the diet, does not affect ADG, HCW, and F:G in a feedlot finishing trial (*2013 Nebraska Beef Cattle Report*, pp.64-65). The effects of feeding de-oiled condensed distillers solubles (CDS) in growing cattle diets has been previously evaluated. Feeding 20% normal CDS improved feed efficiency by 13.6% compared to de-oiled CDS, but only improved feed efficiency by 1% at 40% inclusion (*2013 Nebraska Beef Cattle Report,* pp. 25-26). We hypothesized that feeding normal MDGS would improve performance compared to de-oiled MDGS when fed at low inclusions, but would not be different at 40% inclusion because of negative associative effects of feeding fat with fiber. Thus, the objective of this study was to determine the energy value of de-oiled MDGS at two inclusions in a forage-based diet.

Procedure

An 84-day growing study utilized 60 crossbred steer calves (BW = 660 ± 56) that were individually fed using the Calan gate system at the University of Nebraska–Lincoln Agricultural Research and Development Center (ARDC) near Mead, Neb. Prior to the start of the trial, steers were limit-fed a diet consisting of 25% alfalfa, 25% grass hay, and 50% *Sweet Bran*® at 2.0% BW for five days to minimize differences in gut fill. Steers were then weighed on three consecutive days to determine initial BW. Based on initial BW, steers were blocked into six blocks and then assigned randomly to one of five treatments within block. Treatments were organized in a 2x2+1 factorial design, with five total treatments and 12 steers per treatment. The first treatment factor was concentration of distillers grains at 20% or 40% of the diet (Table 1). The second factor was either de-oiled (7.2% fat) or normal (12.0% fat) modified distillers grains plus solubles (MDGS). A 40% (DM basis) dry-rolled corn (DRC) diet was used as the control. Corn stover (ground through a 1-inch screen) and supplement comprised the remainder of all five diets. All diets were formulated to meet the metabolizable protein requirements using the 1996 NRC model. Cattle consuming the 40% DRC control or 20% distillers grains diets had urea supplemented at 1.65% of the diet to meet metabolizable protein requirements. Diets were also formulated to provide 200mg/steer of monensin daily. All steers received a Ralgro implant on day 21 of the study.

Feed refusals were collected weekly, weighed, and then dried in a 60°C forced air oven for 48 hours to calculate an accurate DMI for individual steers. Feed ingredient samples were

Table 1. Diet composition on a DM basis fed to growing steers.

	Control[1]	De-Oiled MDGS[2]		Normal MDGS[2]	
Ingredient, % of DM	0	20	40	20	40
De-oiled MDGS	—	20.0	40.0	—	—
Normal MDGS	—	—	—	20.0	40.0
DRC	40.0	—	—	—	—
Corn Stover	55.0	75.0	55.0	75.0	55.0
Fine Ground Corn	1.68	1.68	3.41	1.68	3.41
Limestone	1.19	1.19	1.11	1.19	1.11
Salt	0.30	0.30	0.30	0.30	0.30
Tallow	0.10	0.10	0.10	0.10	0.10
Urea	1.65	1.65	0.00	1.65	0.00
Rumensin-90[3]	0.01	0.01	0.01	0.01	0.01
Trace Mineral premix	0.05	0.05	0.05	0.05	0.05
Vitamin ADE premix	0.02	0.02	0.02	0.02	0.02
Diet Composition (% diet DM)					
Fat	2.25	2.25	3.45	3.25	5.45
Sulfur	0.12	0.19	0.30	0.18	0.28
Protein	12.28	16.76	16.18	17.89	16.73
NDF	48.64	68.10	68.28	59.44	59.80

[1]Urea was added to supplements formulated for control and 20% distillers grain diets to meet metabolizable protein requirements.
[2]MDGS=modified distillers grains plus solubles.
[3]All diets formulated to provide 200 mg/steer daily of Rumensin.

Table 2. Effects of de-oiled and normal fat MDGS[1] fed at 20 and 40% inclusion in forage-based diets.

	20 % MDGS		40% MDGS		40% DRC			*P*-values[2]		
	De-oiled	Normal	De-oiled	Normal	Control	SEM	F-Test	Concentration	Type	Int
Initial BW, lb	659	663	663	661	660	5	0.98	0.83	0.90	0.58
Ending BW, lb	731[a]	728[a]	809[c]	797[b,c]	772[b]	10	<0.01	<0.01	0.39	0.64
DMI, lb/day	11.6[a]	10.9[a]	13.7[b]	12.9[b]	13.1[b]	0.4	<0.01	<0.01	0.05	0.95
ADG, lb	0.86[a]	0.77[a]	1.73[c]	1.61[c]	1.33[b]	0.10	<0.01	<0.01	0.26	0.85
Feed:Gain	13.89[a]	14.09[a]	7.94[c]	7.87[c]	9.80[b]	—	<0.01	<0.01	0.85	0.98

[1]Modified distillers grains plus solubles.
[2]Concentration = Main effect of MDGS concentration in the diet; Type = Main effect of de-oiled vs. normal MDGS; Int = Interaction of MDGS concentration and MDGS type.
[a,b,c]Means with unlike superscript letters differ ($P = 0.05$).

collected each week throughout the trial, and analyzed for fat, sulfur, protein, and fiber content. At the conclusion of the study, steers were limit-fed for five days the same diet fed prior to the start of the trial and then were weighed on three consecutive days and averaged to determine an accurate ending BW.

Data were analyzed as a 2X2 factorial arrangement of treatments to evaluate the interaction of MDGS concentration (20% vs. 40%) and fat content (de-oiled vs. normal). If no interaction was detected ($P < 0.05$), main effects were evaluated. Additionally, an F-test was used to determine the response to the 40% DRC control to other treatments. Treatment means were separated using a t-test ($P < 0.05$) when the F-test was significant ($P < 0.05$).

Using the 1996 NRC, the energy value of MDGS relative to DRC was calculated by using the observed ADG. First, the TDN of MDGS and cornstalks were set at 108% and 43%, respectively. Then the NE adjusters were set so that the observed ADG was achieved in the model for 20% and 40% MDGS inclusion. This resulted in NE adjusters of 131% and 106% for 20% and 40% MDGS, respectively. The change in NE adjuster per change in ADG was calculated to determine the NE adjuster required to achieve the ADG for the 40% DRC control (116%). Finally, the TDN of DRC was adjusted to achieve the observed gain for the 40% DRC control. The resulting TDN for DRC was estimated to be 87% which is similar to a previous estimated TDN of DRC in forage-based diets of 83% (*2003 Nebraska Beef Cattle Report,* pp. 8-10). The TDN of DRC was compared to the TDN of MDGS to provide a relative energy value of MDGS to DRC in a growing, forage-based diet.

Results

The fat content of the de-oiled and normal MDGS were 7.2% and 12.0%, respectively, and DRC and corn stover contained 4.0% and 1.0% fat, respectively. Sulfur content was 0.63% and 0.57% for de-oiled and normal MDGS, and 0.16% and 0.10% for DRC and corn stover, respectively. Protein content was 35.5% and 32.6% for de-oiled and normal MDGS, respectively, and 9.9% and 6.7% for DRC and corn stover, respectively. Fiber (i.e., NDF) content was 37.5% and 38.4% for de-oiled and normal MDGS, respectively, 10.5% for DRC, and 80.8% for corn stover. There was no inclusion by fat content interaction observed between de-oiled and normal MDGS at either 20% or 40% inclusion in this study (Table 2). Main effects of concentration and fat content of MDGS will be discussed.

Concentration of MDGS

As expected, feeding 40% MDGS resulted in greater ending BW, DMI, and ADG ($P < 0.01$) compared to 20% MDGS. Additionally, steers consuming 40% MDGS had improved F:G ($P < 0.01$) compared to steers consuming 20% MDGS.

Fat Content

Steers receiving diets with MDGS containing 7.2% fat had a greater DMI when compared to steers fed MDGS containing 12.0% fat ($P = 0.05$). Ending BW ($P = 0.39$) and ADG ($P = 0.26$) were not significantly different for steers fed de-oiled or normal MDGS diets, but steers fed diets containing 12.0% fat numerically gained less than those consuming 7.2% fat diets causing F:G to be unaffected ($P = 0.85$).

Energy Value

Cattle consuming the 40% DRC control diet tended to be lighter at the conclusion of the study compared to the those cattle receiving the 40% normal MDGS diet ($P = 0.08$). Their DMI was not different compared to cattle receiving either 40% de-oiled or normal MDGS ($P = 0.28$ and $P = 0.81$ respectively), and ADG and F:G were intermediate for steers fed the DRC control diet compared to steers fed 20% or 40% inclusion of either normal or de-oiled MDGS. The energy value of MDGS relative to corn was calculated to be 124% for these growing calves. The results of this study suggest that removing oil from thin stillage to create MDGS fat content of 7.2% vs. 12.0% does not alter cattle performance in forage-based diets. Further reduction of corn oil in MDGS may result in decreased performance, thus further research will be required if additional oil is removed from distillers grains.

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