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Summary

An experiment was conducted to determine the effects of dried distillers grains (DDG) supplementation level and composition on growing steer performance and forage intake. Factors included DDG supplementation level (0.25, 0.50, 0.75 or 1.00% of BW), and DDG solubles level (0, 5.4, 14.5, 19.1, or 22.1% DM). Final BW improved, and forage intake decreased with increasing levels of DDG. An interaction between DDG supplementation level and solubles level was observed on ADG and F:G and was likely related to supplemental fat levels. Supplementation of forages with DDG improves performance while decreasing forage intake when fat levels are not too great.

Introduction

Supplementing forage with dried distillers grains (DDG) decreases forage DMI and increases ADG (Morris et al., *2005 Nebraska Beef Report*, pp. 18-20; Morris et al., *2006 Nebraska Beef Report*, pp. 30-32). This allows producers to increase the carrying capacity of pastures, and expand current production without increasing the amount of land devoted to grazing. Although the forage replacement value of DDG has been researched, the importance of supplemental DDG composition has not. Of concern is the variability of DDG produced both between and within ethanol plants and its impact on animal production measures. The goal of the current study was to examine the effects of DDG composition at increasing levels of DDG supplementation in steers fed high quality forage.

Procedure

One-hundred twenty crossbred steer calves (549 ± 27 lb) were used in a randomized complete block design. Upon arrival at the feedlot, steers were individually identified and vaccinated. Five days prior to initiation of the experiment, steers were limit fed (2% BW) a diet containing 40% wet corn gluten feed, 27.5% grass hay, 27.5% alfalfa hay, and 5% supplement. Steers were weighed on three consecutive days, immediately prior to initiation of the experiment, and the average of the three weights was used as the initial BW. A 4 x 5 factorial treatment structure was used with the factors being DDG supplementation level (0.25, 0.50, 0.75 or 1.00% of BW), and DDG solubles level (0, 5.4, 14.5, 19.1, and 22.1% DM; calculated using NDF content of solubles and 0% solubles DDG). Varying solubles levels were added to the distillers grains before drying at the Otter Creek Ethanol, Ashton, Iowa. The amount ranged from 0 to 110% of the amount of solubles produced in the plant relative to the amount of dried grains (DM basis). Steers were stratified by weight before being assigned randomly to treatments, and the experiment was conducted in two blocks (60 steers/block) representing two different time periods.

All steers were fed once daily and allowed ad libitum access to the basal diet that consisted of 58.8% alfalfa hay, 39.2% sorghum silage, and 2% vitamin and mineral supplement. Steers were fed individually using Calan electronic gates and the DDG was placed on top of the forage to encourage complete consumption. Amount of DDG supplemented was determined using the initial BW for the first 28 days. Body weights were also taken days 27 and 28, as well as days 55 and 56. Average BW from those two-day periods was used to adjust supplemental DDG amounts appropriately. Prior to initiation of the trial, DDG was transferred from a feed bin to 50 lb bags. Samples were taken periodically during the bagging process to ensure a representative sample was obtained. Refused feed samples were taken weekly and analyzed for DM and CP content to determine the amount of DDG and forage refused. DDG samples were also taken and analyzed for DM, CP, fat, and NDF content (Table 1).

Results

Data for the effects of DDG supplementation level on intake and BW are presented in Table 2. There was a linear (*P*<0.01) effect of supplementation level on final BW, forage intake, and DDG intake. Distillers grains supplementation level also tended to affect final BW quadratically (*P*= 0.08). Final BW improved with increasing levels of DDG supplementation, but only a 1 lb increase was seen when increasing the DDG level from 0.75 to 1.00% of BW. Forage intake decreased, while DDG intake increased with increasing levels of supplementation. These observations are consistent with previous studies examining the effects of DDG supplementation level on intake and performance (Morris et al., *2005 Nebraska Beef Report*, pp. 18-20; MacDonald et al., *2006 Nebraska Beef Report*, pp. 27-29; Morris et al., *2006 Nebraska Beef Report*, pp. 30-32). Supplementing forage-based diets with DDG is advantageous in terms of maximizing forage use compared to corn. The high starch content of corn causes an increase in the number of ruminal amylolytic bacteria that compete with cellulolytic bacteria. Competition between these two bacterial populations leads to an overall reduction in fiber digestion. In the case of DDG, starch content is relatively low and bacterial competition is not a major factor.

Table 1. Composition of dried distillers grains with solubles.

	Solubles Level, %[a]				
	0	5.4	14.5	19.1	22.1
DM, %	95.5	92.1	90.8	89.3	89.6
CP, %	32.1	31.9	31.5	30.7	30.9
Fat, %	6.9	8.9	10.4	12.7	13.3
NDF, %	36.8	34.9	31.9	30.3	29.3

[a]Solubles level calculated using % NDF of solubles (2.3%) and 0% solubles DDG.

Table 2. Effect of dried distillers grains supplementation level on intake and BW of growing steers.

	DDG Supplementation Level, % BW					*P*-value		
	0.25	0.50	0.75	1.00	SEM	Linear	Quadratic	Cubic
Initial BW, lb	609	611	605	607	21.5	0.72	0.98	0.62
Final BW, lb	806	835	849	850	23.9	< 0.01	0.08	0.94
Forage intake, lb/day	15.2	14.6	13.8	12.4	0.8	< 0.01	0.18	0.50
DDG intake, lb/day	1.7	3.5	5.2	6.7	0.19	< 0.01	0.97	0.99

Table 3. Effect of dried distillers grains composition on intake and BW of growing steers.

	DDG Solubles Level, %						*P*-value		
	0.01	5.4	14.5	19.1	22.1	SEM	Linear	Quadratic	Cubic
Initial BW, lb	609	606	609	605	612	21.5	0.89	0.68	0.98
Final BW, lb	832	831	838	826	848	23.9	0.36	0.52	0.47
Forage intake, lb/day	13.9	14.1	13.9	13.6	14.5	0.8	0.69	0.28	0.06
DDG intake, lb/day	4.3	4.3	4.2	4.2	4.3	0.19	0.99	0.65	0.60

Table 4. Effect of dried distillers grains supplementation level and composition on ADG and F:G of growing steers.

	DDG Solubles Level, %					
DDG Level, % BW	0.0[a]	5.4[b]	14.5[b]	19.1[b]	22.1[c]	SEM
ADG						0.19
0.25[d]	2.57	2.33	2.13	2.22	2.50	
0.50[e]	2.38	2.52	2.85	2.49	3.08	
0.75	2.87	2.83	2.81	3.02	2.94	
1.0[f]	2.78	3.06	3.11	2.80	2.74	
F:G						—
0.25[d]	6.36	7.22	8.00	7.14	7.18	
0.50[e]	7.45	7.01	6.29	7.05	6.16	
0.75	6.58	6.64	6.42	6.28	6.74	
1.00	6.99	6.50	6.13	6.59	6.74	

[a]Cubic effect of DDG supplementation level on ADG within solubles level ($P<0.05$).
[b]Linear effect of DDG supplementation level on ADG within solubles level ($P<0.01$).
[c]Quadratic effect of DDG supplementation level on ADG within solubles level ($P<0.05$).
[d]Quadratic effect of solubles level within distillers grains supplementation level ($P<0.01$).
[e]Linear effect of solubles level within distillers grains supplementation level ($P<0.01$).
[f]Quadratic effect of solubles level within distillers grains supplementation level ($P<0.05$).

Data for the effects of DDG composition on intake and BW are presented in Table 3. There tended to be a cubic ($P= 0.06$) effect of solubles level on forage intake. The numerically lowest intake observed was with the 19.1% level and the numerically highest intake observed was with the 22.1% level. No other effects of solubles level on intake or BW were observed.

A DDG supplementation level x solubles level interaction ($P<0.01$) was observed for ADG and F:G (Table 4). The effects of DDG supplementation level on ADG within each solubles level may help explain this interaction. Within the intermediate solubles levels (5.4 - 19.1%) a linear ($P<0.01$) increase in ADG was observed in response to increasing DDG supplementation levels, but at the 22.1% level a quadratic ($P<0.05$) response was observed. Within the 22.1% solubles treatment group, the highest ADG were seen with the 0.50 and 0.75% DDG supplementation treatments. Within the 1.00% DDG supplementation group, a quadratic ($P<0.05$) response in ADG to solubles level was also observed. Within that group, a numeric increase in ADG was observed up to the 14.5% solubles level, but ADG numerically decreased when the solubles level was increased to 19.1 and 22.1%. Interestingly, steers within the 1.00% DDG supplementation group who were fed the 19.1 and 22.1% solubles consumed the highest amount of supplemental fat (4.5 and 4.8% of total diet DM respectively). Although fat content of the diet would be expected to increase the energy value of the diet, fat can also have a depressing effect on fiber digestion. At higher fat levels, the depression in fiber digestion may have overcome the increased energy supplied by the supplemental fat, possibly explaining the interaction. Results from this trial indicate that the highest supplemental fat level for maximizing ADG in steers consuming a high quality forage diet is between 3.6 and 4.5% of total diet DM.

In summary, with increasing levels of DDG, final BW was increased, whereas forage intake was decreased. The interaction between DDG supplementation level and solubles level on ADG and F:G is likely a reflection of factors associated with supplemental fat level. Although results from this trial indicate that feeding high levels of a high fat content DDG may depress ADG in steers fed a high quality roughage diet, over most treatments the response to solubles level appeared small. Within the DDG types fed in this trial that are most comparable to those fed by producers (5.4 - 19.1% solubles), ADG increased linearly with increasing DDG supplementation levels.

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