CORN GLUTEN FEED OR SOYBEAN MEAL AS WINTER SUPPLEMENTS FOR PREGNANT BEEF COWS GRAZING NATIVE RANGE

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Story in Brief

Ninety mature Hereford cows bred to calve in March and April were divided into five winter supplement treatments. Supplementation began November 20, 1984 and terminated as each cow calved. Treatments were: negative control, 1.1 lb/day soybean meal; positive control, 2.0 lb/day soybean meal; 4.6 lb/day corn gluten feed; 3.2 lb/day of a 2:1 corn gluten feed-soybean meal mixture; and 3.2 lb/day corn gluten feed plus urea. All supplement amounts were increased 50% on January 30, 1985. Supplements were prorated and fed six days per week. Cow weight changes during the trial were -77.3, -23.6, 2.8, 1.0, and -55.8 lb for the negative control, positive control, corn gluten feed, corn gluten feed/soybean meal, and corn gluten feed/urea treatments, respectively. Cow body condition changes were -.96, -.47, -.39, -.49 and -.69, respectively. Conception rates were lower for the negative control group but did not differ between other treatment groups (55 vs 80 to 88%). Calf average daily gains were not significantly affected by treatment. Rumen fluid propionate concentrations were higher and acetate concentrations were lower in cows fed corn gluten feed, and ammonia concentrations were higher in the positive control treatment. Corn gluten feed appears to be an effective energy and protein supplement for beef cattle consuming low quality forage. Adding urea to corn gluten feed was detrimental to cattle performance.

(Key Words: Beef Cows, Winter, Supplements, Corn Gluten Feed, Soybean Meal.)

Introduction

Cattle in Oklahoma are commonly maintained on dormant native range or other low-quality roughage throughout the winter. When low quality forage is plentiful, feeding oil seed meal supplements improves forage digestibility and intake, increasing total energy available to the animal. When the energy requirement cannot be met with protein supplementation alone, the rancher may feed hay or a larger amount of an energy supplement. Feeding hay is often avoided due to the expense and labor involved in both harvesting and feeding hay. Feeding traditional grain-based supplements have often given disappointing results because supplements containing starch tend to reduce forage intake and, therefore, energy intake of the animal. Recent Nebraska research by DeHann et al. (1983) suggests that supplements containing highly digestible fiber sources such as corn gluten feed (CGF) are more efficient at increasing total energy intake of grazing cattle than supplements containing grains. This research evaluates corn gluten feed as an energy and protein supplement for beef cows grazing low quality forage.

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Materials and Methods

Ninety mature Hereford cows bred to calve in March and April were blocked by age, weight, body condition and expected calving date and allotted to five supplement treatment groups. Treatments were negative control, low level of soybean meal (NC/SBM); positive control, higher level of soybean meal (PC/SBM); corn gluten feed (CGF); corn gluten feed/soybean meal blend (CGF/SBM); and corn gluten feed/urea (CGF/Urea). The treatments, supplement compositions, and amounts fed are presented in Table 1. Supplementation began November 20, 1984 and was terminated as each cow calved. All cows grazed as a group on native tallgrass range in north central Oklahoma.

Cattle were gathered from the pasture six days per week and individually fed their respective supplements. Daily feeding rates were prorated for a 6 day per week feeding schedule. Treatments 2 through 5 provide the same daily amount of crude protein. Treatment 1 was fed 1/2 this traditional amount and served as the negative control. The amount of energy varied between treatments depending on supplement source. Cane molasses was added to aid in pelleting. All supplements provided the same daily amounts of calcium, phosphorous, potassium, and vitamin A. Grass hay was fed when snow or ice covered the ground and when temperatures were extremely cold (less than 10°F wind chill).

Cow weights (overnight shrink) and body condition scores were recorded at 28 day intervals until cows neared calving at which time measurements were taken every 14 days. As cows calved they were removed from the trial and their nearest 14 day records were used as the final measurement. Following calving, cows were allotted by condition and precalving treatment to a high or low nutrition group to study the effect of nutrition after calving on cows of different weights and condition. Calving dates, birth weights, and weaning weights were recorded. Calf weaning weights were adjusted for age, sex and age of cow.

Table 1. Supplement composition.

	Treatment				
	NC/SBM	PC/SBM	CGF	CGF/SBM	CGF/UREA
Amount fed, lb/day:					
11/20/84-1/29/85	1.1	2.0	4.6	3.2	3.2
1/30/85-3/26/85	1.6	3.0	6.9	4.8	4.8
Ingredients, %:					
Soybean meal	84.69	93.10	0.00	32.33	0.00
Corn gluten feed	0.00	0.00	96.38	62.66	90.84
Molasses	3.60	3.59	3.58	3.58	3.59
Dical	9.30	13.24	0.00	1.38	1.39
Potassium chloride	2.26	0.00	0.00	0.00	.90
Vitamin A premix	0.15	.07	.04	.05	.04
Urea	0.00	0.00	0.00	0.00	3.24
Composition, %:					
Crude protein	37.43	41.11	17.89	25.90	25.71
TDN	67.92	74.41	73.99	73.94	69.86
Calcium	2.19	.98	.34	.62	.61
Phosphorus	2.25	1.22	.71	.94	.92
Potassium	2.85	1.87	.66	1.08	1.09

Cows were bred by natural service and pregnancy diagnosed by rectal palpation on October 17, 1985.

On day 114 of the trial, rumen fluid samples were taken via stomach tube from 40 randomly selected cows at 1 and 4 hours after supplement feeding. Fluid pH was recorded at the time of collection before storing for later laboratory analyses. Laboratory analyses consisted of VFA determination by gas chromatography and NH_3 determination by the phenol-hypochlorite colorimetric assay.

Results and Discussion

Cow weight and body condition changes are shown in Table 2. One cow was removed from the CGF/SBM treatment group for health reasons unrelated to the trial. Cow weight losses were greater (P<.01) for the NC/SBM treatment group than the PC/SBM treatment, demonstrating a protein deficiency did exist. Cows fed corn gluten feed alone (CGF) or the corn gluten feed/soybean meal blend (CGF/SBM) maintained the initial fall weight through the winter period. The PC/SBM, CGF, CGF/SBM and CGF/UREA supplements each provided equal amounts of daily crude protein, yet the consumption of a higher level supplemental TDN in the CGF and CGF/SBM supplements increased the total energy available to the cow. Cows receiving the corn gluten feed and urea supplement (CGF/UREA) lost weight similar to the NC/SBM treatment. Body condition scores reflected weight change; the NC/SBM group had the greatest loss in condition (-.91 units) and the CGF treatment lost the least (-.39 units). All treatments tended to maintain the same differences in weight and body condition to weaning (October 17, 1985).

Cow conception and calf performance is presented in Table 3. The percent of cows conceiving in the breeding season was lower (P<.11) for

Table 2. Performance of mature cows and their calves.

	Treatment[a]					
	NC/SBM	PC/SBM	CGF	CGF/SBM	CGF/UREA	Prob.
Number of pairs	18	18	18	17	18	
Initial cow wt, lb, 11/20/85	1041	1047	1048	1044	1040	
Cow wt change, lb, 11/20 to precalving	-77[b]	-24[cd]	3[d]	1[d]	-56[bc]	P<.01
Initial body condition (1-9)	5.8	5.7	5.7	5.7	5.7	
Body condition change	-.96[b]	-.47[c]	-.39[c]	-.49[c]	-.69[bc]	P<.01
Cow wt at weaning, 10/17/85	975.1	993.3	1003.4	998.6	987.8	NS
Cow CS at weaning[e], 10/17/85	5.11	5.11	5.31	5.16	5.13	NS

[a]LS means.
[bcd]Means with different superscript letters differ.
[e]Condition scoring system used was 1 through 9 (1=very thin and 9=very fat).

Table 3. Cow conception rate and calf performance.

	Treatment[a]					
	NC/SBM	PC/SBM	CGF	CGF/SBM	CGF/UREA	Prob.
No. cows exposed to bull	18	16	18	15	17	
Conception rate, %	55.5	87.5	83.3	80.0	88.2	P<.11
Calf birth wt, lb	74.7	76.8	80.0	80.4	76.4	P<.14
Calf ADG, lb/day	1.25	1.40	1.38	1.27	1.32	NS
Calf adj. weaning wt, lb	346	384	377	359	367	P<.19

[a]Least squares means.

the NC/SBM group (55.5%) while 80% or more cows conceived in each of the other four treatment groups. Although calf weaning weights and rates of gain were slightly lower in the NC/SBM treatment groups, calf performance was not significantly affected by previous winter nutritional treatment of the dam.

Rumen volatile fatty acid (VFA) concentrations at 1 and 4 hours after supplementing is presented in Tables 4 and 5, respectively. Regardless of treatment, total VFA's were higher 4 hours after supplements were fed than at 1 hour. At 1 hour after feeding the supplement, the CGF cows had lower (P<.01) concentrations of acetate and higher (P<.01) levels of propionate and butyrate. The same relationship existed at 4 hours after feeding; therefore, the acetate/propionate ratio was lower in the CGF treatment at both 1 and 4 hours after feeding than other treatments.

Table 4. Volatile fatty acid concentration (molar %) in rumen fluid collected one hour post supplementation.

	Treatment[a]					
	NC/SBM	PC/SBM	CGF	CGF/SBM	CGF/UREA	Prob.
Cows sampled	8	7	11	6	8	
Total VFA (μmoles/ml)	55.24_{b}	63.57_{b}	59.61_{c}	60.13_{b}	55.88_{b}	NS
Acetate	75.50^{b}	72.08^{b}	64.03^{c}	69.73^{b}	71.66^{b}	P<.01
Propionate	13.47^{c}	15.52^{c}	22.78^{b}	17.02^{c}	17.12^{c}	P<.01
Isobutyrate	1.47^{bc}	2.06^{b}	$.74^{c}$	1.27^{bc}	1.62^{b}	P<.05
Butyrate	6.86^{c}	7.50^{c}	9.88^{b}	9.18^{bc}	7.07^{c}	P<.01
Isovalerate	1.66	1.80	1.15	1.46	1.31	NS
Valerate	1.03	1.04	1.42	1.32	1.21	NS
Acetate/ propionate	5.72^{b}	4.67^{bc}	2.80^{d}	4.26^{c}	4.28^{c}	P<.01

[a]Least squares means.
[bcd]Means in same row with different superscripts differ.

Table 5. Volatile fatty acid concentration (molar %) in rumen fluid collected four hours post supplementation.

	Treatment[a]					
	NC/SBM	PC/SBM	CGF	CGF/SBM	CGF/UREA	Prob.
Cows sampled	8	7	11	6	8	
Total VFA (μmoles/ml)	57.73^{b}	66.47^{b}	70.67^{c}	60.56^{b}	54.80^{b}	NS
Acetate	71.81^{b}	67.86^{b}	60.74^{c}	66.76^{b}	69.36^{b}	P<.01
Propionate	17.51^{c}	17.73^{c}	24.53^{b}	18.31^{c}	19.30^{c}	P<.01
Isobutyrate	1.40^{bc}	2.11^{b}	1.65^{c}	1.55^{bc}	1.39^{bc}	P<.05
Butyrate	6.25^{d}	8.30^{cd}	11.29^{b}	10.29^{bc}	7.61^{d}	P<.01
Isovalerate	2.01^{bc}	2.46^{b}	1.05^{c}	1.67^{bcd}	1.34^{c}	P<.01
Valerate	1.02^{cd}	1.53^{bc}	1.74^{b}	1.42^{bcd}	1.00^{d}	P<.01
Acetate/ Propionate	4.13^{b}	3.84^{b}	2.49^{c}	3.65^{b}	3.73^{b}	P<.01

[a] Least squares means.
[bcd] Means in same row with superscripts differ.

Rumen pH and ammonia concentrations at 1 and 4 hours after supplementing are presented in Table 6. Rumen pH was lower (P<.01) in the CGF treatment than all other treatments at 4 hours after supplementing. This lower pH may be expected since feeding grain supplements result in pH reduction. It should be noted, however, that all pH levels were still relatively high and would not be expected to seriously affect fiber digestibility. Rumen ammonia concentrations were similar at 1 hour after feeding; however, at 4 hours after feeding rumen fluid ammonia concentrations were higher (P<.05) for cows on the PC/SBM treatment than all other treatments.

Table 6. Ruminal pH and the concentration of ammonia in rumen fluid collected one and four hours post supplementation.

	Treatment[a]					
	NC/SBM	PC/SBM	CGF	CGF/SBM	CGF/UREA	Prob.
Cows sampled	8	7	11	6	8	
Rumen pH:						
1 hr post-feeding	7.47	7.29	7.04	7.19	7.37	P<.2
4 hr post-feeding	7.49^{b}	7.42^{b}	6.84^{c}	7.16^{b}	7.35^{b}	P<.01
Rumen ammonia (mg/dl):						
1 hr post-feeding	13.75	18.80	13.73	17.47	20.53	P<.07
4 hr post-feeding	14.53^{c}	20.94^{b}	10.89^{c}	14.82^{c}	11.32^{c}	P<.05

[a] Least squares means.
[bc] Means in same row with different superscripts differ.

These results suggest that corn gluten feed can be used alone or with soybean meal as a winter protein and energy supplement. The CGF/SBM cows maintained the same weights as the CGF cows on 30% less daily feed; therefore, corn gluten feed was more efficiently utilized when SBM was added to the supplement. Corn gluten feed performed as well as or better than soybean meal in improving or maintaining cow weight, body condition, conception rates, or calf performance. Adding urea to corn gluten feed resulted in increased cow weight loss compared to feeding corn gluten feed alone.

Literature Cited

DeHaan, K., et al. 1983. Corn gluten feed--energy source for ruminants. Nebraska Beef Cattle Report MP-44:19.