

INTAKE AND DIGESTIBILITY OF LOW-QUALITY NATIVE GRASS HAY BY BEEF COWS FED GRADED LEVELS OF SOYBEAN HULLS

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Story in Brief

Sixteen mature beef females were maintained on low-quality native grass hay to determine the effect of soybean hull supplementation on digestibility and intake of low-quality forage. Cattle received coarsely chopped (2 inch) native grass hay (3.7 percent crude protein) plus 0, 2.2, 4.4 or 6.6 lb of soybean hulls daily. Maximum hay intake was observed with 2.2 lb of soybean hulls. The substitution rate of soybean hulls for hay was low; feeding 6.6 lb of soybean hulls decreased hay intake by only 1.5 lb/day compared to the control. Organic matter digestibility increased with added soybean hulls. Digestible organic matter intake increased from 10.8 lb/day for the control to 12.7 lb/day when 6.6 lb of soybean hulls were fed suggesting that soybean hulls enhanced the energy status of the cattle. This study indicates that soybean hulls provide a useful alternative to cereal grains in high-energy supplements for cattle consuming low-quality forage.

(Key Words: Soybean Hulls, Supplement, Native Grass, Beef Cattle.)

Introduction

Beef cows wintered on native range require protein supplementation because of the low nutritional quality (< 4% crude protein) of dormant native grass. Low forage quality and availability frequently coupled with the increased energy requirements due to environmental or physiological stress may necessitate energy supplementation. Most high-energy supplements contain cereal grains which have been shown to decrease digestibility and intake of forage so that the nutritional status of the cow is not improved (Chase and Hibberd, 1985). Soybean hulls are a byproduct of the soybean milling industry that contain intermediate levels of protein (12.1%) and energy (64% TDN). Although soybean hulls offer an economical, low-starch alternative to cereal grains, their effectiveness as a supplement for low-quality forage has not been measured. The objective of this study was to evaluate the effect of feeding graded levels of soybean hulls on the intake and utilization of low-quality native grass hay by mature beef females.

Materials and Methods

Twelve Hereford cows (1000 lb) and four ruminally cannulated Hereford X Angus heifers (866 lb) were blocked according to weight into four simultaneous 4 X 4 latin squares. Four supplements (table 1) were formulated to provide 0, 2.2, 4.4 or 6.6 lb/day of soybean hulls and were fed once each day (0800 hours). Cottonseed meal was added to

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Table 1. Supplement intake and nutrient supply (DM basis).

	Soybean hulls (lb DM/day)			
	0	2.2	4.4	6.6
Daily intake, lb				
Cottonseed meal	2.12	1.42	.70	
Soybean hulls	--	2.23	4.46	6.68
Mineral mix ^a	.28	.28	.28	.28
Total	2.40	3.93	5.44	6.96
Nutrient supply, lb				
Crude protein	.94	.95	.95	.96
TDN (estimated)	1.6	2.5	3.4	4.3

^aMineral mix contained 53.7% dicalcium phosphate, 12.9% potassium chloride, 15.1% sodium sulfate, 17.6% trace mineralized salt and provided 18,000 IU Vitamin A/day.

equalize total protein intake for all supplements. Native grass hay (3.7 % crude protein) harvested in mid-November was coarsely chopped (2 inch screen) and offered free choice to all animals.

Fourteen-day experimental periods consisted of 9 days for adaptation followed by fecal sampling on days 10 to 13 (0800 and 2000 hours) and ruminal fluid sampling on day 14. Supplements and hay, offered and refused, were weighed and sampled daily. All samples were composited for each animal, dried (55 C) and ground through a 1 mm screen prior to analysis. Sample analyses included dry matter (DM), ash and acid-insoluble ash (AIA). Acid-insoluble ash was used as an indigestible marker to calculate organic matter (OM) digestibility.

Ruminal contents were sampled at 0, 2, 4, 6, 9, 12 and 24 hours post-supplementation. Ruminal pH was measured immediately after which the fluid was strained and acidified (1 ml 20% H₂SO₄/50 ml fluid) prior to freezing. Ruminal fluid samples were later analyzed for ammonia and volatile fatty acid (VFA) profiles.

Data were subjected to least squares analysis. Treatment responses were evaluated using orthogonal contrasts for linear, quadratic and cubic effects.

Results and Discussion

Hay intake responded quadratically (P<.05) to increased soybean hull supplementation and peaked at 2.2 lb/day of soybean hulls (table 2). Soybean hulls swell rapidly when exposed to water and might decrease hay intake via rumen fill. In this study, however, hay intake decreased by only 1.5 lb/day when 6.6 lb of soybean hulls were fed suggesting that rumen fill from soybean hulls was not a major factor limiting hay intake. Dry matter intake (hay plus supplement) also responded quadratically (P<.05) with added soybean hulls and peaked at 4.4 lb/day of soybean hulls.

Organic matter digestibility increased linearly (P<.01) with added soybean hulls (table 2). This response is expected due to the substitution of poorly digestible hay with more highly digestible soybean hulls. Soybean hull supplementation increased total feed intake

Table 2. Digestibility and intake of low-quality native grass hay with soybean hull supplementation.

Item	Soybean hulls, lb/day				SEM ^a
	0	2.2	4.4	6.6	
OM digestibility, % ^b	45.8	46.1	46.6	48.6	.69
Intake, lb/day					
Hay ^c	23.1	24.2	23.4	21.6	.66
Dry matter ^c	25.4	28.0	28.8	28.5	.66
Digestible OM ^d	10.6	11.8	12.3	12.7	.26

^aStandard error of the mean.

^bLinear treatment response ($P < .01$).

^cQuadratic treatment response ($P < .05$).

^dLinear treatment response ($P < .0001$).

and OM digestibility which resulted in a linear ($P < .0001$) increase in digestible OM intake. Increased digestible OM intake with soybean hull supplementation suggests that the energy intake of cows fed soybean hulls should increase. Fall-calving beef cows fed a soybean hull supplement lost less weight and body condition than cows receiving either cottonseed meal or corn supplements (Hibberd et al., 1986).

Ruminal ammonia concentrations 2 hours post-supplementation were greatest for heifers receiving 2.2 lb of soybean hulls per day (figure 1). Ruminal ammonia concentrations declined by 6 hours post-supplementation and remained low (< 2 mg/dl) throughout the remainder of the day.

Although treatment responses were not significant, ruminal pH peaked for heifers receiving 2.2 lb of soybean hulls and declined as soybean hull supplementation increased (table 3). Soybean hulls are

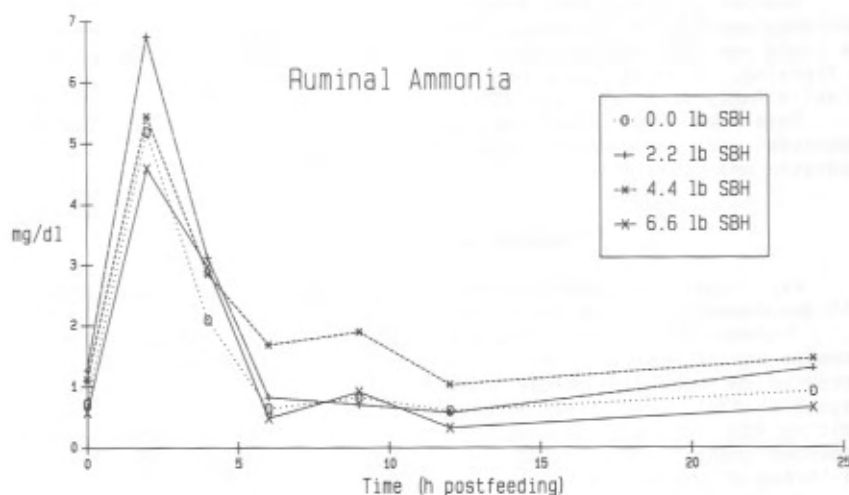


Figure 1. Ruminal ammonia response to supplementing low-quality native grass hay diets with graded levels of soybean hulls.

Table 3. Ruminant parameters of heifers supplemented with graded levels of soybean hulls.

Item	Soybean hulls, lb/day				SEM ^a
	0	2.2	4.4	6.6	
Ruminal pH	6.45	6.49	6.46	6.39	.029
Total VFA, mmole/liter ^b	63.5	65.7	74.8	74.9	3.75
Molar proportions, mole/100 mole					
Acetate ^c	78.5	77.7	76.2	76.0	.47
Propionate ^c	14.6	14.9	15.8	15.7	.22
Butyrate ^d	6.2	6.7	6.8	7.0	.25

^aStandard error of the mean.

^bLinear treatment response (P<.05).

^cLinear treatment response (P<.01).

^dLinear treatment response (P<.10).

more fermentable than low-quality native grass hay and would be expected to decrease ruminal pH due to volatile fatty acid production. Indeed, total VFA concentration increased linearly (P<.05) with added soybean hulls (table 3). The molar proportion of acetate decreased linearly (P<.01) while propionate increased linearly (P<.01) with added soybean hulls. Butyric acid proportions tended to increase linearly (P<.10) with increased soybean hulls.

Soybean hull supplements fed to cattle maintained on low-quality native grass hay increase the digestibility and intake of the total diet. When large quantities (6 lb/day) of cereal grains are fed, hay digestibility and intake decrease to the extent that total energy intake is not enhanced (Chase and Hibberd, 1985). Feeding large quantities of soybean hulls (up to 6.6 lb/day), however, increased digestible organic matter intake because of increased diet digestibility and a low substitution rate of soybean hulls for hay. Soybean hulls and other digestible fiber feedstuffs used in range supplements should enhance the energy status of grazing cattle by avoiding the negative associative effects observed with cereal grain supplementation. Soybean hulls should be considered as a potential component of range supplements when economics and availability permit.

Literature Cited

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