EFFECTS OF LACTATION TYPE OF SUPPLEMENTS ON FORAGE INTAKE AND DIGESTIBILITY

T.T. Marston[1] and K. S. Lusby[2]

Story In Brief

Spring-calving beef cows were used in two consecutive years, (n=32, year 1; n=42, year 2) to determine the effects of supplement type and lactation status on forage intake, digestibility and energy intake. Supplements fed during gestation provided equal amounts of protein from a 40% (PROTEIN) or a 20% protein supplement (ENERGY). After calving, cows remained on the same supplement or were switched. In year 2, a 40% protein (HI PROT) supplement also was fed postpartum at twice the rate as the ENERGY supplement. Prairie hay intake was measured directly and dry matter digestibility was estimated during late gestation and early lactation. Gestating cows fed PROTEIN consumed 1.9 lb/day more hay dry matter and had greater hay digestibility than cows fed ENERGY. Lactating cows fed PROTEIN also consumed a greater amount of hay than cows fed ENERGY. However, lactating cows fed HI PROT had hay intake similar to those fed PROTEIN and ENERGY. Hay digestibility was not different among supplement types. Total metabolizable energy intake was similar for cows fed PROTEIN and ENERGY in late gestation. After calving, cows consumed similar amounts of metabolizable energy regardless of the supplement fed. Results indicate that an energy supplement, even though lower in starch, decreases digestibility of low-quality forage and can decrease forage intake. Increasing the total energy intake of grazing cattle by feeding a supplement is difficult if protein requirements are met.

(Key Words: Beef Cattle, Forage Intake, Digestibility, Energy, Protein.)

Introduction

Spring-calving cows fed winter supplements containing wheat middlings gained more weight and body condition during gestation than cows fed the same daily protein from soybean meal. However, cow weight and condition were not improved when spring or fall calving cows were supplemented with extra energy during lactation. This suggests that cow weight and condition responses differ with physiological status. Postpartum increases in dry matter (DM) intake in excess of 30% are common for dairy cows. Perhaps the increased forage intake during lactation alters the associative effect of supplements on forage intake and digestibility. A greater postpartum DM

---

[1]Former Graduate Student [2]Professor

intake coupled with an increased protein requirement of lactating cows could result in a protein deficiency for lactating beef cows. The objectives of our study were to determine the effect of different levels of protein and energy on intake and digestibility of low-quality forage by beef cows during late gestation and again during early lactation.

Materials and Methods

Thirty-two spring-calving Hereford and Hereford x Angus cows were used in year 1 and 42 were used in year 2 to determine effects of supplement type and stage of lactation on forage intake and digestibility. Cows had been allotted to the different supplement types and regimens in November after being blocked by breed, age and weight. Supplements fed precalving (Table 1) consisted of a 20% protein supplement (ENERGY) or a 40% protein soybean meal-based supplement (PROTEIN). In year 1, cows remained on the same precalving supplement or were switched to the other supplement after calving. In year 2, one third of the cows from each precalving treatment were switched to the other precalving supplement at calving and one third were switched to a 40% protein supplement fed at a rate to provide 2.4 lb/day of protein (HI PROT) at calving. Amounts of supplement fed were reduced in the second year because cows weighed less.

Two 14-day forage intake and digestion studies were conducted each year, one beginning on January 20 when cows were gestating and the other

Table 1. Supplement composition, nutrient content and amounts fed (DM basis).

	PROTEIN	ENERGY	HI PROT
Ingredients, %			
Soybean meal	90.86	15.49	91.72
Soybean hulls	3.28	79.93	3.36
Molasses	3.99	4.02	4.03
Dicalcium phosphate	1.80	.51	.91
Vitamin A, 30,000 IU/lb	.05	.05	.03
Copper sulfate	.01		.01
Nutrient content, %			
Protein	40.0	20.0	40.0
Phosphorus	1.09	.40	.93
Calcium	.59	.57	.39
Potassium	2.48	1.56	2.51
TDN	81.73	77.46	82.50

conducted to end on April 20 when cows were lactating. During these two intake trials, cows were maintained in individual covered stalls in an open-fronted barn with free access to native grass hay for two 4-hour sessions beginning at 8:00am and 2:00pm daily. Supplement was fed individually once daily at 8:00am. Fresh hay was placed in feeders twice daily and residual hay was removed each night. When not in their stalls, cows were maintained in an open drylot and provided water only. During the lactation phase, calves remained in the drylot while cows were being fed hay and were allowed to suckle when dams were in the drylot. Between intake trials, cows were returned to dormant, native grass pastures and were managed with the remainder of the cows used for the performance study.

One day prior to each trial period, cows were weighed following 16-hour (overnight) withdrawal from feed and water. This weight was used to calculate forage DM intake per unit of body weight. On April 21, milk production was estimated using the weigh-suckle-weigh technique modified for consecutive, 8-hour periods. Fecal output was estimated by feeding each cow 10g of chromic oxide daily as an indigestible marker.

A linear model was fit to the data for each response variable by least squares using the GLM procedure of SAS (1985). The model included the effects of year, treatment, period, breed and age. A random effect for cow within treatment x year was used as the error term for testing treatment. Data were pooled for the gestation period between years, but because the high protein level was not fed during the first year, data for the lactation period are reported on a yearly basis.

Results and Discussion

Gestation. Cows averaged 1067 lb at the start of the gestation phase (Table 2). Cows fed PROTEIN consumed about 13% more hay than ENERGY fed cows ($P<.01$). This decrease in daily hay DM intake (1.9 lb) was less than the extra amount of supplements fed from ENERGY (0.4 lb), indicating that the ENERGY supplement did not entirely substitute for hay. When expressed on a body weight, PROTEIN-fed cows consumed .2 percentage units more dry matter than cows fed ENERGY ($P<.01$).

Hay DM digestibility was about 6 percentage units greater ($P<.001$) for gestating cows fed PROTEIN compared to ENERGY. Previous research at OSU indicated that dry matter digestibility of native grass hay for gestating and lactating cows was 5 and 8% greater for cows supplemented with soybean meal than for cows supplemented with wheat middlings or a corn-soybean meal supplement, respectively. This decrease in hay digestibility presumably was caused by the starch present in the wheat middlings and corn-soybean meal supplements. However, soybean hulls contain no starch. Why hay DM digestibility was decreased by the soybean hull-based energy supplement is not clear.

Table 2. Hay intake and digestibility, ME and protein intake and fecal output of cows during gestation.

Item	PROTEIN	ENERGY	P value	SE
No. of cows	37	37		
Cow weight, lb	1052	1082	.10	.4
Intake				
Hay, lb/day	16.9	15.0	.001	.22
Hay, % body weight	1.74	1.51	.001	.028
Dry matter digestibility, %				
Total diet	49.7	49.5	.88	.91
Hay	44.2	37.8	.001	1.22
ME intake, Mcal/day	16.1	16.7	.35	.42
Protein intake, lb/day	2.0	2.0	.70	.05
Protein intake, % diet	10.1	9.3	.002	.19

The ME intake of gestating cows was similar for PROTEIN and ENERGY (P=.35), in agreement with similar weight gains observed with PROTEIN and ENERGY fed cows during late gestation in a companion cow performance study (Marston et al., 1994).

Lactation. Hay intake averaged 5% greater for PROTEIN than ENERGY fed cows (Table 3). Cows fed ENERGY and HI PROT (year 2) had similar hay intakes. Cows fed ENERGY and HI PROT ate more total diet dry matter than PROTEIN fed cows (22.7, 23.1, 20.9 lb/day, respectively). During both years, when hay dry matter intake was expressed as a percentage of body weight, PROTEIN-fed cows ate significantly more hay than did cows fed ENERGY. ENERGY and HI PROT-fed cows consumed similar amounts of hay DM expressed as a percentage of body weight.

Calculated ME intake was similar between the PROTEIN and ENERGY fed cows. These findings agree with cow weight changes in the companion performance study. ME intake was also similar (P<.35) for lactating cows fed HI PROT.

According to NRC (1984) the protein intake for approximately 1100 lb cows producing 15 lb of milk is about 2.25 lb per day or about 10.75% of the diet DM. This means that our cows fed PROTEIN or ENERGY supplements were deficient in protein, especially in year 2. HI PROT was the only supplement that resulted in adequate daily protein intake (NRC, 1984). Yet daily milk production was similar for all supplements fed during lactation suggesting that protein supply was adequate.

Table 3. Hay intake and digestibility, ME Intake, fecal output and milk yield of lactating cows.

	Supplement			Comparison		
	PROT	ENERGY	HI PROT	Energy[a]	Protein[a]	SE
Cows, number						
Yr 1	16	16	--			
Yr 2	14	14	14			
Cow weight, lb						
Yr 1	950	986				
Yr 2	867	898	893			
Hay intake, lb/day						
Yr 1	20.9	19.4		.001		.24
Yr 2	17.3	16.9	16.5	.13	.93	.26
Hay intake, % of body weight						
Yr 1	2.17	1.99		.001		.028
Yr 2	1.99	1.88	1.90	.01	.57	.031
Hay dry matter digestibility, %						
Yr 1	48.1	46.7		.49		1.41
Yr 2	37.5	33.8	34.9	.08	.62	1.49
ME intake, Mcal/day						
Yr 1	21.6	21.9		.66		.47
Yr 2	14.5	14.8	15.2	.70	.58	.50
Protein intake, % of diet						
Yr 1	9.4	9.2		.26		.09
Yr 2	9.4	8.9	11.4	.001	.001	.10
Milk, lb/day						
Yr 1	15.0	16.5		.15		.75
Yr 2	14.3	13.6	14.5	.59	.48	.79

[a] Comparisions for Energy are PROT vs ENERGY and comparisons for protein are PROT and ENERGY vs HI PROT.

Table 4. Effect of lactation on hay intake, digestibility, fecal output, ME and CP intake of cows fed PROTEIN and ENERGY.

Item	Gestation	Lactation	P value	SE
No. of cows	60	57		
Hay dry matter intake				
lb/day	16.1	20.7	.001	.26
% of body weight	1.64	2.01	.001	.030
DM digestibility				
Total diet	49.6	49.1	.63	.71
Hay	41.0	41.9	.52	1.02
ME intake, Mcal/day	16.4	17.9	.001	.37

Physiological status. Forage intake increased (4.6 lb/day, .37% of body weight) as cows advanced from late gestation to lactation (Table 4), suggesting that forage intake increases by six weeks after calving. This 28% increase is similar to the 30% increase observed with lactation in dairy cows. Hay dry matter digestibility was not affected by lactation status.

Conclusions. Increasing the total energy intake of grazing cattle by feeding supplements once protein requirements are met is difficult. Beef cows consumed about 28% more total DM when lactating than when in late gestation, but the substitution of supplement for forage DM was not changed. Increasing total ME intake during lactation may require more PROTEIN than is economically feasible.

Literature Cited

Marston, T. T. et al. 1994. J. Anim. Sci. (submitted).

NRC. 1984. Nutrient Requirements of Beef Cattle (6th Ed.). National Academy Press, Washington, DC.