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Effect of Fat and Undegradable Intake Protein in Dried Distillers Grains on Performance of Cattle Grazing Smooth Bromegrass Pastures

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Summary

Growing heifers grazing smooth bromegrass pastures were supplemented daily with dry distillers grains, corn bran + corn oil, or corn bran + corn gluten meal to determine the relative contributions of fat and undegradable intake protein in dried distillers grains to animal performance. For cattle supplemented from 0 to 0.75% body weight with dried distillers grains, ADG was improved by 0.14 lb for every 0.10% BW increase in dried distillers grains supplementation. Cattle supplemented with corn bran + corn gluten meal gained 38% as much as cattle supplemented with dry distillers grains while cattle supplemented with corn bran + corn oil showed no improvement in ADG over cattle supplemented with a corn bran control supplement. Neither fat nor undegradable intake protein account for all the observed improvement in ADG from supplementing dry distillers grains.

Introduction

Dried distillers grains (DDG) have been shown to increase ADG in animals consuming both low and high quality forages (*2005 Nebraska Beef Cattle Report,* pp. 18-20) yet the reason for increased gain is unproven. It has long been recognized that cattle consuming actively growing forages will respond to undegradable intake protein (UIP) supplementation because the protein in the forage is highly degraded in the rumen causing a metabolizable protein (MP) deficiency (*1990 Nebraska Beef Cattle Report,* pp. 65-67). Dried distillers grains consist of approximately 15 to 20% UIP (DM), thus it is likely that UIP is responsible for the additional gain. However, DDG also contains 8 to 12% fat (DM) and 40 to 45% fiber (DM). The relative contributions of these nutrients to the performance of cattle grazing forages remains undocumented and are important because DDG nutrient compositions will change as the milling industry continues to alter the manner in which it processes corn. The purpose of the present study was to determine the relative contributions of UIP and fat to the performance of growing cattle grazing high quality forage.

Procedure

One hundred twenty crossbred heifers (811 lb, SD=86) were used to determine the relative contributions of UIP and fat measured as ether extract (EE) in DDG to animal performance. Heifers were blocked by previous gain and randomly received one of ten treatments in a 3 x 3 + 1 factorial arrangement with three supplements, three levels, and a control. Heifers rotationally grazed six smooth bromegrass pastures (IVDMD=65.7%, CP=20.8% DM, UIP=2.17% DM) which were nine acres each. Supplements were provided individually using a Calan gate system and refusals for each animal were collected weekly. Heifers were limit fed for 5 days at the beginning and end of the trial and weights were measured for three consecutive days to minimize variation in gut fill.

Supplements are shown in Table 1 and included DDG (15.8% UIP, 9.67% EE), corn gluten meal (CGM; 31.6% UIP, 0.83% EE) to provide UIP, or corn oil (OIL; 0.74% UIP, 19.3% EE) to provide fat. Corn gluten meal and corn oil were selected as sources of UIP and fat, respectively, because like DDG, they are derived from corn and therefore their amino acid and fatty acid profiles, respectively, should be similar to DDG. Levels of daily DDG supplementation were 1.65, 3.30, and 4.95 lb DM per head while CGM and OIL were supplemented daily with 0.83, 1.65, and 2.48 lb DM per head. While heifers supplemented with CGM and OIL were offered half the DM compared to heifers supplemented with DDG, their respective concentrations of UIP and fat were doubled such that the levels of these

(Continued on next page)

Table 1. Composition of supplements.

	Composition, %DM									
	DDG[a]			CGM			OIL			CONT
Ingredient/level	1[b]	2	3	1	2	3	1	2	3	
Dry distillers grains	96.8	98.4	98.9	—	—	—	—	—	—	—
Corn gluten meal	—	—	—	53.8	55.5	56.1	—	—	—	—
Corn oil	—	—	—	—	—	—	17.3	17.8	18.0	—
Corn bran	—	—	—	32.5	33.6	33.9	69.0	71.3	72.0	81.8
Molasses	—	—	—	7.4	7.7	7.8	7.4	7.7	7.8	7.1
Salt[c]	3.2	1.6	1.1	6.3	3.2	2.2	6.3	3.2	2.2	11.1

[a]DDG contained 15.8% undegradable intake protein (UIP), 9.67% ether extract (EE); CGM contained 31.6% UIP, 0.83% EE; OIL contained 0.74% UIP, 19.3% EE; CONT contained 2.07% UIP, 1.23% EE.
[b]Levels of DDG: 1=1.65 lb/hd/day, 2=3.30 lb/hd/day, 3=4.95 lb/hd/day; Levels of CGM and OIL: 1=0.83 lb/hd/day, 2=1.65 lb/hd/day, 3=2.48 lb/hd/day; CONT=0.55 lb/hd/day.
[c]Included to provide 25g/hd/day salt.

nutrients matched those found in DDG. Control heifers were each offered daily 0.55 lb of a supplement containing corn bran and molasses to serve as a carrier for salt. For CGM and OIL, corn bran was used as a carrier and molasses was included to bind the supplement and improve palatability. Salt was included in all supplements at levels that provided 25 g per head per day.

Forage intake for cattle consuming DDG was predicted from animal performance using TDN values for DDG and forage samples. Forage TDN was estimated from IVDMD values that were adjusted to In vivo digestibility values. This was accomplished by including five hay samples which had known In vivo digestibility values as standards in the In vitro run. The In vitro values were regressed on the known In vivo values for the five standards and the resulting equation was used to adjust the forage samples of interest. The TDN for DDG was set at 108% based on its comparison to corn fed in forage diets (*2003 Nebraska Beef Cattle Report,* pp. 8-10). Animal performance was used to predict TDN intake using the following equation by Winchester: TDN = 0.0553 $BW^{2/3}$ (1+0.805 ADG) where ADG and BW are expressed in pounds. This product was adjusted using the following equation that more accurately reflects forage intake in the current situation based on a study where cattle consuming forage diets were supplemented DDG and forage intake was directly measured (*2005 Nebraska Beef Cattle Report,* pp. 18-20): adjusted TDN intake = (predicted TDN intake - 2.07) / 0.94. The TDN from DDG intake was subtracted from TDN required to meet animal performance and the remaining TDN requirement was divided by TDN of the forage to yield forage intake.

Statistical analysis was conducted using the mixed procedures of SAS with block considered to be a random effect. Many heifers consumed less supplement than was offered such that it was not logical to analyze the data based on treatment allotments. Therefore, actual average daily UIP and fat intake as %BW were used as a covariate for regression analysis comparing DDG vs. CGM and DDG vs. OIL. Regression equations were developed using the solutions option in SAS with the highest order polynomials included in the equation that were significant at P<0.05. The statistical model and estimate statements were developed so it could be determined if each slope was different from 0 and if slopes were different from one another. The intercept was forced through the response of control cattle.

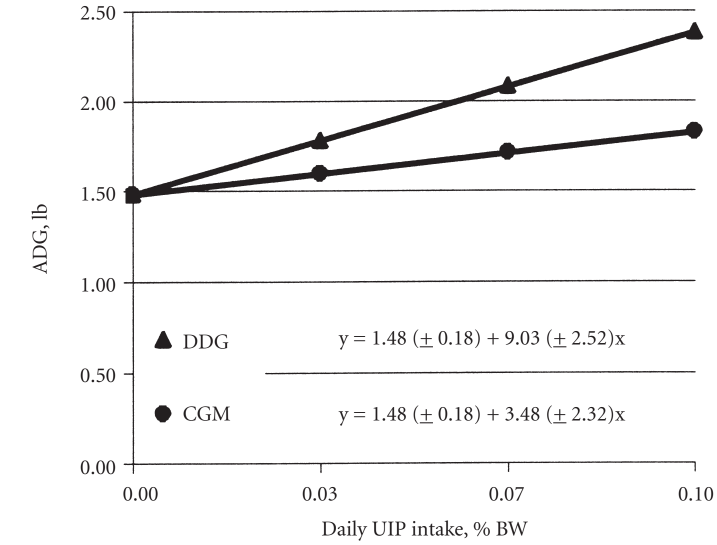

Figure 1. Effect of undegradable intake protien (UIP) intake from dry stillers grains (DDG) or corn gluten meal (CGM) on ADG. DDG slope > 0 (P < 0.01). CGM slope > 0 (P = 0.14). DDG slope > CGM slope (P = 0.10).

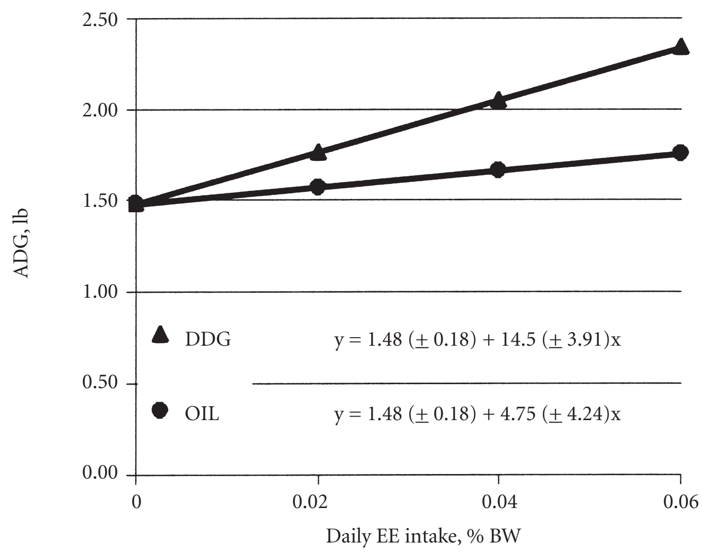

Figure 2. Effect of ether extract (EE) intake from dry stillers grains (DDG) or corn oil (OIL) on ADG. DDG slope > 0 (P < 0.01). OIL slope > 0 (P = 0.26). DDG slope > CGM slope (P = 0.09).

Results

Figure 1 and Figure 2 shows the response of ADG to UIP and fat supplementation, respectively. Animal performance was improved (P<0.01) from DDG supplementation when expressed either as UIP or EE intake as %BW. When expressed as DM intake as %BW (data not shown), the DDG slope was 1.42 (±0.39) and was significantly different from 0 (P<0.01). This equates to an 0.14 lb increase in ADG for every 0.10 %BW

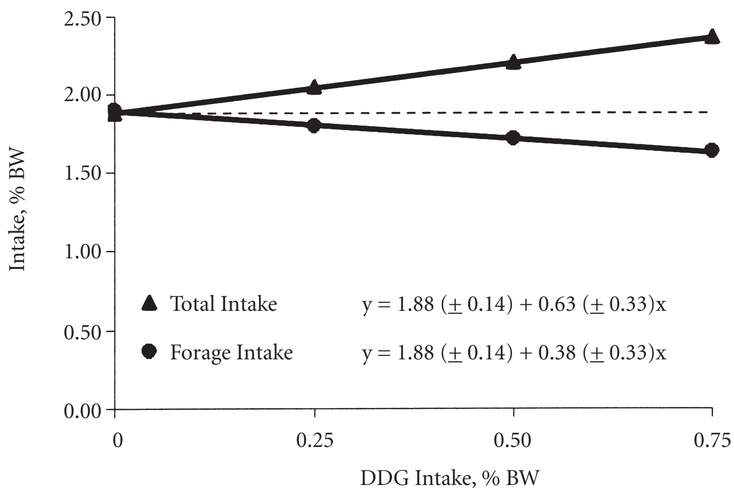

Figure 3. Effect of dry distillers grains supplementation on forage intake and total intake. Total intake slope > 0 (*P* < 0.07). Forage intake slope < 0 (*P* = 0.27). Dashed line represents intake of controls.

increase in DDG supplementation within the range of DDG supplemented in this study. Cattle in this study consumed DDG from 0 to 0.75% BW. Using these data, a 700 lb steer consuming 3.5 lb DDG (0.50% BW) would be expected to gain 0.70 lb/day more than the same animal not consuming DDG. This response matches closely with a previous gain response with high quality forages observed at the University of Nebraska (*2005 Nebraska Beef Cattle Report,* pp. 18-20), which measured a 0.13 lb increase in ADG for every 0.10 %BW increase in DDG supplementation.

Performance tended to be improved (P=0.14) from CGM supplementation, while the slope for OIL was not different from 0 (P=0.26). The response from DDG tended to be greater than the response from both CGM (P=0.10) and OIL (P=0.09). The slope for CGM was 38.5% the slope for DDG which may represent the proportion of the response of DDG that is due to meeting a MP deficiency. The fact that the response of CGM is linear rather than quadratic may indicate cattle used excess protein for energy. The lack of response from adding energy from OIL supplementation is not surprising considering MP is first limiting in these cattle and ruminal microbes yield essentially no microbial crude protein from fat. Therefore, supplying additional energy without protein should not be expected to improve gain. However, the added response of DDG over CGM and OIL suggests that adding energy and protein in combination may allow for additional gain. Other nutrients provided in DDG, such as phosphorus may also contribute to the additional gain, but we are unable to separate their relative contributions with these data.

The effects of DDG supplementation on forage intake and total intake are shown in Figure 3. There tended to be an increase in total DMI (P<0.07), but no significant decrease in forage intake (P=0.27) due to DDG supplementation. We have previously reported that one pound of DDG replaces from 1.72 (*2004 Nebraska Beef Cattle Report,* pp. 25-27) to 0.53 (*2005 Nebraska Beef Cattle Report,* pp. 18-20) pounds of forage in grazing cattle. The replacement rate for the current study was 0.38 lb forage replaced per lb DDG supplemented, but this small change was not significantly different from 0 when accounting for the variation in this study. Forage replacement may be inversely related to ADG because cattle in the current study showed the greatest gain response with no significant change in forage intake, while cattle in the afore mentioned study with the largest reduction in forage intake showed the smallest improvement in ADG. This issue needs to be developed further in the future because forage replacement is an important factor in determining the value of DDG in grazing situations.

Dry distillers grains significantly increase ADG in cattle grazing high quality forages. The response to CGM and lack of response to OIL in this data set suggests a portion of the increased ADG is due to meeting a MP deficiency. An associative effect of providing a combination of protein and energy from UIP and fat may be responsible for the additional gain observed from DDG supplementation. Other nutrients such as phosphorus may also play a role, but cannot be separated from these data.

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