2011

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Summary

A grain adaptation metabolism trial was conducted to compare wet corn gluten feed (WCGF, Sweet Bran®, Cargill) to wet distillers grains with solubles (WDGS). In both strategies, co-products were fed at decreasing levels (87.5% to 35% of DM). The WCGF step-up strategy resulted in greater DMI than WDGS for cattle fed steps 1, 2, and 3. The average of ruminal pH was lower for WDGS with steps 2 and 3 compared to WCGF. No differences in H_2S between treatments were observed. Both WCGF and WDGS adaptation strategies resulted in safe ruminal pH, DMI, and H_2S, even when S levels were high.

Introduction

Using co-products containing high energy and low starch content, such as wet corn gluten feed (Sweet Bran, Cargill) are a viable adaptation strategy for beef cattle finishing diets (*2009 Nebraska Beef Cattle Report*, pp. 53-55; *2009 Nebraska Beef Cattle Report*, pp. 56-58) when compared to traditional forage step-up diets. Wet distillers grains with solubles (WDGS) also appear to safely adapt cattle to finishing diets when compared to a traditional adaptation method (*2010 Nebraska Beef Cattle Report*, pp. 66-67). However, DMI, ruminal pH, and hydrogen sulfide concentration of cattle managed under WCGF vs WDGS adaptation strategies are unknown, since the previous studies only compared these co-products against traditional adaptation methods containing roughage. Therefore, the objective of the current study was to determine impact of grain adaptation using strategies based on WCGF or WDGS as measured by ruminal pH, DMI, and ruminal H_2S concentration.

Procedure

Cattle Background

Six crossbred beef steers (661 ± 49 lb BW) were received as weaned calves in early February 2009 at the Animal Science Complex. Animals were ruminally fistulated and fed at maintenance based on bromegrass hay and a supplement containing macro and micro minerals at 2% BW until the beginning of the experimental period (May 1).

Diets, Feeding and Experimental Design

Cattle were stratified and assigned to one of the two adaptation strategies in a completely randomized design. The experiment was divided into six periods of seven days each. The first four periods consisted of decreasing co-products and increasing DRC in the diets. After 28 days, steers were fed a finishing diet containing 35% (DM basis) of each respective co-product. In the last period, a common diet containing a 1:1 blend of WDGS and WCGF for 35% total co-product inclusion was fed (Table 1). Bunks were read once daily prior to feeding, and steers were fed *ad libitum* once a day at 0800. Mean sulfur concentrations in the co-products were 0.87% and 0.49% of DM for WDGS and WCGF, respectively.

Measurements and Statistical Analysis

Dry matter intakes were calculated based on DM offered after subtracting DM refused. As the bunks were equipped with individual load cells, meal size was also evaluated. On day 0, pH probes were calibrated to take measurements at each minute and introduced into the rumen via rumen cannula, and downloaded at the end of each period. Ruminal gas samples were collected on day six and seven of each period, once daily eight hours post feeding, through devices inserted via rumen cannula prior to feeding on day six. Six gas samples were taken from each steer at each time point.

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Table 1. Dietary strategy to adapt cattle to finishing diets in a metabolism trial.

	Adaptation					
Ingredients, % DM	Step 1	Step 2	Step 3	Step 4	Finishing	Blend 1:1
WDGS[1]	87.50	74.38	61.25	48.13	35.00	17.50
WCGF	0.00	0.00	0.00	0.00	0.00	17.50
Dry rolled corn	0.00	13.13	26.25	39.38	52.50	52.50
Alfalfa hay	7.50	7.50	7.50	7.50	7.50	7.50
Supplement[2]	5.00	5.00	5.00	5.00	5.00	5.00
WDGS	0.00	0.00	0.00	0.00	0.00	17.50
WCGF[1]	87.50	74.38	61.25	48.13	35.00	17.50
Dry rolled corn	0.00	13.13	26.25	39.38	52.50	52.50
Alfalfa hay	7.50	7.50	7.50	7.50	7.50	7.50
Supplement[2]	5.00	5.00	5.00	5.00	5.00	5.00

[1]Adaptation treatment: WDGS and WCGF = decreasing wet distillers grains or wet corn gluten feed (Sweet Bran®) to 35% (DM basis) in the finishing diet, and increasing DRC during adaptation periods.
[2]Supplement: diets providing 30 g/ton of DM of Monensin, 90 mg/steer/day of Tylosin, and 150 mg/steer/day of Thiamine.

Hydrogen sulfide concentration was analyzed with a spectrophotometer. As each period consisted of a different diet, adaptation strategies were compared within each period individually, using GLIMMIX procedure of SAS. Data were analyzed with day as a repeated measure for pH and intake data, and values from the last period (Blend) used as a covariant for all variables.

Results

Steers fed WDGS adaptation strategy had lower ($P < 0.03$) DMI for steps 1 through 3 (Tables 2, 3, and 4). This effect may be partially explained by the fact that during these initial steps the high inclusion of WDGS (87.5%, 74.8% and 61.3 % of DM, respectively) resulted in high levels of fat and sulfur, compared to the WCGF strategy. Steers fed WDGS adaptation strategy also showed lower ($P < 0.04$) meal size during all steps and when fed the finisher diets.

Subtle differences on ruminal pH variables were observed after step 2 (Table 3). Steers on the WDGS adaptation strategy had lower pH average (steps 2, 3, 4, and finisher), greater time below pH 5.6 (steps 2, 3, and finisher), and greater area below pH 5.6 (steps 3, finisher, and blend). Albeit, both adaptation strategies had safe pH patterns, as variance was not different during the adaptation period. Moreover, the pH averages across all steps did not deviate much from the average of each respective finisher diet (Figure 1), showing a consistent pattern of ruminal pH for both adaptation strategies.

No differences ($P > 0.19$) and small concentrations of ruminal H_2S were observed, even for the initial steps of the WDGS adaptation strategy (Tables 2, 3, 4, and 5), that contained high inclusion of co-product. Hydrogen sulfide values were not high for the WDGS strategy during these initial steps; because DMI was also relatively low, S intake was also lower. It is unclear if S caused the depression in DMI. Regardless, S intake was low despite elevated dietary S concentrations.

Table 2. Intake, ruminal pH, and hydrogen sulfide during the adaptation period: STEP 1.

	Treatments[1]			
Variables – Step 1	WCGF	WDGS	*SEM*	*P*-value
Co-product inclusion, %	87.5	87.5		
Intake				
DMI, lb/day	17.28	9.24	1.19	0.02
Meal size, lb DM	3.06	1.61	0.26	0.04
Ruminal pH				
Average	6.11	6.02	0.19	0.75
Variance	0.037	0.049	0.013	0.38
Time below 5.6, min	211	371	192	0.58
Area below 5.6, min*pH	19	35	28	0.71
Ruminal gas sample				
Hydrogen sulfide, µmol/L	2.43	2.98	1.97	0.85

[1]Treatment: WDGS and WCGF = decreasing co-products to 35% (DM basis) in the finishing diet, and increasing DRC as steers go through adaptation periods.

Table 3. Intake, ruminal pH, and hydrogen sulfide during the adaptation period: STEP 2.

	Treatments[1]			
Variables – Step 2	WCGF	WDGS	*SEM*	*P*-value
Co-product inclusion, %	74.37	74.37		
Intake				
DMI, lb/day	21.12	15.10	0.33	< .01
Meal size, lb DM	2.20	2.40	0.04	0.04
Ruminal pH				
Average	5.69	5.39	0.02	< .01
Variance	0.039	0.027	0.010	0.26
Time below 5.6, min	372	979	83	0.01
Area below 5.6, min*pH	71	167	30	0.12
Ruminal gas sample				
Hydrogen sulfide, µmol/L	0.64	0.45	0.11	0.29

[1]Treatment: WDGS and WCGF = decreasing co-products to 35% (DM basis) in the finishing diet, and increasing DRC as steers go through adaptation periods.

Table 4. Intake, ruminal pH, and hydrogen sulfide during the adaptation period: STEP 3.

	Treatments[1]			
Variables – Step 3	WCGF	WDGS	*SEM*	*P*-value
Co-product inclusion, %	61.25	61.25		
Intake				
DMI, lb/day	22.0	19.25	0.46	0.03
Meal size, lb DM	2.58	2.04	0.51	0.03
Ruminal pH				
Average	5.85	5.57	0.02	< .01
Variance	0.041	0.046	0.006	0.49
Time below 5.6, min	233	861	78	0.01
Area below 5.6, min*pH	19	153	34	0.08
Ruminal gas sample				
Hydrogen sulfide, µmol/L	10.92	25.45	6.15	0.19

[1]Treatment: WDGS and WCGF = decreasing co-products to 35% (DM basis) in the finishing diet, and increasing DRC as steers go through adaptation periods.

Table 5. Intake, ruminal pH, and hydrogen sulfide during the adaptation period: STEP 4.

	Treatments[1]			
Variables – Step 4	WCGF	WDGS	*SEM*	*P*-value
Co-product inclusion, %	48.12	48.12		
Intake				
DMI, lb/day	21.56	19.93	0.68	0.20
Meal size, lb DM	4.28	3.22	0.29	0.02
Ruminal pH				
Average	5.67	5.55	0.04	0.07
Variance	0.051	0.046	0.005	0.77
Time below 5.6, min	592	858	93	0.14
Area below 5.6, min*pH	81	208	43	0.15
Ruminal gas sample				
Hydrogen sulfide, µmol/L	2.42	4.56	2.20	0.57

[1]Treatment: WDGS and WCGF = decreasing co-products to 35% DM basis) in the finishing diet, and increasing DRC as steers go through adaptation periods.

Table 6. Intake, ruminal pH, and hydrogen sulfide during the adaptation period: FINISHER.

	Treatments[1]			
Variables – Finisher	WCGF	WDGS	*SEM*	*P*-value
Co-product inclusion, %	35	35		
Intake				
DMI, lb/day	23.30	21.47	0.68	0.16
Meal size, lb DM	4.94	3.57	0.42	< .01
Ruminal pH				
Average	5.69	5.49	0.06	0.09
Variance	0.050	0.047	0.003	0.86
Time below 5.6, min	570	996	110	0.07
Area below 5.6, min*pH	92	253	44	0.10
Ruminal gas sample				
Hydrogen sulfide, μmol/L	1.73	2.55	1.08	0.68

[1]Treatment: WDGS and WCGF = decreasing co-products to 35% (DM basis) in the finishing diet, and increasing DRC as steers go through adaptation periods.

Table 7. Intake, ruminal pH, and hydrogen sulfide during the adaptation period: BLEND.

	Treatments[1]			
Variables – Blend	WCGF	WDGS	*SEM*	*P*-value
Co-product inclusion, %				
WCGF	17.50	17.50		
WDGS	17.50	17.50		
Intake				
DMI, lb/day	22.91	23.63	0.35	0.22
Meal size, lb DM	5.20	4.30	0.11	< .01
Ruminal pH				
Average	5.75	5.72	0.01	0.13
Variance	0.060	0.047	0.013	0.02
Time below 5.6, min	493	414	0.01	< .01
Area below 5.6, min*pH	79	130	8.0	0.01
Ruminal gas sample				
Hydrogen sulfide, μmol/L	5.66	0.71	0.34	< .01

[1]Treatment: WDGS and WCGF = decreasing co-products to 35% (DM basis) in the finishing diet, and increasing DRC as steers go through adaptation periods.

Both adaptation strategies appear to adapt cattle to finishing diets. Ruminal pH averages during the adaptation period and the average of the finisher diet of each respective adaptation strategy were similar. Due to DMI observed in this experiment, both adaptation strategies showed safe values of ruminal hydrogen sulfide concentration. However, before recommending the WDGS adaptation strategy, this treatment should be evaluated in a feedlot experiment.

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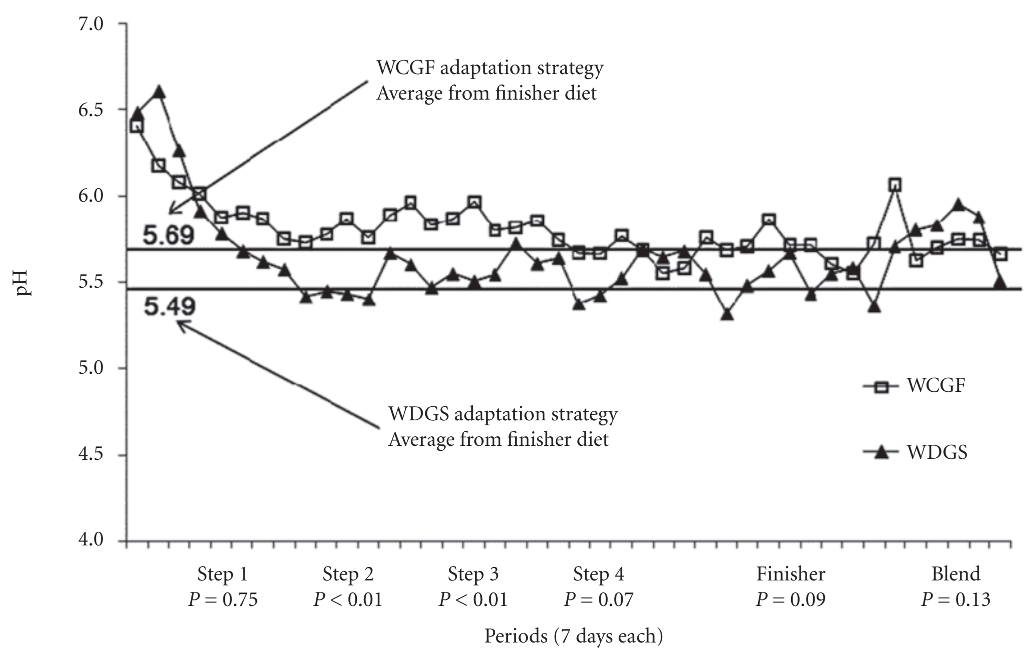

Figure 1. Daily ruminal pH across all experimental evaluation (42 days). *P*-values on the "x" axis represent difference between treatments inside of each period.