Digestibility Measures on Gestating Beef Cows Supplemented Whole or Rolled Drought Stressed Soybeans

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Story in Brief

Four Angus x Hereford beef cows (avg BW = 1120 lb) were used to determine the effects of three supplements on diet intake and digestibility during late gestation. Treatments included: 1) no supplement (CON), 2) 1.8 lb/d of whole soybeans (WSB), 3) 1.8 lb/d of rolled soybeans (RSB), or 4) 2.5 lb/d of a traditional supplement (PCON; 45.4% soybean meal, 54.2% soybean hulls, and .4 % dicalcium phosphate). Hay was offered *ad libitum* and contained 5.15% CP, 71.5% NDF, and 39.6% ADF on a dry matter basis. Periods consisted of a 14-d adaptation followed by 7 days of collection and sampling of forage, supplements, orts, and feces. Dry matter intake expressed on a percent body weight basis was higher for WSB (2.28%), RSB (2.24%), and PCON (2.29%) compared with CON (1.46%). Supplementation increased dry matter intake by an average of 55%. Treatment did not influence apparent dry matter digestibility or fiber digestibility. However, apparent fat digestibility was higher for WSB (36.67%), RSB (39.32%), and PCON (34.6%) compared with CON (24.78%). Apparent crude protein digestibility was higher for WSB (42.54%), RSB (42.39%), and PCON (43.56%) compared with CON (22.03%). The total dietary fat level of both soybean supplemented treatments was not high enough to suppress forage intake or digestibility in this study.

Key Words: Soybeans, Beef Cows, Digestibility, Supplementation

Introduction

A frequent problem associated with soybean production in Oklahoma is drought conditions during late summer months when the plant is filling the seed head. These conditions cause damage to the grain being produced and a new problem arises in marketing this damaged grain. High quality soybeans have proven to be a good source of energy and protein in beef cattle rations and supplements (Albro et al., 1993). Drought damaged soybeans have a decreased level of protein and fat compared with high quality soybeans (Lalman and Gill, 2000). Drought stressed soybeans are altered in terms of size, color, weight, and nutrient content. This study was designed to validate a cow performance project that showed drought damaged soybeans to be an effective winter supplement for late gestating beef cows grazing native tall grass prairie (Steele et al., 2002). The objective of this experiment was to determine the effects of drought damaged soybeans on diet intake and digestibility.

Materials and Methods

Four Angus x Hereford beef cows (avg BW = 1120 lb) were used in a 4 x 4 Latin square design experiment to determine the effects of three supplements on diet intake and digestibility. Treatments included: 1) no supplement (CON), 2) 1.8 lb/d of whole soybeans (WSB), 3) 1.8 lb/d of rolled soybeans (RSB), and 4) 2.5 lb/d of a traditional supplement (PCON 45.4% soybean meal, 54.2% soybean hulls, and .4 % dicalcium phosphate). Each supplement was formulated to provide similar amounts of crude protein and degradable intake protein (Table 1). The soybeans

used for this study were purchased in the fall of 2000 for the cow performance trial (Steele et al., 2002). Half of these beans were processed through an eighteen inch corrugated roller at the time of purchase. The soybeans were then sacked in paper bags and placed in dry storage until this study was conducted in the fall of 2002.

Table 1. Prairie hay and supplement chemical composition

	Treatment			
Item	Hay	WSB	RSB	PCON
Ash, % of DM	6.5	5.4	5.1	6.6
Fat, % of DM	2.1	7.6	7.9	2.6
NDF, % of DM	71.5	24.8	21.7	40.1
ADF, % of DM	39.6	14.4	11.9	28.8
CP, % of DM	5.2	39.8	36.9	29.2
Feeding rate, lb/d (as-fed)		1.8	1.8	2.5
CP, lb/d		.7	.7	.7
TDN, lb/d		1.8	1.8	1.8

Each period consisted of a 14-d diet adaptation followed by a 7-d collection. Cows were provided hay *ad libitum*; this was accomplished by offering 5 lb more hay than the previous day's hay intake. Daily hay intake was measured directly and fecal output was estimated using acid detergent insoluble ash (ADIA) as a marker. Hay, supplement, orts and feces were composited by cow for each period. A sub-sample of each composite was dried at 100^{o} C for 24 h to determine dry matter. Composite samples were dried at 50^{o} C for 48 h before grinding. Samples were ground in a Wiley Mill through a 2-mm screen before analysis. All samples were analyzed for ash, fat, crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), and ADIA.

Statistical Analysis. Cow was considered to be the experimental unit because each cow was fed individually. Data were analyzed using MIXED MODEL procedures of SAS (SAS Inst. Inc., Cary, NC). The data were analyzed as a Latin square with period and treatment included as fixed effects and cow included as a random effect. Least square means were separated using the least significant difference procedure.

Results and Discussion

Intake and digestibility of dietary components are shown in Table 2. Dry matter intake expressed on a percent body weight basis was greater (P<.05) for WSB, RSB, and PCON, compared with CON. This is most likely due to the increased protein content of the diet due to these supplements. Numerous experiments have shown a dramatic increase in intake when protein deficient forage is protein supplemented. Treatment did not influence (P>.05) apparent dry matter digestibility or fiber digestibility (NDF and ADF). Dietary fat content above 5% typically decreases fiber digestibility; however, due to lower than expected fat content of soybeans, all dietary fat concentrations were below 3%. The soybeans used for this study were the remainder of a load purchased for a cow performance trial two years prior (Steele et al., 2002). The whole and rolled soybeans were stored in a dry, non-temperature controlled area free of insects and rodents. Crude protein was not affected over time, but the fat content decreased from 16.1 to 7.7%. The average fat content of the diets in this digestion study were: 2.07, 2.45, 2.44, and 2.13% for the CON, WSB, RSB, and PCON treatments, respectively. These low dietary fat concentrations should explain why no differences in apparent dry matter digestibility or fiber digestibility were observed among treatments. Apparent fat digestibility was greater (P<.05) for WSB, RSB, and PCON compared with CON. Apparent crude protein digestibility was greater (P<.05) for WSB, RSB, and PCON compared with CON. Results of this experiment confirm other studies demonstrating the importance of protein supplementation. We found that WSB and RSB were as effective as our PCON as a protein supplement to deficient forage. These observations agree with other performance studies when cows were provided bermudagrass hay (Steele et al., 2002) or stockpiled native prairie grass (Steele et al., 2002). The question of processing these drought damaged beans is also in line with a developing replacement heifer study (Steele et al., 2002), as cows receiving WSB performed as well as RSB.

Table 2. Daily intake and apparent digestibility of dietary components

	Treatment					
Item	CON	WSB	RSB	PCON	SEM[a]	P-value
Intake						
Hay, lb/d	17.6[x]	24[y]	23[y]	23.6[y]	.82	.0005
Hay, % body weight	1.6[x]	2.1[y]	2.1[y]	2.1[y]	.05	.0005
Dry matter (hay and Supp.), lb/d	16.1[x]	25.9[y]	24.9[y]	25.9[y]	.91	<.0001
Dry matter, % body weight	1.5[x]	2.3[y]	2.2[y]	2.3[y]	.07	<.0001
Fecal Output, lb/d	9.1[x]	13.7[y]	12.7[y]	12.8[y]	.71	.006

Digestibility						
Apparent dry matter, %	43.9	47.5	49.8	51.1	1.97	.14
Apparent fat, % DM	24.8[x]	36.7[y]	39.3[y]	34.6[y]	2.93	.01
Apparent CP, % DM	22.0[x]	42.5[y]	42.4[y]	43.6[y]	3.22	.003
NDF, % DM	49.1	51.1	54	54.7	2.00	.26
ADF, % DM	48.2	51.9	54.2	54.6	1.75	.10

[a]Pooled standard error of the mean (n=4).
[xy]Within a row means without a common superscript differ (P<.05).

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