Total GIT and ruminal DM turnover rates of steers fed only wheat forage were similar. Ruminal DM turnover rates of steers fed wheat forage and sorghum-sudan hay were greater than DM turnover rates of the total GIT; an explanation for this discrepancy is not apparent. Estimated *vs* measured daily fecal outputs were similar for steers fed sorghum-sudan hay but greater for control steers. Accurate estimates of fecal output are prerequisite to calculations of forage intake of grazing cattle. Additional studies are needed to assess the accuracy of estimated fecal outputs in trials using pulse dosage marker techniques.

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Protein-Sparing Effect of Monensin Fed to Steers Wintered on Dormant, Native Range

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Story in Brief

Ninety-six Hereford steer calves were allotted to four treatments (two levels of supplemental protein with or without monensin). The steers grazed dormant native range pastures and were group fed, 6 days per week, 2 lb of supplement/head/day that contained 13.5 or 27 percent digestible protein and 0 or 150 mg of monensin during the 120-day trial (November 30, 1978, to March 30, 1979). The data suggest that a protein supplement containing 19.4 percent digestible protein plus monensin would support equivalent steer gains (i.e., 30 lb) during the total wintering period as a protein supplement containing 28 percent digestible protein without monensin.

Introduction

While the mechanism of action of monensin is not completely understood, the improvement in feed efficiency of feedlot cattle is related to the shift affected by monensin in the production of ruminal volatile fatty acids (VFAs), increasing pro-

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pionic acid and decreasing acetic and butyric acid concentrations (Richardson *et al.*, 1976). Monensin may also have a protein-sparing effect by (a) decreasing *ruminal* destruction of feed protein and/or amino acids by bacteria, and (b) decreasing the catabolism of gluconeogenic amino acids at the animal *tissue level* as a result of the increased levels of propionic acid. The response of feedlot cattle to monensin has been greater when fed low-protein rations, and has decreased or disappeared when fed higher protein levels (Owens and Thornton, 1977; Gates and Embry, 1976; Hanson and Klopfenstein, 1977). The trial reported herein was conducted to obtain data relative to the protein-sparing effect of monensin fed to steers wintered on dormant native range.

Experimental Procedure

The trial was conducted during a 120-day period, November 30, 1978, to March 30, 1979, at the U.S. Southern Great Plains Field Station, Woodward, Oklahoma.

Ninety-six (96) fall-weaned Hereford steer calves that weighed 547 ± 10.3 (SEM) lb were randomly allotted to four treatments (i.e., two levels of supplemental protein with or without monensin) of 24 steers each in a randomized complete block design with four blocks. The steers grazed native range pastures (approximately 50 acres each) that consisted primarily of blue grama, little and sand bluestem, sand dropseed and switchgrass (blocks 1, 2 and 3) and caucasian bluestem, sideoats, blue and hairy grama (block 4), and were rotated among the four pastures of each block at 2-week intervals throughout the trial. The steers had been vaccinated for blackleg, malignant edema, infectious bovine rhinotracheitis (IBR), parainfluenza 3(PI-3), and leptospirosis; treated for ear ticks; and implanted with 15 mg of diethylstilbestrol.

Steers were group fed 2 lb per head per day, 6 days per week, of one of the pelleted protein supplements shown in Table 1. The low- and high-protein supplements, fed at 2 lb per head per day, supplied the digestible protein-equivalent of .75 or 1.5 lb of

Table 1. Composition [a] of protein supplements.

Protein level:	Low[b]	High[b]
Corn, grd., %	72.40	29.16
Cottonseed meal, %	22.42	68.93
Dicalcium Phosphate, %	2.34	— — —
KC1, %	2.84	1.92
Net energy (maintenance), Mcal/cwt	91.07	82.69
Net energy (gain), Mcal/cwt	59.82	54.31
Crude protein, %	17.46	34.35
Digestible protein, %	13.50	27.00
Ca, %	.54	.12
P, %	.93	.93
K, %	2.00	2.00
Vitamin A[c]	+	+

[a]Dry matter basis, except for monensin and vitamin A which are expressed on an as-fed basis.
[b]Contained either 0 or 75 mg of monensin per lb.
[c]10,215 international units per lb.

cottonseed meal and 0 or 150 mg of monensin per head per day. The supplements were not formulated to be isocaloric in order that protein level and source would not be confounded. The difference in net energy $_{(gain)}$ content (59.82 *vs* 54.31 Mcal/cwt DM) would result, however, in a difference of less than .1 Mcal of net energy $_{(gain)}$ intake per head per day at the above level of feeding.

Steers were weighed in early morning at about 28-day intervals throughout the trial. Initial and final steer weights were means of two consecutive daily weights. The steers did not have access to water for about 24 hours before each weighing. Because of the relatively low weight gains of steers in this type of study, weight gains for the first and second halves (periods) and the total trial are reported. Steer weight gains were subjected to analysis of variance using the general linear model (GLM) procedure of the Statistical Analysis System (SAS). The effect of protein level, monensin, and the interaction of the two were tested for significance by the block x treatment error mean square with 9 degrees freedom.

Hand-plucked forage samples were taken in February and March from pastures of blocks 2 and 4 for crude protein analysis, after the dry-weight composition of plant species in the diets of the steers had been estimated by the "bite-count method" of Free *et al.*, 1971.

Results and Discussion

The mean crude protein content (averaged across pastures within the sampling dates) of the hand-plucked forage samples ranged from about 4 to 6 percent as shown in Table 2.

Steer weight gains by period and for the total trial are shown in Table 3, and graphically in Figure 1. The winter of 1978-79 was unusually severe, and steers did not gain as much as would be expected in normal years. All values are total gains for the indicated period, except those of the last row of Table 3 which are daily gains. The effect of protein level was significant during periods 1 and 2 and the total trial ($P<.0001$, .004, .0001). Effect of monensin was significant during period 1 ($P<.0005$) and the total trial ($P<.0001$), and not significant ($P>.48$) during period 2. A protein level x monensin interaction was not observed ($P>.34$) for any of the periods or the total trial. The effect of monensin on steer weight gains for the total trial at both protein levels is interesting. Although two levels of protein are insufficient to establish a relationship, the steer gains

Table 2. Crude protein content (% of dry matter) of forage samples.

	Block 2[a]				Block 4[b]				
Pasture:	1	2	3	4	1	2	3	4	Mean
Date									
2/13-16/79				5.71	3.32	3.42	3.82	4.50	4.15
2/20-23/79	5.08	5.74	5.42						5.41
3/13-16/79					4.14	2.88	5.08	4.69	4.20
3/19-23/79	5.42	6.74		5.82					5.99

[a]Pastures of blocks 1, 2 and 3 consisted primarily of blue grama, little and sand bluestem, sand dropseed and switchgrass.
[b]Pastures of block 4 consisted primarily of caucasian bluestem, sideoats, blue and hairy grama.

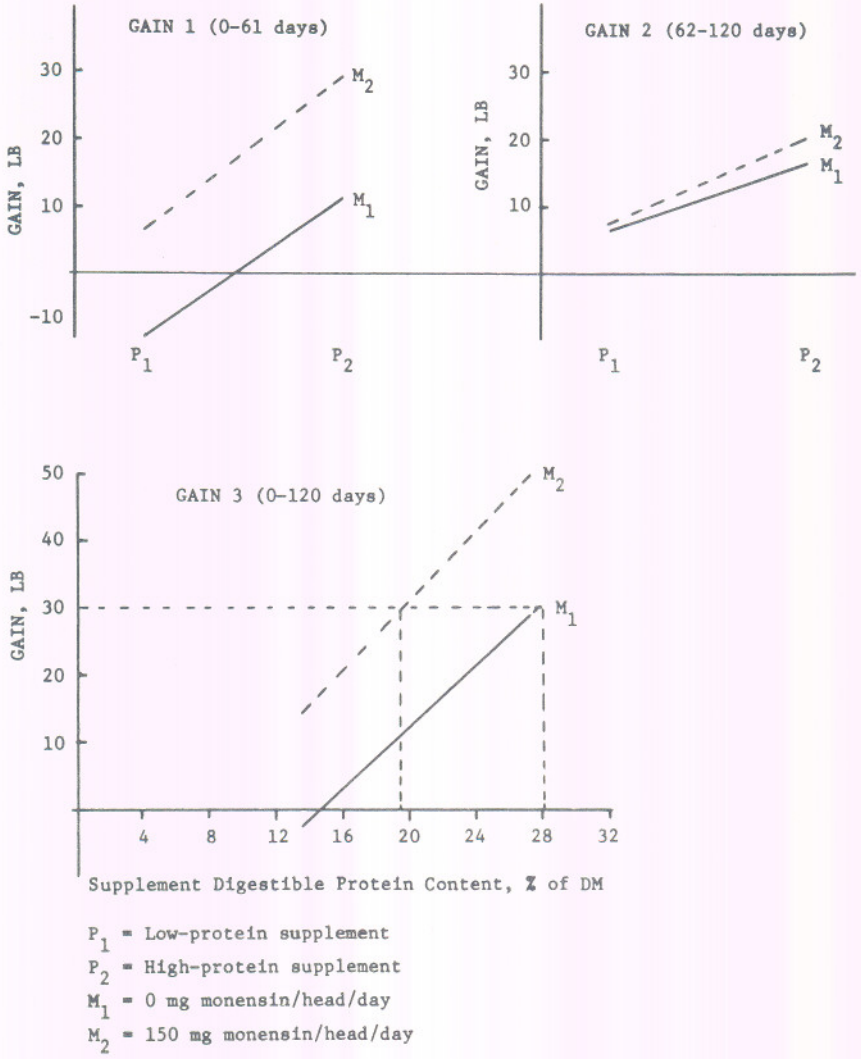

Figure 1. Effect of supplement protein level and monensin on steer weight gains.

Table 3. Effect of supplement protein level and monensin on steer weight gains[a].

Protein level:	Low[b]		High[c]			
Monensin, mg/head/day	0	150	0	150	SEM[d]	LSD[e] .05
Gain 1 (0-61 days), lb:[f]	−9.4	6.6	11.5	29.4	3.21	10.3
Gain 2 (62-120 days) lb:[g]	6.7	7.5	16.8	20.2	2.92	9.4
Gain 3 (0-120 days)[h]						
lb:	−2.7	14.2	28.3	49.6	2.27	7.3
lb/day:	− .02	.12	.24	.41	.019	.06

[a]Means of 24 steers per treatment group, except for low-protein, monensin-fed group which had 23 steers (1 steer was removed because of wildness).
[b]13.5% digestible protein on DM basis.
[c]27.0% digestible protein on DM basis.
[d]Standard error of the mean.
[e]Least significant difference (P<.05).
[f]Significant protein level and monensin effect (P<.0005).
[g]Significant protein level effect (P<.005).
[h]Significant protein level and monensin effect (P<.0001).

for the total trial suggest that a protein supplement containing 19.4 percent digestible protein and monensin would support equivalent steer weight gains (i.e., 30 lb) as a protein supplement containing 28 percent digestible protein and no monensin (Figure 1). Additional studies with protein supplements containing three or four levels of protein with and without monensin are needed to further examine this relationship. Four protein levels would provide a better check for non-linearity of the relationship.

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