THE EFFECTS OF ENERGY AND PROTEIN SUPPLEMENTS ON SPRING-CALVING COWS

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Story in Brief

A 2-year study used 222 cows to determine if feeding different amounts of supplemental energy and protein before and/or after calving affected cowherd performance. Starting on November 1 (both years) cows were fed either 3 lb/day of a 40% crude protein soybean meal-based or 6 lb/day of 20% crude protein soybean hull-based supplement. During year 1, half the cows were switched to the other supplement at calving. In the second year an additional post-calving supplement of 6 lb/day of a 40% crude protein supplement was also fed. Cows fed more supplemental energy (20% crude protein supplement) gained slightly more weight during late gestation than their counterparts. From calving until April 19, weight losses were similar for cows fed different amounts of supplemental energy before and/or after calving. Calves nursing dams fed the lower amount of energy before and after calving (3 lb/day of 40% crude protein supplement) consistently gained more weight and had heavier weaning weights. Those cows on the supplemental program that decreased supplement energy at calving had the lowest pregnancy percentage and the lightest calves at weaning. Results from the second year of the study indicate that feeding greater amounts of energy and protein can maintain high levels of reproduction efficiency performance, but can be detrimental for calf weaning weights.

(Key Words: Cows, Supplementation, Energy, Protein, Reproduction, Weaning Weight.)

Introduction

Dormant native tallgrass prairie is utilized by many cow-calf producers to winter spring-calving cows. Winter native pastures do not provide enough crude protein or energy to adequately maintain cow weights and body condition scores during late gestation and early lactation. This is especially true for first

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calf heifers. Research by Fleck et al. (1987) and Ovenell (1991) has shown that feeding the proper amounts and type of supplements (those low in starch) improves utilization of low quality forages. Therefore soybean hulls, a soybean by-product high in ruminally digestible fiber, should increase energy intake without the adverse effects normally observed when high-starch feedstuffs are used to supplement low-quality forages.

If protein and energy requirements can be met using feedstuffs high in ruminally digestible fiber, properly feeding the right type of supplement at different stages of the cow production cycle could improve cowherd efficiency. This study was conducted to determine if feeding different amounts of supplemental energy and protein during late gestation or early lactation affected body weight, condition score, calf gains, and reproductive performance.

Material and Methods

In a 2-year study, 222 spring-calving Hereford and Hereford x Angus cows (two year olds = 74, three year olds = 67) were allotted by breed, age and weight to treatments. The average calving date for all cows was February 27 of the respective year of the trial. The first year cows (n = 96) were fed either 3 lb/day of a 40% all natural CP supplement (SBM) or 6 lb/day of a 20% CP supplement (SBH) composed mostly of soybean hulls (see Table 1) from

Table 1. Composition and nutrient content of supplements (DM basis) and daily feeding rates (as is basis).

Supplement	SBM	SBH	HI SBM
Ingredient, %			
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	.05	.05	.03
Copper sulfate[a]	.01		.01
Nutrient content, %			
Crude protein[b]	44.08	19.14	43.74
TDN[c]	81.73	77.46	82.50
Amount fed, lb/day	3.0	6.0	6.0

[a] Copper sulfate was added to those supplements determined below NRC (1984) requirement levels.
[b] Actual analysis.
[c] Estimated from NRC (1984).

November 1 until calving. At calving half the cows fed a particular supplement (n = 23) were switched to the other supplement, therefore, four supplemental regimens (SBM/SBM, SBM/SBH, SBH/SBM, and SBH/SBH) were used. Supplementation ended on April 19, which was the start of a breeding season which ended on July 1 (cows were exposed to bulls which had passed breeding soundness exams). In year 2, cows (n =126) were fed similarly from November 1 until calving as in year 1, with half the cows receiving either 3 lb/day of SBM or 6 lb/day of SBH. However, at calving an equal number of cows (n=21) either remained on the same supplement, were switched to the other supplement, or were fed 6 lb/day of a 40% all natural supplement (HI-SBM), so two additional supplementation regimens (SBM/HI-SBM and SBH/HI-SBM) were fed. The SBH and HI-SBM supplements were isocaloric, while the SBM and SBH supplements were isonitrogenous. Each year cows grazed common dormant tallgrass pastures and were individually fed their supplements in covered stall barns. Because of a uncontrolled range fire the first year, native grass hay was fed from March 22 until the end of the supplementation period. Hay feeding was repeated the next year on the same dates to minimize the effect of year. Cows had free access to salt and a trace mineral mix.

Cows were weighed at approximately 28-day intervals following overnight removal from feed and water from November 1 until February 1. After February 1, cows were weighed empty at 14-day intervals, to determine the weight before and after calving, until the end of the supplementation. Empty weights were also recorded on July 1 and November 1. Body condition scores (scale: 1 = emaciated, 9 = extremely obese) were assigned by two independent evaluators on November 1, February 1, April 19, July 1 and the following November 1. Calves were weighed at birth, April 19, July 1 and November 1. Bull calves were band castrated at birth and no growth implants were used during the trial. In both years, calves were weaned on November 1 and cows were palpated to determine pregnancy.

Cows (n = 9) were systematically removed from the study when they failed to calve within the supplementation period or for calf mortality. When appropriate data for both years was combined and analyzed using least square means procedures. Postcalving data was analyzed as a 2 x 2 factorial to compare supplemental regimens common to both years. Appropriate main effects and interaction terms were included in the statistical models along with starting supplementation weight and calving date as covariates. The second years data was then analyzed as a 2 x 3 factorial with contrast statements used to compare the different levels of protein and energy.

Results and Discussion

No differences in cow weight gains or body condition scores were noted from feeding SBM or SBH supplements during late gestation (November 1

until calving Table 2). This is contrary to studies conducted by Fleck et al. (1987) and Ovenell et al. (1991) where larger weight gains were noted when supplements high in ruminally digestible fiber were fed. These data also indicate if cows need to increase body weight (or body condition), weight gains are most likely to occur during the months of November and December. The supplements did not affect birth weight. Calves nursing dams fed the SBM supplement prior to parturition gained more weight ($P < .02$) from birth to weaning than their counterparts.

Cowherd performance for supplement types and regimens fed in both years of the study are listed in Table 3. Cows that remained on the same supplement before and after calving gained more weight from calving until April 19 than cows that had supplement changes at calving. After supplementation ended on April 19, cows that had been switched from SBM to SBH and SBH to SBM gained more weight ($P < .05$) than their non switched counterparts. On November 1, cows from all supplement programs had similar weights. On April 19, the start of the breeding season, no difference in body condition score was noted between the supplement regimens. Pregnancy rates were similar for cows fed supplement combinations that either increased or continued the same level of supplemental energy. Cows fed SBH/SBM (those

Table 2. Feeding response to isonitrogenous amounts of 20% CP supplement(SBH) and 40% CP supplement(SBM) prior to calving.

Supplement	SBM	SBH
No. of cows	90	89
Average calving date	Mar 3	Feb 27
Cow weight, lb		
Start of trials, Nov. 1	1006	1003
At calving	1064	1067
Cow weight gains, lb		
Nov. 1 to Jan. 1	47	52
Jan. 1 to calving	11	12
Total for late gestation	58	64
Body condition score		
Nov. 1	6.0	6.0
Feb. 1	5.5	5.4
Calf birth weight, lb	85	83
Calf weight gains, lb		
Birth to April 19	86[a]	72[b]
April 19 to July 19	188[a]	175[b]
July 19 to Nov. 1	104[a]	98[b]
Weaning weight, lb	463[a]	432[b]

[a,b] Means in the same row with different superscripts differ ($P < .05$).

Table 3. Responses to feeding isonitrogenous amounts of 40% CP (SBM) and 20% CP (SBH) supplements before and after calving.

	Supplementation regimen			
Supplements fed:				
Before calving	SBM		SBH	
After calving	SBM	SBH	SBM	SBH
No. of cows	46	45	45	43
Average calving date	Feb 28	Mar 5	Mar 3	Feb 25
Calving weight, lb	1090[a]	1038[b]	1068[ab]	1063[ab]
Calving weight loss, lb	-141	-130	-137	-136
Cow weight gains, lb				
Calving to April 19	-41	-33	-26	-19
April 19 to July 1	105[a]	131[b]	132[b]	115[a]
July 19 to November 1	-5[a]	-21[ab]	-8[a]	-23[b]
Condition score				
April 19	5.2	5.2	5.2	5.2
July 1	5.2	5.2	5.2	5.2
November 1	5.4[a]	5.5[ab]	5.6[b]	5.5[ab]
Pregnancy rates, %	89[a]	85[ab]	73[b]	89[a]
Calf performance, lb				
Birth to April 19	88[a]	84[a]	71[b]	74[b]
April 19 to November 1	290[a]	294[a]	269[b]	278[b]

[a,b,c] Means in the same row with different superscripts differ ($P < .05$).

fed decreased amounts of supplemental energy at calving) had lower pregnancy rates than cows fed the supplemental regimens (SBM/SBM and SBH/SBH) that continued on the same supplement before and after calving.

Comparisons of the different supplement programs fed in year 2 are shown in Table 4. Cow weight gains from calving to April 19 were similar between all supplement combinations. From April 19 to July 1 cows fed the SBM/SBM combination gained the least amount of weight, while cows fed SBM/SBH gained the most. No difference was noted in body condition scores among the different supplements. Those cows which received lowered amounts of supplemental energy (SBH/SBM) after calving again had reduced pregnancy rates. Cows fed additional supplemental protein after calving (SBH/HI-SBM) had the lowest calf weaning weights.

These data indicate the feeding of higher amounts of supplemental energy during late gestation could slightly increase body weight, but not to the extent body condition is improved. Cows fed SBM supplement prior to calving raised the heaviest calves indicating feeding large supplemental quantities of energy and protein do not always increase milk production. Finally, results from both

Table 4. Responses to feeding different combinations of supplements in year 2.

	Supplementation regimen					
Supplements fed:						
Before calving	SBM			SBH		
After calving	SBM	SBH	HI-SBM	SBM	SBH	HI-SBM
No. of cows	20	18	18	20	20	18
Average calving date	Feb 28	Mar 5	Feb 28	Mar 3	Feb 25	Feb 25
Calving weight, lb	983	976	982	994	970	985
Calving weight loss,lb	-125	-117	-123	-129	-126	-130
Cow weight gains, lb						
Calving to April 19	-19	-12	-8	-21	-10	-5
April 19 to July 1	72[a]	110[b]	85[ac]	92[bc]	88[ac]	81[ac]
July 1 to November 1	7	16	14	11	3	1
Condition score						
April 19	5.2	5.2	5.1	5.2	5.2	5.3
November 1	5.2	5.3	5.1	5.0	5.0	5.2
Pregnancy rates, %	83[a]	88[a]	92[a]	72[b]	90[a]	94[a]
Calf performance, lb						
Birth to April 19	80[a]	85[a]	83[a]	69[b]	74[a]	78[a]
April 19 to November 1	280[a]	279[a]	255[bc]	267[ac]	265[ac]	258[bc]

[a,b,c] Means in the same row with different superscripts differ ($P < .05$).

years of the study indicate decreasing supplemental energy at calving is detrimental to pregnancy rates, while increasing energy and/or protein at calving results in the highest pregnancy rates.

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