Protein Supplements Fed to Yearling Steers Grazing Common Bermudagrass Pastures

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Summary

Twelve yearling steers grazing a common bermudagrass pasture in late summer and early fall were randomly assigned to receive cottonseed meal supplement, fish meal supplement, or no supplement. Both supplemented groups gained significantly (P<.05) more than the no supplement group. Steers that were offered the fish meal supplement rejected most of it. The improved weight gain of steers offered the cottonseed meal supplement may have resulted as much from the added energy as the additional protein. Results of laboratory analyses of samples of the sward and the diet suggest that ease of prehension of desirable sward components, particularly green leaves, was too low for intake to approach maximum levels.

Introduction

Body weight gains by yearling cattle grazing summer pastures are low, usually less than 0.8 lb daily in the Texas Gulf coastal region. Although this low performance is often attributed to a deficiency in digestible energy intake, protein may at times be the first-limiting nutrient for growing cattle grazing warm-season perennial grasses. Cottonseed meal and soybean meal, two major sources of supplemental protein for cattle, are rapidly deaminated in the rumen and may provide little additional protein to the body tissue. Fish meal, on the other hand, contains a higher proportion of protein that escapes breakdown in the rumen and provides improved protein nutrition at the tissue level. The experiment described here was conducted to provide further information on the relative contributions of energy and protein toward improved weight gains on summer pastures.

Procedure

After being trained to operate individual, electronically activated, gate feeders, 12 Hereford x Brahman F1 yearling steers were randomly assigned to one of three treatment groups, 1) cottonseed meal supplement (CSM), 2) fish meal supplement (FM), and 3) no supplement (NS). The FM supplement also contained cottonseed meal to improve palatability. Ingredients of the supplement mixes are shown in Table 1. The supplements, intended to provide 0.5 lb of protein daily, were offered in individual feeders mounted in an open portable shed. Orts were removed, dried and weighed every other day.

All animals were placed on a small common bermudagrass pasture for a week prior to being weighed (16-hours fast) and introduced to the experimental pasture on August 2, 1988. Unfasted weights were obtained at 4-week intervals and another fasted weight was obtained at the end of the experiment on October 22, 1988.

TABLE 1. COMPOSITION OF PROTEIN SUPPLEMENT MIXES

Item	Supplement	
	FM	CSM
	%	
Fish meal	50	0
Salt	3	3
Dried molasses	4	4
Cottonseed meal	42.7	92.7
Ionophore	.18	.18
Trace mineral premix	.12	.12

In order to more rapidly reduce an excessive accumulation of herbage, half of the 12-acre experimental pasture was harvested for hay at the beginning of the experiment and protected from grazing for 4 weeks. Also, four grazer steers were added to the experimental group to increase grazing pressure. Samples from the grazed half of the pasture were gathered during the week of August 23 by clipping 2.7-ft^2 quadrats to ground level (sward) at 40 randomly selected sites. Two or three diet samples were also collected daily from a mature crossbred cow fitted with an esophageal cannula. Sampling was repeated during the week of October 17. All samples were frozen within 1 hour after collection and were subsequently freeze-dried and weighed. After grinding each sample through a Wiley mill fitted with 4-mm screen, sward samples were composited in sets of five by weight. Diet samples were composited over 5 days by time of day of collection. An aliquot was removed from each composite for microscopic examination of botanical composition and the remainder was ground through a 1-mm screen for determination of neutral detergent fiber (NDF), acid detergent fiber (ADF), cellulose, and indigestible NDF (INDF) remaining after 144 hours of in vitro fermentation.

Results and Discussion

The FM supplement was poorly accepted throughout the experiment. On average the FM steers ate only one-quarter of the supplement that they were offered (Table 2). A few cottonseed meal pellets (CSP), in addition to the cottonseed meal that was part of the FM supplement, were offered to the FM steers each day to entice them to eat the FM supplement. Steers on CSM supplement consumed an average of 0.93 lb daily or 75 percent of offerings. A draw-

TABLE 2. AVERAGE INITIAL AND FINAL WEIGHTS, INTERMEDIATE UNFASTED WEIGHTS, SUPPLEMENT INTAKES AND INCREMENTAL CONVERSION RATES FOR YEARLING STEERS GRAZING COMMON BERMUDAGRASS

Item	Treatment		
	NS	CSM	FM
	pounds		
Initial weight	535	529	572
28 days	580	583	627
56 days	579	606	639
Final weight	571	606	643
Average daily gain	.44	.94	.87
Supplement offered daily	-	1.25	1.00
Daily intakes			
Supplement	-	.93	.23
Cottonseed meal pellets	-	.04	.22
Protein from supplement[1]	-	.40	.21
Incremental conversion rate[2]	-	1.94	1.05

[1] Includes protein from cottonseed meal pellets.
[2] Pounds supplement (including cottonseed meal pellets) consumed per pound gain above NS group.

back to using individual feeders in pasture situations is the potential loss of competitive feeding behavior among cattle. As a consequence, supplement intakes in this experiment may have been lower than would be experienced under practical feeding conditions. The FM orts as well as the CSM orts were fed in an open trough to a small group of steers in another pasture and were readily consumed.

Average weights and average daily gains are shown in Table 2 for steers on each of the three treatments. Average daily gain (ADG) for steers on the CSM treatment was 0.5 lb higher (P<.05) than the ADG for NS steers. The energy supplied by CSM may have been equally responsible with the added protein for the improved gain of the CSM steers. If one assumes that herbage intakes by the CSM and NS groups were the same, the increased gain by the CSM steers can be accounted for rather precisely by the digestible energy content of the supplement they consumed. For the FM group ADG was 0.43 lb greater (P<.05) than for the NS group. This is more than can be accounted for by the energy content of the FM and CSP that the FM group consumed. The ionophore, which often improves gain by altering rumen fermentation, may have contributed to improvement in performance of the FM group. However, its effect has usually been limited to 0.2 lb ADG, and it appeared to provide no benefit to the CSM group. The added minerals provided by the supplements may also have contributed to increased gains. However, a mineral supplement was offered to all cattle throughout the experiment.

The results of laboratory analyses are shown in Table 3. For all measures except percent green leaf in the October 17 harvest period, sward, and diet samples were significantly different (P<.05) within harvest period. In each case the means reflect higher quality in diet samples than in sward samples. None of the fiber components show the difference more clearly than INDF, a measure that is most closely associated with animal performance (Lippke 1986). Statistical analysis within sample showed that INDF was negatively related to the proportions of green sward components, which accounted for 70 percent of the variation in INDF. Only cellulose content made an additional significant (P<.05) contribution (10%) toward explaining variation in INDF.

When the INDF levels in diet and sward samples are related to results of previous stall-feeding experiments (Lippke 1980; Lippke 1986), they indicate that factors other than

TABLE 3. CHARACTERISTICS OF SWARD AND DIET SAMPLES

Item	Collection Period			
	August 23		October 17	
	Sward	Diet	Sward	Diet
	percent			
NDF[1]	71.5	68.8	72.8	66.7
ADF[1]	39.2	37.5	43.3	39.3
Cellulose[1]	32.2	28.8	31.3	29.2
INDF[1]	34.4	19.6	41.0	28.5
Green Leaf	34	44	19	27
Green Stem	28	37	18	41
Dead Leaf	10	6	13	9
Dead Stem	21	8	38	14

[1]Organic matter basis.

digestibility of the diet limited body weight gains in this experiment. Although total herbage mass (Table 4) was high in August, the ease of prehending more desirable sward components (i.e., green leaves and stems) was apparently low enough to restrict intake substantially. Herbage mass and proportion of green components declined to October so that estimated green herbage was less than one-third the amount in August.

Taken in total, overall, the data support the hypothesis that low weight gains by yearling cattle grazing late summer bermudagrass pastures are caused by deficient digestible energy intake and inefficent energy utilization due to protein deficiency. While other interpretations are possible, it is most likely that much of the incremental benefit (Table 2) in weight gains derived from the FM supplement was due to improved

TABLE 4. HERBAGE MASS AND ESTIMATES OF GREEN HERBAGE COMPONENTS OF COMMON BERMUDAGRASS SWARD

Item	Collection Period	
	August 23	October 17
	lbs/A	
Herbage Mass	5,050	2,690
Green Leaves	1,720	510
Green Stems	1,410	480

protein nutrition. The CSM supplement, on the other hand, appeared to make a major contribution to energy nutrition and provide enough protein to the body tissues for that energy to be used efficiently. The conversion rates (Table 2) indicate that feeding either supplement would be profitable under most economic conditions.

Literature Cited

1. Lippke, H. 1980. Forage characteristics related to intake, digestibility, and gain by ruminants. J. Anim. Sci. 50:952.
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