Impact of Varying Inclusion of Modified Distillers Grains Plus Solubles Compared to Constant Inclusion on Feedlot Cattle Performance and Carcass Characteristics

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Summary with Implications

An experiment was conducted to evaluate the effect of varying inclusion of modified distillers grains plus solubles on a weekly basis with two inclusions of grass hay on the performance of finishing steers. No interaction was observed between modified distillers grains plus solubles inclusion (0%, 25% constant, or 25% varying from 15–35%) and hay inclusion (6% or 12%). When evaluating the effect of hay inclusion on performance, cattle fed 6% grass hay had less dry matter intake than those fed 12% grass hay, and there was a tendency for gains to be greater for cattle fed 6% grass hay. Adding 25% modified distillers grains plus solubles to the diet improved gain and feed conversion. Interestingly, varying modified distillers grains plus solubles inclusion from 15 to 35% (averaged 25% over the whole feeding period) did not impact average daily gain or feed conversions if the variations were weekly and the average inclusion was 25% during the feeding period. As a result, adding extra roughage was unnecessary.

Introduction

The inclusion of distillers grains has been used extensively by the beef industry as a protein supplement (inclusions < 15%) or an energy source (inclusions > 15%). With increasing availability and competitive prices, inclusions increased for many feedyards as a replacement for corn with inclusions of 30% or more. More recently, the inclusion of distillers grains in beef finishing diets has been decreasing due to inconsistent supply or availability at a competitive price. In all previous research evaluating the energy value and economic opportunity for feeding distillers grains, inclusion never varied, which may not mimic what producers experience with varying supply over the feeding period for their cattle. Our hypothesis was that varying inclusion of MDGS in the diet would negatively impact cattle performance as varying MDGS in the diet also leads to varying corn content which may increase risk of acidosis. One solution to help with ruminal acidosis concerns with variable MDGS inclusion would be increasing roughage inclusion. Therefore, our objective was to evaluate if varying the inclusion of modified distillers grains plus solubles (MDGS) would impact performance compared to a constant inclusion, at either normal or elevated roughage inclusions.

Procedure

The experiment was conducted at the Eastern Nebraska Research, Extension, and Education Center near Mead, NE. Five hundred seventy-six crossbred steers (initial BW= 836 lb; SD = 52 lb) were fed for an average of 144 days. Before the study began, steers were restricted to 50% alfalfa hay and 50% Sweet Bran (DM basis) fed at 2% of body weight (BW) for 5 days to equalize gut fill. The initial BW was determined using the average of two weights collected across 2 days. The experiment was conducted in a randomized block design, with three body weight (BW) blocks: heavy, medium, and light, based on initial BW.

The treatment design was 2×3 factorial, with one factor being two inclusions of grass hay as the sole roughage source at 6% or 12%. The other factor was three inclusions or approaches to feeding MDGS. Inclusions were either 0 (0% MDGS) or 25% MDGS. Two treatments, both averaged 25% inclusion, but with either MDGS kept constant at 25% inclusion (25% constant), or inclusion varied from 15 to 35% by adjusting inclusion weekly so that at the end of the feeding period, inclusion averaged 25% of diet DM. For the variable inclusion (25% variable) either 15, 20, 25, 30, or 35% was fed. Inclusion variations occurred weekly, and each week's MDGS inclusion was randomly determined before the start of the experiment. Diet compositions are shown in Table 1. Pen was considered the experimental unit and the treatments were assigned randomly to pens, with each treatment replicated across 6 pens with 16 steers per pen, totalizing 36 pens.

On day 1, the steers received Revalor-IS (80 mg trenbolone acetate and 16 mg of estradiol; Merck Animal Health) and were re-implanted on days 52 or 55 with Revalor-200 (200 mg trenbolone acetate and 20 mg of estradiol; Merck Animal Health). Cattle in the heavy and medium blocks were supplemented with 300 mg ractopamine/steer daily (Optaflexx; Elanco Animal Health) for the last 28 days of the feeding period and the light block was supplemented during the last 42 days (all steers started on Optaflexx on the same day). Heavy and medium block cattle were fed for 137 days, light block cattle were fed for 151 days, and they were harvested at a commercial abattoir located in Omaha, NE. Hot carcass weight (HCW), and liver score data were collected during the harvest. 46 hours after slaughter. 12^{th} rib fat, *longissimus* muscle (LM) area and USDA marbling score were collected, and yield grade (YG) was calculated.

Data were analyzed using the MIXED procedure of SAS 9.4 as a 2×3 factorial and pen was considered the experimental unit. The fixed effects included in the model were grass hay inclusion (6% and 12%) and MDGS inclusion (0% MDGS, 25% MDGS constant, 25% variable MDGS), grass hay × MDGS interaction, and block. If no interaction was detected, the main effects of roughage inclusion and MDGS inclusion are presented. If a significant interaction was observed, then simple effects of MDGS inclusion within each roughage inclusion are presented.

Table 1. Composition of experimental diets fed to steers consuming two inclusions of grass hay and three distillers' grains inclusion strategies

	Treatments[1]													
	6% Grass Hay							12% Grass Hay						
		25% MDGS	Variable MDGS						25% MDGS	Variable MDGS				
Item	0% MDGS	Constant	15%	20%	25%	30%	35%	0% MDGS	Constant	15%	20%	25%	30%	35%
Ingredient[1], %														
HMC	44	31.5	36.5	34	31.5	29	26.5	41	28.5	33.5	31	28.5	26	23.5
DRC	44	31.5	36.5	34	31.5	29	26.5	41	28.5	33.5	31	28.5	26	23.5
Grass Hay	6	6	6	6	6	6	6	12	12	12	12	12	12	12
MDGS	-	25	15	20	25	30	35	-	25	15	20	25	30	35
Supplement 1[2]	6	-	3	1.2	-	-	-	6	-	3	1.2	-	-	-
Supplement 2[2]	-	6	3	4.8	6	6	6	-	6	3	4.8	6	6	6

[1] HMC=high-moisture corn, DRC=dry-rolled corn, MDGS= modified distillers grains plus solubles.

[2] Supplement 1 provided 2.31% soybean meal and 1.5% urea in the diet. Supplement 2 provided no urea and fine ground corn was used as a carrier to replace the soybean meal. Both supplements provided Rumensin (30 g/ton of DM), Tylan (8.8 g/ton of DM), minerals, vitamins, salt, and limestone.

Table 2. Main effects of roughage inclusion on performance and carcass characteristics of finishing steers

	Treatments[1]			
Item	6% Grass Hay	12% Grass Hay	SEM	*P*- value
Performance				
Initial BW, lb	867	866	0.5	0.13
Final BW[2], lb	1546	1518	5.7	<0.01
DMI, lb/d	28.9	30.0	0.17	<0.01
ADG, lb	4.80	4.61	0.04	0.07
F:G	6.02	6.49	0.001	<0.01
Carcass characteristics				
HCW, lb	974	956	3.6	<0.01
12th rib fat, in	0.66	0.65	0.010	0.61
LM area, in^2	14.9	14.7	0.09	0.07
Marbling score	485	488	6.4	0.70
Yield grade	3.41	3.41	0.022	1.00

[1] The treatments were due to grass hay inclusion in the diet. Grass Hay 6%= inclusion of 6% grass hay in the diet, Grass Hay 12%= inclusion of 12% grass hay in the diet (DM basis)

[2] Final BW calculated as HCW divided by a common dressing percentage of 63%.

Results

No interaction was observed between grass hay inclusion and MDGS treatment ($P \geq 0.37$) for any performance and carcass characteristics except for a tendency for F:G ($P = 0.09$). Cattle fed 6% hay tended to have similar F:G with all MDGS treatments (0% MDGS = 5.98, 25% MDGS constant = 6.02, MDGS variable = 6.02), but in treatments with 12% hay, the inclusion of MDGS improved F:G compared to 0% MDGS inclusion (0% MDGS = 6.66, 25% MDGS constant = 6.45, MDGS variable = 6.41). For all other variables, only main effects of either grass hay or MDGS treatment will be presented.

As expected, cattle fed 12% grass hay had greater dry matter intake (DMI; 30.0 lb/d) than steers fed 6% grass hay (28.9 lb/d; $P < 0.01$; Table 2). Steers fed 12% grass hay tended to have reduced ($P = 0.07$) average daily gain (ADG; 4.61 lb) compared to steers fed 6% grass hay (ADG =4.80 lb). Of the carcass traits, only HCW was significantly reduced ($P < 0.01$) for steers fed 12% grass hay (956 lb) compared to steers fed 6% grass hay (974 lb). There were no significant differences ($P \geq 0.61$) between 6 or 12% grass hay for other carcass characteristics (12th rib fat, marbling score, yield grade), except for a tendency ($P = 0.07$) for steers fed 12% grass hay to have reduced LM area.

Steers fed MDGS had greater ADG ($P < 0.01$; Table 3) than steers fed 0% MDGS, but there was no difference ($P = 0.29$) between steers fed 25% MDGS constant or variable MDGS. Steers fed 0% MDGS had lower DMI ($P < 0.01$) than steers fed MDGS, and there was a tendency ($P = 0.09$) for steers fed constant MDGS to have greater DMI than steers fed variable MDGS. Final BW and HCW were greater ($P < 0.01$) for steers fed MDGS than for steers fed no MDGS; there were no differences in final BW or HCW ($P = 0.23$) due to variable concentrations of MDGS. Both 12th rib fat and USDA yield grade were greater in the treatments containing MDGS ($P < 0.01$) than for 0% MDGS. No differences in marbling score were observed between constant and variable inclusion of MDGS ($P > 0.47$).

Conclusion

Feeding MDGS increased dry matter intake and average daily gain but was variable on whether feed conversion was improved depending on whether 6% or 12% hay was used. Varying inclusion of MDGS weekly in

Table 3. Main effects of MDGS inclusion on performance and carcass characteristics of finishing steers.

	Treatments[1]					
Item	0% MDGS	25% MDGS Constant	25% MDGS Variable	SEM	F-test	*P*- value Constant *vs* Variable
Performance						
Initial BW, lb	867	867	866	0.6	0.67	0.58
Final BW[2], lb	1494[b]	1556[a]	1545[a]	6.7	<0.01	0.22
DMI, lb/d	28.1[b]	30.3[a]	29.9[a]	0.20	<0.01	0.10
ADG, lb	4.44[b]	4.87[a]	4.80[a]	0.05	<0.01	0.29
F:G	6.32	6.21	6.21	0.001	0.29	0.85
Carcass characteristics						
HCW, lb	941[b]	980[a]	974[a]	4.2	<0.01	0.22
12th rib fat, in	0.60[b]	0.68[a]	0.69[a]	0.012	<0.01	0.50
LM area, in^2	14.7	14.9	14.8	0.11	0.52	0.53
Marbling score	464[b]	494[a]	501[a]	7.5	0.02	0.46
Yield grade	3.28[a]	3.47[b]	3.49[b]	0.026	<0.01	0.47

[a-b] Within a row, means without a common superscript differ (P < 0.05).

[1] The treatments were due to the MDGS (modified distillers grains plus solubles) inclusion in the diet. No MGDS= no inclusion of MGDS in the diet, MDGS Constant= constant inclusion of 25% MDGS in the diet, MDGS Variable= Weekly variation of MDGS, at levels of 15, 20, 25, 30, and 35% randomly distributed over the experimental period with an average of 25% inclusion in the total feeding period.

[2] Final BW calculated as HCW divided by a common dressing percentage of 63%.

finishing diets did not impact the performance of finishing cattle compared to constant inclusion when the variation occurred between 15 and 35% and the average inclusion was 25% during the feeding period. Given that performance was not hindered due to varying inclusion of MDGS, feeding more roughage was unnecessary as feeding more hay increased DMI, decreased gain, and reduced feed conversion.

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