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Utilization of Soybean Hulls When Fed in Combination with MDGS in Finishing Diets

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Summary

A finishing trial evaluated the effects of feeding different levels of soyhulls with modified distillers grains plus solubles (MDGS) on feedlot cattle performance. Soyhull inclusion level was 0, 12.5, 25, or 37.5% of diet DM. As soyhulls replaced dry rolled corn (DRC), ADG decreased linearly (4.22 vs 3.48) and F:G increased linearly in response to increasing levels of soyhulls. When comparing the feeding value of soyhulls relative to corn, feeding values decreased from 70 to 60% of corn as dietary inclusion of soyhulls increased from 12.5 to 37.5% of DM. Results show that as inclusion of soyhulls in the diet increase, ADG and F:G becomes poorer.

Introduction

Soybean hulls are a co-product from the soybean processing industry, where the soybean is de-hulled leaving a highly digestible, fibrous feed. Previous research (*Journal of Animal Science,* 2010, 88:E143) with diets including 35% soyhulls along with distillers grains, improved animal performance when compared to traditional corn-corn silage based diets. With this, minimal research exists when feeding different levels of soyhulls in place of corn in diets containing distillers grains plus solubles. Therefore, the objective of this experiment was to 1) determine optimum level of soyhulls in a feedlot finishing diet with modified distillers grains plus solubles (MDGS) and 2) assess the energy value of soyhulls relative to corn.

Procedure

A 117-day finishing study was conducted at the University of Nebraska–Lincoln Haskell Agricultural Laboratory in Concord, Neb. A randomized block design utilized 167 crossbred yearling steers (871 ± 48 lb). Prior to initiation of trial, steers were limit fed at 2% BW (a common diet) for four days to limit gut fill variation. Initial BW was established by weighing steers on two consecutive days (days 0 and 1) with cattle stratified by BW, blocked by day 0 BW into three blocks (light, medium, heavy), and assigned randomly to pens. Pens were assigned randomly to one of four treatments with six or seven steers per pen and six pens per treatment.

Dietary treatments (Table 1) consisted of pelleted soyhulls (ADM, Fremont, Neb.) fed at 0, 12.5, 25, or 37.5% diet DM while replacing dry rolled corn (DRC). All diets included 25% MDGS, 15% corn silage, and 5% liquid supplement. The liquid supplement was formulated to provide 318 mg/steer Rumensin® and 90 mg/steer Tylan® daily. The supplement contained limestone, salt, trace minerals, and vitamins to meet animal requirements. The nutrient composition of soyhulls was 57% NDF, 13.2% CP, and 3.8% ether extract.

Steers were implanted with Revalor®-S on day 0 and harvested at Greater Omaha Pack (Omaha, Neb.) on day 118. Hot carcass weight (HCW) and liver scores were recorded on day of slaughter. After a 48-hour chill, USDA marbling score, 12th rib fat depth, and LM area were collected. A common dressing percentage of 63% was used to calculate carcass adjusted performance to determine final BW, ADG, and F:G. Yield grade was calculated from the following formula: 2.5 + (2.5 x 12th rib fat) – (0.32 x LM area) + (0.2 x 2.5 [KPH]) + (0.0038 x HCW).

The NRC (1996) model was used to predict animal performance based on dietary energy content and intake. With input variables of diet composition, initial BW, final BW, ADG, and DMI known, the energy value of soyhulls relative to corn was calculated for each pen. Total digestible nutrients were assumed to be 90% for corn, 72% for corn silage, and 112.5% for MDGS in all diets. The net energy (NE) adjusters for the 0% level were adjusted to equal observed ADG for that treatment. The NE adjusters were set at 80.2%. With NE adjusters held constant, the percent TDN value for soyhulls was adjusted until the observed ADG for each pen was met using observed DMI. The energy value was then calculated by taking the percent TDN value of soyhulls divided by percent TDN of corn for each level.

The feeding value of soyhulls relative to corn was calculated for each inclusion level of soyhulls by taking the G:F (the inverse of F:G) of soyhulls minus G:F of 0% inclusion level, divided by the 0% G:F, then divided by the decimal percentage of inclusion level of soyhulls.

Table 1. Diet composition for diets containing 0% to 37.5% soyhulls (DM basis).

	Soyhulls, % Diet DM			
Ingredient[1], %	0	12.5	25	37.5
DRC	55.0	42.5	30.0	17.5
MDGS	25.0	25.0	25.0	25.0
Soyhulls	—	12.5	25.0	37.5
Corn Silage	15.0	15.0	15.0	15.0
Supplement	5.0	5.0	5.0	5.0

[1]DRC = dry rolled corn; MDGS = modified distillers grains solubles.

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Table 2. Effect of soyhulls inclusion on cattle performance and carcass characteristics.

Item	Soyhulls, % Diet DM				SEM	*P*-value	
	0	12.5	25	37.5		Lin.[1]	Quad.[2]
Performance							
Initial BW, lb	869	870	872	872	2	0.23	0.92
Final BW, lb[3]	1364	1343	1331	1279	11	<0.01	0.19
DMI, lb/day	26.8	26.6	26.9	25.9	0.2	0.04	0.10
ADG, lb	4.22	4.04	3.93	3.48	0.10	<0.01	0.19
Feed:Gain[4]	6.33	6.58	6.85	7.46		<0.01	0.37
Energy Value[5], %		88	84	82	4	<0.01	0.28
Feeding Value,[6] %		70	70	60			
Carcass Characteristics							
HCW, lb	859	846	839	806	7	<0.01	0.18
Marbling[7]	591	585	564	566	11	0.07	0.75
LM area, in^2	13.0	13.1	13.0	12.8	0.2	0.54	0.31
12th rib fat, in	0.49	0.47	0.48	0.48	0.03	0.78	0.82
Calculated YG	3.48	3.29	3.20	2.98	0.11	<0.01	0.90

[1]Lin. = *P*-value for the linear response to Soyhulls inclusion.
[2]Quad. = *P*-value for the quadratic response to Soyhulls inclusion.
[3]Calculated from carcass weight, adjusted to 63% common dressing percent.
[4]Analyzed as G:F, the reciprocal of F:G.
[5]Calculated from percent TDN of soyhulls, divided by percent TDN of corn (90%).
[6]Percent of corn feeding value calculated as percent different in G:F from control divided by inclusion.
[7]Marbling Score: 400 = Slight, 500 = Small, 600 = Modest, etc.

Performance and carcass characteristics were analyzed using the MIXED procedure of SAS (SAS Inst. Inc., Cary, N.C). Pen was the experimental unit and block was treated as a fixed effect. Orthogonal contrasts were constructed to determine the response curve (linear, quadratic, and cubic) for soyhulls level in the diet.

Results

As soyhulls level increased (Table 2), DMI decreased linearly ($P = 0.04$) as did ADG ($P < 0.01$). A 4.3% decrease in ADG was observed between levels 0% and 12.5% soyhulls, and a 17.5% decrease between 0% and 37.5% soyhulls. Feed conversion (F:G) increased linearly ($P < 0.01$) as levels of soyhulls increased, with a 3.9% increase in F:G observed from 0 to 12.5% soyhulls. Level of soyhulls had no effect on LM area or 12th rib fat, but showed a tendency ($P = 0.07$) for a linear decrease in marbling score. Both yield grade and HCW decreased linearly ($P < 0.01$) as inclusion of soyhulls in the diet increased, with steers fed 0% soyhulls having 53 lb heavier HCW than those fed 37.5% soyhulls.

The energy values of soyhulls relative to corn decreased linearly ($P < 0.01$) from 88 to 82% when inclusion of soyhulls increased from 12.5 to 37.5% in finishing diets. Feeding values of soyhulls were 70, 70, and 60% of corn when soyhulls were included at 12.5, 25, or 37.5% diet DM, respectively. These values were much lower than the values observed when using the NRC model. When looking at animal performance (i.e., ADG), the NRC model appears to overestimate the energy value of soyhulls, especially at higher inclusion levels. A reduction of 2% in energy value of soyhulls when comparing 25 to 37.5% inclusion doesn't explain the loss in gains that was actually observed. Therefore, the use of feed conversion (G:F) may accurately predict the feeding value of soyhulls observed by producers.

These data suggest that with increasing levels of soyhulls in the diet, DMI and ADG decrease; and F:G increases. As inclusion level of soyhulls increased, the cattle were leaner and lighter with same days on test. Based on results of this study, it appears that soyhulls should be included at levels of 12.5% or less in finishing diets for yearling steers and the price relative to corn is critical for economics. In contrast, a calf-fed study conducted with soyhulls in combination with wet distillers grains plus solubles (*2013 Nebraska Beef Cattle Report,* pp. 88-89) suggests that response to levels of soyhulls was much better than in the current study. Differences observed between studies could be partially attributed to the type and inclusion level of distillers grains utilized.

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