EFFECTS OF LACTATION AND TYPE OF SUPPLEMENT ON INTAKE AND DIGESTIBILITY OF HAY BY SPRING-CALVING COWS

T. T. Marston[1], K. S. Lusby[2] and R. P. Wettemann[3]

Story in Brief

Thirty-two spring-calving Hereford and Hereford x Angus cows were used to determine the effects of lactation and type of supplement on intake and digestibility of grass hay (4.5% CP). Supplements were based on either soybean meal (40% CP) or soybean hulls (20% CP) and fed to provide 1.4 lb of crude protein per day. Half of the cows were fed each supplement pre-calving. After calving, half of each pre-calving supplement group was switched to the other supplement, resulting in four post-calving treatments. Intake and digestibility of hay were measured during late gestation and early lactation. Pre-calving hay intake was reduced about .5 lb for each pound of additional supplement compared to 1 lb of reduced hay intake for each additional pound of supplement fed post-calving. Dry matter digestibility of hay was not affected by supplement type or lactation. Feeding additional amounts of supplements post-calving did not increased total energy intake of the cows.

(Key Words: Forage Intake, Beef Cattle, Soybean Hulls, Soybean Meal.)

Introduction

Feeding supplemental protein to cows grazing forages that are deficient in protein increases forage intake (Ovenell, et al., 1991; Fleck, et al., 1988). However, some classes of cattle such as first-calf heifers may need additional energy over that consumed when economically feasible amounts of high protein supplements are fed. When the supplemental crude protein level is adequate, feeding additional amounts of lower protein supplements can improve weight and condition before calving but apparently have little effect on post-calving weight and condition changes (Lusby et al., 1991; Marston et al., 1992). Because of the importance of body condition on reproduction in beef cows, it is critical to know what type of supplements to feed and when best to feed them to maximize utilization of forages for beef production. The

[1]Graduate Assistant [2]Professor [3]Regents Professor

objectives of this study were to compare the effects of soybean meal and soybean hull-based supplements on native grass hay intake and digestibility when spring-calving cows were either in late gestation or early lactation.

Material and Methods

On November 2, 1990 ninety-six spring-calving Hereford and Hereford x Angus cows were allotted to one of four treatments by blocking on breed, age, weight, and body condition score. Cow performance data are reported by Marston et al. (1992). Cows were supplemented until calving with a soybean hull based supplement (hulls) or a soybean meal (meal) based supplement. After calving, half of the cows from each pre-calving group were switched to the other supplement resulting in four post-calving supplement treatments. From these cows, thirty-two were chosen to study the effects of supplement type fed pre- and post-calving on forage intake and digestibility. The pre-calving intake and digestion study was conducted in late January, just before the beginning of calving, and the post-calving study was conducted in April after all cows had calved. Two cows were removed from the post-calving period because of calf mortality.

Supplement and hay composition and feeding rates are shown in Table 1 and Table 2. During intake and digestion periods, supplements were fed once daily and provided similar amounts of crude protein. Cows were weighed after an overnight removal from feed and water preceding each period. Cows had ad libitum access to native range hay (4.3% CP) in individual covered stalls for 8 h/day beginning at 8 a.m. When not in covered stalls, cows were maintained in a 100 x 100 foot open lot. Calves were allowed to suckle at will overnight and from noon until 1 p.m. each day, when cows were moved to the lot and permitted access to water.

Voluntary hay intake was directly measured for 7 days following a 7-day adaptation period. Fecal output was estimated using chromic oxide (Cr_2O_3 at 10 gram/day) as an indigestible marker. Chromic oxide was mixed with finely ground corn at a concentration of 10 gram per .25 lb of corn and fed with the supplement once daily from day 1 through day 13 of each period. Fecal grab samples (Cr recovery was assumed to be 100%) were taken at 8 a.m. and 5 p.m. from day 8 through day 14 and composited.

Crude protein was determined for hay and supplements with a KjelTech 1030 AutoAnalyzer. Fecal Cr concentrations were determined by atomic absorption spectrophotometry. Fecal output was calculated from the Cr concentrations and total diet dry matter digestibility was calculated using known daily hay and supplement intakes and estimated fecal outputs. Supplement digestibility was assumed to be the digestibility of its major ingredients (soybean hulls = 65%, Anderson et al., 1988; soybean meal = 84%, NRC, 1984). Grass hay digestibility was determined by adjusting for

Table 1. **Composition of supplements and daily feeding rates (as fed basis).**

Supplement	Soybean hull (SBH)	Soybean meal (SBM)
Ingredients, %		
Soybean meal	15.51	90.34
Soybean hulls	79.14	3.23
Molasses	4.83	4.76
Dicalcium phosphate	.47	1.66
Vitamin A, 30,000 IU/gm	.05	.05
Copper sulfate		.01
Crude protein, %		
Dry matter %	19.83	42.96
As fed %	18.27	39.71
Feeding rate, lb/day	7.8	3.5
Crude protein supplied		
Supplemental, lb/day	1.42	1.39

Table 2. Composition of native grass hay (dry matter basis).

Item, %	Amount, %
Period 1	
Dry matter	94.5
Crude protein	4.35
Period 2	
Dry matter	95.8
Crude protein	4.24

the portion contributed by the supplement. All values reported are on a dry matter basis unless otherwise noted. The day following period 2, daily milk production was estimated using the weigh-suckle-weigh technique (three consecutive 8-h intervals).

Data from both periods were analyzed using least squares analysis of variance. Models included calving dates and body weights taken prior to the intake period as covariates. All two- and three-way interactions were tested and removed from the model if nonsignificant (P>.20). Data obtained during the early lactation period were analyzed as a 2 x 2 factorial with two supplement types (hulls or meal) and two time periods (pre- or post-calving).

Results and Discussion

During period 1, cows fed the soybean meal-based supplement consumed more hay (Table 3), both on a daily amount and percent body weight basis (P=.02) than cows fed the 20% CP soybean hull-based supplement. The difference in hay intake was approximately half the difference in amounts of the supplements fed, indicating some substitution. Supplement type did not influence digestibility of native hay. Total ME intake tended to be greater for cows fed the soybean hull-based supplement. Ovenell et al. (1991), using the same hay source, reported lower hay intake of nonlactating cows fed wheat midds-based supplements at greater daily rates (same daily protein) than soybean meal-based supplements.

Daily hay intake increased about 25% from the first to the second period (Table 4). Ovenell et al. (1990) reported smaller differences in hay intake between the dry and lactating cows. This can be partially explained because cows used in this study were extremely late in gestation during period 1, whereas, Ovenell used cows that were only 4 to 5 months pregnant. During the early lactation period, cows fed soybean meal post-calving consumed more hay (both daily amount and percent body weight) than cows fed soybean hulls (P<.01). Cows switched from soybean hulls to soybean meal consumed more hay (P=.06) than cows switched from soybean meal to soybean hulls. The type of supplement fed prior to calving did not affect hay intake after calving.

The type of supplement fed post-calving had no effect on dry matter digestibility of the hay. It appeared that soybean hull- and soybean meal-based supplements have similar effects on the rumen environment. During the post-calving period, cows from all treatments consumed similar amounts of metabolizable energy on a daily and body weight basis. Greater amounts of the soybean hull-based supplements did not offset greater forage intakes of cows fed soybean meal supplements, as was the case during the pre-calving period.

Table 3. Least square means for voluntary forage intake, forage dry matter digestibility, and diet metabolizable energy of dry, late gestating cows.

	Treatment	
	SBH[a]	SBM[b]
No. of cows	16	16
Cow weight, lb	1147	1100
Hay DM intake		
Amount, lb/d	16.5[e]	18.3[f]
% body weight, %	1.48[e]	1.64[f]
Digestibility, %		
Hay	50.9	51.7
Total diet	55.1	56.3
Energy consumed		
ME, Mcal/day[c]	23.1	21.6
ME, Mcal/lb BW[d]	.0206	.0193

[a] SBH = soybean hulls.
[b] SBM = soybean meal.
[c] ME = .82(DDMI * 2 Mcal/lb) + ME of supplement. ME = metabolizable energy; DDMI = digestible dry matter intake of hay. NRC, 1984.
[d] Total ME/lb cow body weight.
[e,f] Means in the same row with different superscripts differ ($P < .05$).

Average milk production for all cows was 15.8 ± 3.5 lb/day. Supplementing with either soybean hulls or soybean meal post-calving did not affect milk production and no difference was found in milk production of cows that were switched from one type of supplement to the other. Cows 4 years old and older produced more milk per day than either 3 year old cows or 2-year-old heifers (19.9 ± .7, 13.4 ± .9, 10.0 ± 4.0 lb/day; respectively).

Table 4. Least square means of voluntary forage dry matter intake and digestibility, diet metabolizable energy, and milk production of early lactating non pregnant cows.

	Supplementation scheme (Pre-/post-calving supplement)[a]			
	SBH/SBH	SBH/SBM	SBM/SBH	SBM/SBM
No. of cows	8	7[b]	8	7[b]
Cow weight, lb	964	984	996	923
Hay intake				
Amount, lb/day	21.1[e]	25.5[f]	21.9[e]	25.4[f]
% body weight, %	2.21[e]	2.61[f]	2.26[e]	2.63[f]
Digestibility, %				
Hay	45.3	46.1	44.0	49.9
Total diet	50.5	50.0	49.4	53.5
Energy consumed				
ME, Mcal/day[c]	29.1	26.5	28.1	29.0
ME, Mcal/ lb BW[d]	.030	.027	.029	.030
Milk production, weigh-suckle-weigh				
Daily basis, lb	17.4	14.8	14.5	15.2

[a] SBH = soybean hull; SBM = soybean meal.
[b] One cow was omitted from analysis because of calf mortality.
[c] ME = .82(DDMI * 2 Mcal/lb) + ME of supplement. ME = metabolizable energy; DDMI = digestible dry matter intake of hay. NRC, 1984.
[d] Total ME/lb cow body weight.
[e,f] Means in the same row with different superscripts differ ($P < .05$).

Conclusions

The substitution of supplement for hay intake appears to be greater post-calving than pre-calving. As a result, increasing supplementation rates post-calving may not improve total energy intake by cows. A number of studies at this station have demonstrated that feeding larger amounts of isonitrogenous supplements pre-calving will result in improved cow weight and condition changes but when the same supplements are fed post-calving, no improvement is seen. Results of this study indicate that greater substitution of supplement for forage intake and increased milk production may explain the difference in pre- and post-calving response to supplementation. Lactating beef cows consumed about 25% more hay compared to pre-calving intake.

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