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Effects of Sulfur Concentration in Distillers Grains With Solubles in Finishing Cattle Diets

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Summary

Effect of dietary sulfur on beef cattle fed diets containing wet or dry distillers grains with solubles (DGS) was evaluated. Sulfur concentration in DGS was either 0.82 or 1.16%. Steers (n = 120; IBW = 761 ± 75 lb) were individually fed ad libitum. Intake decreased when wet and dry 1.16% S DGS were fed. Gain decreased as wet DGS that was 1.16% S increased in the diet to 40%. Feeding wet DGS improved F:G, regardless of sulfur content. Fat thickness and HCW decreased as wet and dry 1.16% S DGS increased in the diet. High sulfur DGS reduced DMI and ADG when fed at high levels to cattle, but it depended on whether fed as wet or dry DGS.

Introduction

The importance of sulfur levels in beef cattle finishing diets and the consequent ruminal hydrogen sulfide (H_2S) production, due to the risk of polioencephalomalacia, has been reported (*2009 Nebraska Beef Cattle Report*, pp. 79-80; *2010 Nebraska Beef Cattle Report*, pp. 68-69). Before dietary sulfur reaches critical levels for animal health, animal growth performance also may be affected. Additionally, since dry and wet distillers grains with solubles have different energetic values, sulfur effects from these two co-products may be different. Therefore, the objective of our study was to determine the effect of dietary sulfur in beef cattle finishing diets formulated with wet or dry distillers grains with solubles that differ in S concentration.

Procedure

Cattle Background

One hundred and twenty crossbred beef steers (761 ± 75 lb BW) previously used in a growth experiment were adapted to electronic Calan gates and fed individually the experimental diets for 110 days.

Feeding and Experimental Design

Steers were allocated by weight in an unbalanced 2x2x3+1 randomized block design. Following a five-day limit feeding period (2% BW — bromegrass hay), cattle were weighed on three consecutive days, and stratified by BW based on day -1, and 0. Nine steers were assigned randomly to 1 of the 12 treatments, and 12 steers were used in a control diet (Table 1). Cattle were implanted on day 1 with Component TE-IS and on day 77 with Component TE-S, and fed from June 12 to Oct. 12, 2009 (151 days). Cattle were adapted to a high-grain finishing diet over 21 days by increasing intake (starting with 14 lb and increasing 0.5 lb/day until *ad libitum*). As levels of co-product inclusion were applied, the 4 high (40%) inclusion and control diets were mixed daily, using Roto mix feed trucks. The control diet was mixed with the 40% inclusion to target the lower (20 and 30%) co-product inclusions. Diets and individual ingredients were sampled weekly.

Treatments and Diet Composition

Treatments (Table 1) were applied as a 2x2x3+1 factorial treatment design with factor of co-product moisture (wet or dry distiller grains), sulfur concentration (0.82 or 1.16% of DM in the co-product), and co-product level of inclusion (20, 30, and

Table 1. Dietary treatments and chemical composition of diets containing wet or dry distillers grains with solubles, with high or low sulfur concentration in the co-product, and subsequent levels of inclusion.

		DDGS[1]			WDGS[1]		
	CONTROL	20%	30%	40%	20%	30%	40%
DDGS from 0.82 or 1.16 % S	—	20.0	30.0	40.0	—	—	—
WDGS from 0.82 or 1.16 % S	—	—	—	—	20.0	30.0	40.0
High-moisture corn	48.0	36.0	30.0	24.0	36.0	30.0	24.0
Dry-rolled corn	32.0	24.0	20.0	16.0	24.0	20.0	16.0
Corn silage	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Supplement [2]	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Low-sulfur diet chemical composition, % DM							
CP	13.1	14.4	14.5	16.1	13.9	13.8	15.1
Fat	4.0	5.6	6.3	7.0	5.9	6.9	7.8
NDF	14.9	19.3	21.5	23.7	18.0	19.5	21.0
Sulfur	0.13	0.26	0.33	0.40	0.26	0.33	0.40
High-sulfur diet chemical composition , % DM							
CP	—	15.1	15.7	17.7	14.6	14.9	16.9
Fat	—	5.5	6.2	6.9	6.1	7.2	7.6
NDF	—	18.2	19.8	21.4	17.1	18.1	20.0
Sulfur	—	0.33	0.43	0.54	0.33	0.43	0.54

[1]DDGS and WDGS = Dry distillers grains with solubles and wet distillers grains plus solubles, respectively.
[2]Supplement - There were three supplements for all 13 diets: one for the control, one for 20% DGS inclusion, and one for 30 + 40% DGS. All supplements were formulated to provide 30 g/ton DM Monensin, 90 mg/steer/day of Tylosin, and 150 mg/steer/day of Thiamine.

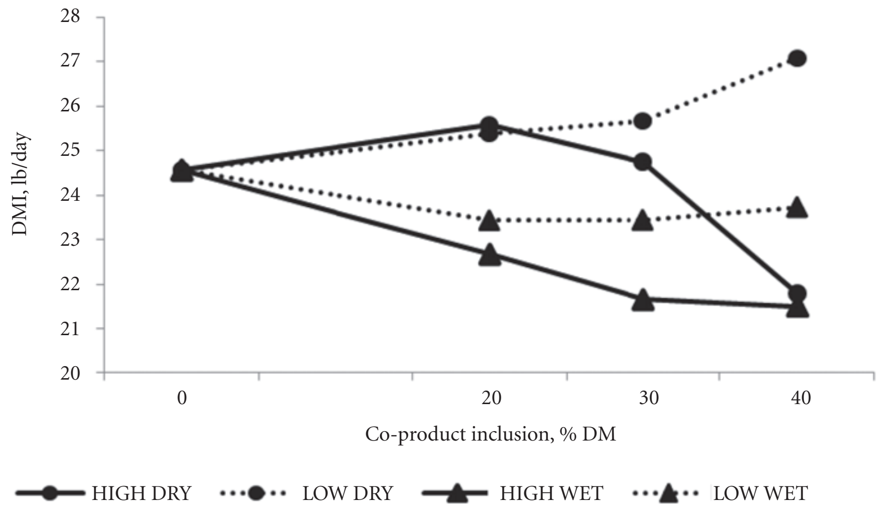

Figure 1. Dry matter intake, lb/day. High and low mean sulfur concentration in the co-product (1.16 and 0.82%, respectively); wet and dry mean diets based on WDGS and DDGS, respectively. Intake decreased linearly (*P* < 0.01)when wet 1.16% S DGS (HIGH WET) were fed; decreased quadratically (*P* < 0.01)when dry 1.16 % S DGS (HIGH DRY) were fed; and increased linearly (*P* = 0.02)when dry 0.82% S DGS (LOW DRY) were fed.

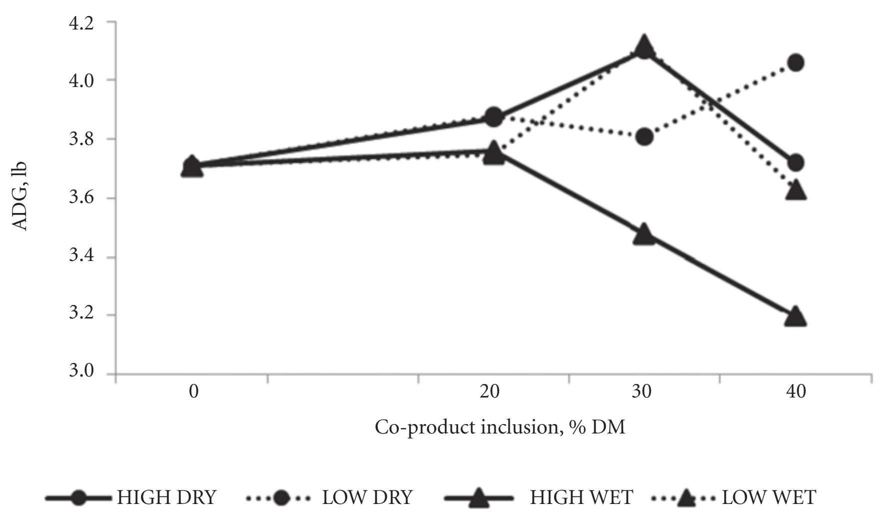

Figure 2. Average daily gain, lb. High and low means sulfur concentration in the co-product (1.16 and 0.82%, respectively); wet and dry mean diets based on WDGS and DDGS, respectively. Gain decreased linearly (*P* = 0.02) when wet 1.16% S DGS (HIGH WET) were fed.

40% DM basis). A corn control diet (Control: no co-product) was also fed. Co-products were obtained from two different dry mill ethanol plants: as either wet or dry DGS. A blend (60:40 DM basis) of high-moisture and dry-rolled corn was replaced as DGS increased.

Measurements and Statistical Analysis

Steers were fed individually *ad libitum* once daily in the morning. Bunks were evaluated prior to feeding and the amount offered adjusted daily. Refusals were removed once a week and subsampled. Dry matter intakes were calculated from DM offered, subtracting DM refused. Final BW was calculated from HCW assuming 62% dressing percentage. Cattle were shipped to a commercial packing plant (Greater Omaha, Omoaha, Neb.) where fat thickness and rib eye area were measured through a digital camera device. Since the steers were fed individually, each animal was considered an experimental unit. The factorial evaluation (3x2x2) was analyzed using GLIMMIX procedure of SAS. Orthogonal contrasts between the control and other diets also were tested for linear and quadratic effects of DGS level with sulfur concentration and whether wet or dry.

Results

Intake linearly increased (*P* = 0.02) when dry 0.82% S DGS was included in the diet, but DMI was not affected when wet 0.82% S DGS was fed (Figure 1). Greater DMI for dry DGS compared to wet DGS suggests dry DGS has lower energy content compared to wet DGS. However, regardless of whether fed wet or dry, high sulfur concentration decreased DMI. Intake decreased linearly (*P* < 0.01) for wet DGS and quadratically (*P* < 0.01) for dry DGS that was 1.16% S.

Gain (Figure 2) decreased linearly (*P* = 0.02) when wet 1.16% S DGS was increased in the diet. Feeding greater sulfur decreased DMI and ADG for steers fed wet DGS. These data suggest drying either changes sulfur availability or conversion to H_2S. Other diets did not result in a similar pattern. Steers fed wet DGS had improved F:G with similar ADG

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(Figure 3). A quadratic response ($P < 0.05$) was observed for F:G when wet DGS increased in the diet, with the best F:G at 20 and 30%, regardless of sulfur content.

A linear ($P < 0.05$) decrease was observed for fat thickness as wet and dry 1.16% S DGS increased in the diet, while no changes were observed for wet and dry 0.82% S DGS diets (Figure 4).

High sulfur DGS reduces DMI, ADG, HCW and fat thickness when fed at 40% of inclusion in beef cattle finishing diets, but depends on whether fed wet or dry. Wet DGS improves feed efficiency compared to dry DGS.

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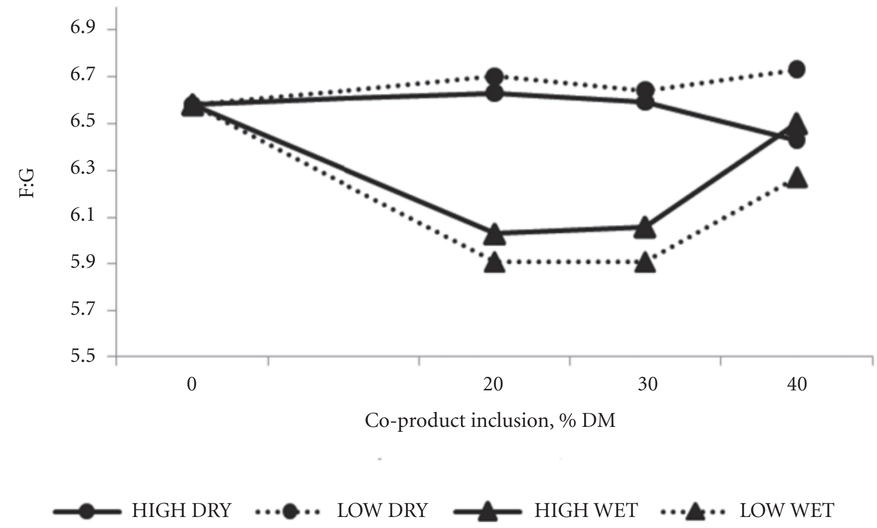

Figure 3. Feed efficiency. High and low means sulfur concentration in the co-product (1.16 and 0.82%, respectively); wet and dry mean diets based on WDGS and DDGS, respectively; Quadratic ($P < 0.05$) response for F:G when wet DGS (HIGH WET and LOW WET) were fed, with the best F:G at 20 and 30%, regardless of sulfur content.

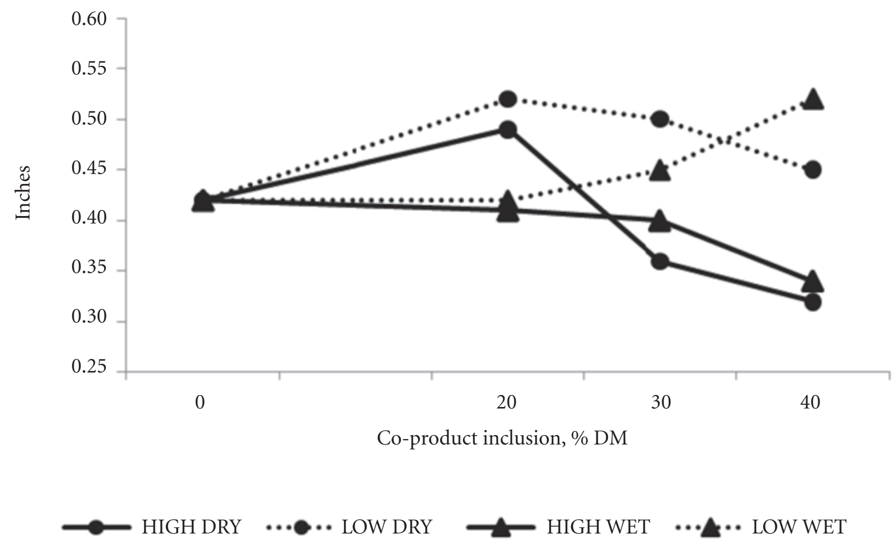

Figure 4. Fat thickness, inches. High and low means sulfur concentration in the co-product (1.16 and 0.82%, respectively); wet and dry mean diets based on WDGS and DDGS, respectively; linear decrease ($P < 0.05$) of fat thickness for wet and dry 1.16% S DGS (HIGH WET and HIGH DRY).