Use of Dry-rolled Corn, Dry or Wet Distillers Grains Plus Solubles as an Energy Source in High Forage Diets for Growing Cattle

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Summary

One hundred twenty crossbred steers were used to determine the energy value of distillers grains relative to corn in high-forage diets. Diets included dry distillers grains plus solubles (DDGS), wet distillers grains plus solubles (WDGS) or dry-rolled corn (DRC), with sorghum silage, grass hay, and supplement. Each block of steers, by design, had similar dry matter intake (DMI) and average daily gain (ADG) across treatments. In this study, WDGS and DDGS contained 120% and 114%, respectively, the energy of DRC when fed in forage-based diets.

Introduction

Past research has shown that in forage-based diets, feeding starch as an energy source can suppress forage digestion. Using dry distillers grains plus solubles (DDGS) or wet distillers grains plus solubles (WDGS) in place of dry-rolled corn (DRC) can reduce the negative associative effects that starch can have on fiber digestion. In forage-based diets, DDGS and WDGS have been shown to contain 118% to 130% (*2003 Nebraska Beef Report*, pp. 8-10) and 130% (*2009 Nebraska Beef Cattle Report*, pp. 28-29), respectively, the energy value of DRC, depending upon level fed. However, research evaluating the energy value of both DDGS and WDGS in the same study is limited in forage-based diets. The objective of this study was to determine the energy value of DDGS and WDGS relative to DRC in forage-based diets within the same experiment.

Procedure

Cattle Performance

One hundred twenty crossbred steers in two weight blocks (543 ± 22 lb) were used in an 84-day growing trial to compare the energy value of DDGS and WDGS, at differing levels, to DRC in a forage-based diet. Calves were blocked into two weight groups, stratified within block and assigned randomly to one of seven diets. Animals were randomly paired into groups of three based on BW and fed either the low or high levels of each diet: 1) DRC, 2) DDGS, or 3) WDGS. Prior to initial and ending BW, steers were limit fed a common diet, containing 60.0% Sweet Bran®, 20.0% grass hay, and 20.0% alfalfa to reduce variation in gut fill. Weights were obtained three consecutive days following each limit-feeding period.

Diets were formulated using the NRC (1996) model and were formulated to meet energy and metabolizable protein requirements. Diets were calculated to contain the same amount of energy assuming DGS contains 108% TDN. Gain was predicted at 1.74 lb/day for the low inclusion level at 15% and 2.37 lb/day for the high inclusion level at 30% DGS. Dry-rolled corn diets were formulated to equal these ADG, which calculated to 22% and 50% corn for low and high inclusion, respectively. Bunks were evaluated daily and managed based on the animal within each pair eating the least as a percentage of BW. Feed refusals were collected weekly, and DM of the feed refused was subtracted from DM offered to determine DMI.

For all diets, a 60:40 blend of grass hay and sorghum silage was fed, with DDGS, WDGS or DRC replacing this blend (Table 1). All diets contained a supplement that included urea to meet degradable intake protein requirements. Soypass® was used in the control diet and DRC treatments to provide undegradable intake protein (UIP) to meet the metabolizable protein requirement. Fat content of DDGS and WDGS was 11.0 and 11.0%, NDF was 36.9 and 37.8%, and CP was 30.2 and 31.0%, respectively. Fat content of DRC was 3.5 %, NDF 10.0%, and CP 9.5%. The NDF of sorghum silage and brome hay was 60.0 and 76.6%, respectively.

Table 1. Diet composition.

	Diet Treatment[1]						
	Control	DRC		DDGS		WDGS	
Ingredients	60:40	22	50	15	30	15	30
Grass hay	56.52	43.08	26.26	49.5	40.5	49.5	40.5
Sorghum silage	37.68	28.72	17.44	33.0	27.0	33.0	27.0
DRC	—	22.0	50.0	—	—	—	—
DDGS	—	—	—	15.0	30.0	—	—
WDGS	—	—	—	—	—	15.0	30.0
Urea	0.65	1.05	1.51	1.13	1.13	1.13	1.13
Soypass®	3.80	3.70	3.45	—	—	—	—
Limestone	0.82	0.943	0.943	0.943	0.943	0.943	0.943
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Trace mineral premix	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Vitamin ADE premix	0.015	0.15	0.015	0.15	0.015	0.15	0.15
Tallow	0.141	0.151	0.157	0.061	0.061	0.061	0.061

[1]Represented as a percentage of diet DM.

Table 2. Effect of feeding low or high levels of dry-rolled corn, dry distillers grains plus solubles or wet distillers grains plus solubles.

Item	DRC	DDGS	WDGS	SEM	*P*-value
	Diet Treatment				
Initial BW, lb	620	622	620	7.77	0.96
Ending BW, lb	803	801	798	8.72	0.91
DMI, lb/day	15.9	16.2	15.8	0.25	0.89
ADG	2.18	2.13	2.13	0.07	0.81
F:G	7.30	7.58	7.41	0.01	0.98

Table 3. Main effects of feeding differing levels of dry-rolled corn, dry distillers grains plus solubles, or wet distillers grains plus solubles.

Item	Control	Low	High	Linear
Initial BW, lb	622	620	621	0.94
Ending BW, lb	742	778	821	<0.01
DMI, lb/day	15.3	15.6	16.3	0.44
ADG	1.43	1.89	2.41	<0.01
F:G	10.75	8.26	6.76	<0.01

The NRC (1996) model predicts gain using DMI and dietary energy content. Therefore, energy content of the feed can be predicted if gain and DMI are known. Intake, diet composition, BW, and ADG were used to calculate the energy value of WDGS and DDGS in the treatment diets. The TDN of DRC utilized for this experiment had been determined in a similar manner at 83% (*2003 Nebraska Beef Cattle Report*, pp. 8-10), thus results for DDGS and WDGS could be expressed relative to corn.

Data were analyzed using the MIXED procedure of SAS with alpha = 0.10. The model included the level of byproduct inclusion and type of feed. Animal was considered the experimental unit (18 head/treatment) for cattle performance.

Results

Cattle Performance

There were no interactions between level of supplement inclusion (low or high) and type of feed (DRC, DDGS, or WDGS). By design, type of feed (DRC, DDGS, or WDGS) did not impact initial BW, ending BW, DMI, ADG, or F:G (Table 2). The main effect of level of inclusion is shown in Table 3. Ending BW and ADG increased linearly as the level of energy increased in the diets, while F:G linearly decreased ($P < 0.01$). This linear improvement was expected as the amount of grain or byproduct included increased, so did the level of energy. Intake was not different between levels ($P = 0.64$).

The TDN value for corn was set at 83% (*2003 Nebraska Beef Report*, pp. 8-10), 52% for hay, and 65% for sorghum silage. Using the NRC (1996) to calculate TDN, net energy (NE) adjusters were set at 104.5%. The resulting TDN value of DDGS and WDGS was 94.5% and 99.2%, respectively. Therefore, the estimated energy value of DDGS and WDGS was 114% and 120% the value of corn (94.5 ÷ 83 and 99.2 ÷ 83).

This trial reiterates that distillers grains (dry or wet) have a high energy value relative to corn in forage-based diets. The level of starch present at low amounts, the energy density of fat, undegradable protein and corn fiber are the possible reasons contributing to greater energy value compared to corn as a supplement.

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