2010

Comparing the Energy Value of Wet Distillers Grains to Dry Rolled Corn in High Forage Diets

Brandon L. Nuttelman
University of Nebraska - Lincoln, blnuttelman@huskers.unl.edu

Matt K. Luebbe
University of Nebraska - Lincoln, mluebbe2@unl.edu

Terry J. Klopfenstein
University of Nebraska-Lincoln, tklopfenstein1@unl.edu

Joshua R. Benton
University of Nebraska-Lincoln, jbenton2@unl.edu

Galen E. Erickson
University of Nebraska-Lincoln, gerickson4@unl.edu

Comparing the Energy Value of Wet Distillers Grains to Dry Rolled Corn in High Forage Diets

Brandon L. Nuttelman
Matt K. Luebbe
Terry J. Klopfenstein
Josh R. Benton
Galen E. Erickson[1]

Summary

Sixty crossbred steers were used to compare the energy value of wet distillers grains (WDGS) to dry rolled corn (DRC) in high forage diets at three levels. DRC was included at 22.0, 41.0, and 60.0% of the diet (DM), and WDGS was included at 15.0, 25.0, and 35.0% of the diet (DM). Diets were formulated to meet degradable intake protein and metabolizable protein requirements. Cattle consuming WDGS gained more than DRC cattle. Average daily gain increased with increasing levels of DRC and WDGS. The energy value of WDGS was calculated using the National Research Council model (1996). In this study, the energy value of WDGS was calculated to be 146, 149, and 142% the energy value of DRC.

Introduction

Previous research indicates WDGS contains 130% the energy value of DRC when fed at 25% of the diet DM in high forage diets (Nuttelman et al., *2009 Nebraska Beef Report*, p. 28). In light of the findings of Loy et al. (2008, *Journal of Animal Science*, 86:3504), who compared dried distillers grains (DDGS) to DRC, the 30% increased feeding value of WDGS is higher than expected. Nuttelman et al. (2009) reported a 46% improvement in feeding value compared to DDGS when WDGS is fed at 25% of the diet DM. The main objective of the present study was to compare the energy value of WDGS to DRC at increasing levels in forage-based diets.

Procedure

Sixty crossbred calves (509 ± 30 lb) were utilized in a completely randomized design to compare the energy value of WDGS to DRC in forage-based diets. Treatments were arranged in a 2x3 factorial design: energy source (WDGS and DRC) fed at three levels (LOW, MEDIUM, and HIGH). Calves were stratified by BW, then assigned randomly to treatment. All treatments contained 30% sorghum silage and various levels of grass hay depending on the inclusion level of WDGS or DRC (Table 1). Levels of WDGS were included at 15.0, 25.0, or 35.0% of the diet DM for diets containing WDGS. A feeding value of 130% the energy value of DRC established by Nuttelman et al. (2009) for WDGS in high forage diets was used to determine the inclusion level of DRC so the diets would be isocaloric. Therefore, DRC was included at 22.0, 41.0, or 60.0% of the diet DM for treatments containing DRC. Calves were matched with a calf of similar initial BW within the same level (LOW, MEDIUM, or HIGH) of energy sources to keep intakes identical for DRC and WDGS treatments. Average daily gain was allowed to vary among animals. Soypass® was included in the low and intermediate levels of DRC treatments to meet or exceed the metabolizable protein (MP) requirements, and urea was included in all diets to meet or exceed the degraded intake protein (DIP) requirements as determined by the NRC (1996) model, to prevent a protein response rather than an energy response between WDGS and DRC.

Steers were individually fed for 84 days using Calan electronic gates. Bunks were evaluated daily. Feed refusals were collected weekly and DM of refused feed was determined. Cattle were limit fed a mixture of 47.5% wet corn gluten feed, 47.5% alfalfa hay, and 5.0% supplement for 5 days prior to and following the feeding period to reduce variation due to gut fill. Calves were consecutively weighed on the final three days of each limit-feeding period, and the average of each three-day weight was used for initial and ending BW.

The NRC (1996) model uses feed intake and net energy content of the diet to predict animal performance. Therefore, if performance and feed intake are known, the energy content of the feed can be determined.

Data were analyzed using the MIXED procedure of SAS. Individual animal was the experimental unit (10/treatment). Interactions between energy source and level were tested.

(Continued on next page)

Table 1. Diet composition, % DM.

	WDGS[1]			DRC[1]		
Item	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH
WDGS	15	25.0	35.0	—	—	—
DRC	—	—	—	22.0	41.0	60.0
S.Silage[1]	30	30.0	30.0	30.0	30.0	30.0
Grass hay	52.8	42.8	32.8	42.5	24.6	6.8
Urea	0.8	0.8	0.8	1.0	1.3	1.6
Soypass®	—	—	—	3.0	1.5	—
Supplement[2]	1.4	1.4	1.4	1.5	1.6	1.6

[1] WDGS = Wet distillers grains plus solubles; DRC = dry rolled corn; S.Silage = sorghum silage.
[2] Supplements contained: limestone, urea, salt, trace minerals, and vitamins.

When interactions were not significant, main effects were reported.

Results

There were no type x level interactions ($P > 0.81$). Therefore, only the main effects of energy source and level are presented.

Type of Supplementation

There was no difference for initial or ending BW ($P > 0.13$; Table 2). By design, DMI was similar between treatments ($P = 1.00$). Cattle consuming diets containing WDGS gained 0.21 lb more per day than cattle consuming diets with DRC ($P < 0.01$). Gain efficiency also was improved for cattle consuming WDGS ($P < 0.01$) due to greater ADG and constant DMI.

Table 2. Main effects of energy source.

	DRC[a]	WDGS[a]	SEM	P-value
Initial BW, lb	510	508	6	0.82
Ending BW, lb	696	711	7	0.13
DMI, lb/day	15.8	15.8	0.24	1
ADG, lb	2.21	2.42	0.05	< 0.01
F:G	7.14	6.54	0.003	< 0.01

[a]DRC = dry rolled corn; WDGS = wet distillers grains plus solubles.

Table 3. Main effects of level of energy source.

	Level[1]						
	LOW	MEDIUM	HIGH	SEM	P-value	Linear	Quadratic
Initial BW, lb	507	510	510	7	0.93		
Final BW, lb	668[a]	715[b]	728[b]	8	< 0.01	0.28	< 0.01
DMI, lb/day	15.6	16.1	15.7	0.29	0.38	0.35	0.18
ADG, lb	1.91[a]	2.40[b]	2.60[b]	0.06	< 0.01	0.10	< 0.01
F:G	8.13	6.23	6.06	0.004	< 0.01	0.02	< 0.01

[1]LOW = 15% wet distillers grains plus solubles or 22% dry rolled corn; MEDIUM = 25% wet distillers grains plus solubles or 44% dry rolled corn; HIGH = 35% wet distillers grains plus solubles or 60% dry rolled corn.
[a,b]Means with different superscripts differ ($P < 0.05$).

Level of Supplementation

Initial BW was similar across level ($P = 0.93$; Table 3). Ending BW responded quadratically ($P < 0.01$) with increasing level of energy, with the LOW level being the lightest at the conclusion of the experiment. Dry matter intake was not different among levels ($P = 0.38$). There was a quadratic response for ADG with the MEDIUM and HIGH levels of DRC and WDGS, gaining 0.49 and 0.69 lb more per day, respectively, compared to LOW. Consequently, feed efficiency was improved with increased level of DRC and WDGS ($P < 0.01$).

The NRC (1996) model was used to determine the energy value of WDGS in relation to DRC in high forage diets. The percent TDN was set to 60% for sorghum silage and to 52% for grass hay. It was necessary to use the net energy (NE) adjusters in the NRC (1996) model to get actual cattle performance to determine the energy calculations in the study. The NE adjusters were set to 95.0, 92.5, and 90.4% for LOW, MEDIUM, and HIGH, respectively. The percent TDN for WDGS was increased until the observed ADG matched the NRC-predicted ADG. The resulting TDN value was divided by the TDN of the corn at the same level to determine the energy value of WDGS in relation to DRC. The feeding values of WDGS were 147, 149, and 142% the energy value of DRC when included in high forage diets at 15.0, 25.0, and 35.0% of the diet DM. This increased feeding value of WDGS in relation to DRC is attributed to the decreased negative associative effects on fiber digestion that are observed with increasing levels of starch, as well as the higher fat content of the WDGS. However, Loy et al. (2007, *Journal of Animal Science*, 85:2625) reported that fat level also can contribute to the quadratic response in animal performance observed with increasing levels of WDGS, due to the subsequent effect on ruminal cellulolytic activity.

The feeding value of WDGS appears to be higher than that of DDGS in relation to DRC when compared to the findings of Loy et al. (2008). The reason for this potential difference is unknown, but could potentially be due in part to the drying process. However, without a direct comparison of WDGS to DDGS at increasing levels, we cannot conclude WDGS has more energy than DDGS in high forage diets. However, this trial suggests that WDGS contains a higher energy value than DRC with values ranging from 142% to 149%.

---

[1]Brandon L. Nuttelman, graduate student. Mathew K. Luebbe, research technician. Terry J. Klopfenstein, professor. Josh R. Benton, research technician. Galen E. Erickson, associate professor, Animal Science, University of Nebraska, Lincoln, Neb.