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Influence of Supplemental Protein or Energy on Performance of Calves Grazing Winter Pastures

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Summary

Forty spring-born Simmental crossbred calves were fall-weaned and placed on rye-ryegrass pastures in mid-February. Calves were blocked by sex and received pasture only (PAS), pasture plus a fishmeal supplement (FIS), pasture plus a corn supplement (CRN), or pasture plus a corn-rumen stable amino acid supplement (CAA). Calves receiving CRN and CAA had average daily gains (ADG) of 3.48 and 3.26, respectively. Both corn supplements produced greater calf ADG than PAS (2.23) and FIS (2.62) supplements. Average daily consumption of the monensin added supplements of FIS, CRN, and CAA was .74, 1.68, and1.60 lbs/hd, respectively. Results from this study indicated that calves were unable to consume sufficient quantities of energy from winter pasture to produce maximum genetic potential gains. The conversion ratio of supplement to increased gain ranged from 1.3 to 1.9 which has encouraging biological as well as economical implications.

KEYWORDS: Protein supplement/corn/amino acid/fishmeal/ryegrass/forage.

Introduction

The humid South is well adapted to producing high quality winter/spring pastures. Although these pastures contain high levels of crude protein (20 to 25 percent), grazing calves often gain at a rate less than their maximum genetic capability. This indicates a possible deficiency in dietary intake of protein and/or energy. Extensive ruminal protein degradation may produce a tissue level protein deficiency which may limit growth. It has also been suggested that the resulting microbial protein may be deficient in the indispensible amino acids, lysine and methionine, which may also be a growth limiting factor. Therefore, the objective of this trial was to determine the influence of supplemental energy and source of protein supplement on stocker calves grazing rye-ryegrass pastures.

Procedure

Forty spring-born, ½ Simmental x ¼ Hereford x ¼ Brahman steers (n = 20) and heifers (n = 20) were weaned on October 2 and grazed on bermudagrass pastures until November 19. On this date, they began receiving 4 lbs/hd/day ground corn, 1 lb/hd/day whole cottonseed, and ad libitum bermudagrass hay. Calves continued to receive this ration until February 13, at which time they were weighed (average 668 lbs), implanted with Ralgro, given a visual condition score (VCS) ranging from 1 to 10, and allotted by weight, and VCS to the following four treatments: (1) 'Elbon' rye-Marshall' ryegrass pasture only (PAS); (2) pasture + low-solubility fishmeal (FIS); (3) pasture + corn (CRN); and (4) pasture + corn and rumen-stable methionine and lysine (CAA).

Each treatment was replicated with five steers (Rep 1) and five heifers (Rep 2). Individual replicates of CRN and CAA were group fed, whereas, Rep 1 and Rep 2 of FIS were combined and fed via Pinpointer 4000 to determine individual daily supplement intake. Therefore, one 6-acre pasture and six 3-acre pastures were grazed in this trial. All groups were fed ad libitum except Rep 2 of CAA, which did not limit voluntary daily intake to the targeted 2 lbs/hd. The FIS, CRN, and CAA supplements contained 37.2, 8.3, and 10.5 percent crude protein, respectively, and monensin at 90 mg/lb (Table 1). Variation in ingredient composition for CAA was due to attempts to regulate voluntary daily intake of CAA by heifers in Rep 2. The FIS and CRN were pelleted; whereas, CAA was fed in a loose form to prevent disruption of the polymer coating on the rumen stable lysine and methionine during the pelleting process. The polymer coating is resistant to rumen pH but sensitive to the more acidic abomasal pH.

TABLE 1. COMPOSITION OF SUPPLEMENTS FED TO CALVES GRAZING RYE-RYEGRASS PASTURES

	Fishmeal	Corn	Corn + AA
		% of DM	
Rolled corn	—	70.00	67.96
Animal fat	—	.98	1.00-5.00
Cane molasses	2.88	2.88	3.00-10.00
Salt	2.94	2.94	0-3.00
Minerals	1.24	10.21	10.50
Rumensin 60	.15	.15	.15
Rumen-stable methionine	—	—	.90
Rumen-stable lysine	—	—	1.17
Fishmeal (Menhaden)	48.50	—	—
Cottonseed hulls	27.00	—	—
Wheat mill run	11.34	—	—
Formulated % Crude Protein	37.2	8.3	10.5
Formulated NEm (mCal/lb)	.59	.85	.84
Formulated NEg (mCal/lb)	.39	.56	.55

Test animals were given a 14-day adjustment period prior to initiation of the grazing trial to allow for adjustment to the high quality forage and the supplement. Calves were weighed on February 27, March 24, April 29, and May 28. The trial was terminated on May 28 (90 days). Each calf was given a final weight and VCS, and was measured for rump fat thickness via ultrasound.

Pastures were fertilized with 50 lbs N/A at 4- to 6-week intervals. Forage on-offer was monitored closely by visual observation and biweekly pasture samples. Pasture samples were taken by hand-clipping four, 1-ft square areas to ground level. Each sample was intended to represent one quarter of the pasture. The level of forage on-offer was equalized across treatments by the put-and-take method. Forage was maintained at a sufficient level to allow animals to graze selectively. Grazer animals were added to pastures on February 27, April 8, and April 29 at various rates and were removed when forage had been consumed to the desired level. The average level of forage on-offer at initiation and termination of the trial was 171 and 138 lbs DM/100 lbs live bodyweight, respectively (Table 2).

Forage samples for chemical analysis were taken biweekly by hand-picking portions of the sward which visually estimated those plant parts selected by the animals. Forage crude protein levels ranged from 20 to 30 percent during the grazing period (Table 3).

Results

The calf average daily gains (ADG) for CRN (3.48) and CAA (3.26) were significantly higher ($P<.01$) than PAS (2.23) and FIS (2.62), but were not different from each other (Table 4). Therefore, rumen-stable methionine and lysine did not increase ADG over that of the corn supplement in this trial. Although there was a .39 lb/day increase in gain due to FIS, FIS was not statistically different from PAS. All supplements were consumed ad libitum except Rep 2 of CAA, which was restricted-fed daily at 2 lbs/hd. Average daily consumption (ADC) for FIS, CRN, and CAA was .74, 1.68, and 1.60 lbs, respectively (Table 4). The magnitude of ADG tended to be related to level of supplement consumption. The increase in gain (IG) due to supplement was defined as the difference in level of ADG of a supplemented treatment and that of PAS. The IG for FIS, CRN, and CAA was .39, 1.25, and 1.03 lbs/hd/day, respectively (Table 4). The supplement:increased gain ratio (ADC:IG) describes the feed efficiency for each supplement, assuming the increase in ADG over PAS was due solely to the nutrient content of the supplement and that there was no effect on forage utilization. The ADC:IG ratio for FIS, CRN, and CAA was 1.89, 1.33, and 1.55, respectively (Table 4). The ADC:IG ratios were below the range considered to be normal for feedlot cattle, indicating an increased forage utilization (i.e., intake, digestibility, or both).

At the beginning of the adjustment period (February 13), VCS were not different for treatments. However, at termination of the 90-day grazing trial, CRN had a

TABLE 2. FORAGE AVAILABLE ON EACH PASTURE AND EXPRESSED AS POUNDS OF DRYMATTER (DM) AVAILABLE/100 POUNDS OF LIVEWEIGHT (BW) OF RYE-RYEGRASS PASTURES

	Date								
Treatment	2/25	3/5	3/20	4/2	4/17	5/2	5/16	5/18	AVG.
	lbs DM/100 lb BW								
PAS	154	155	102	195	147	68	146	189	145
FIS	146	139	82	135	97	77	75	104	107
CRN	146	136	113	177	103	229	107	116	141
CAA	238	229	153	262	155	127	100	144	176
AVG.	171	165	113	192	126	125	107	138	142

TABLE 3. PERCENT CRUDE PROTEIN OF RYE-RYEGRASS PASTURES

	Date								
Treatment	2/25	3/5	3/20	4/2	4/17	5/2	5/16	5/28	AVG.
	Percent								
PAS	24.0	20.2	18.7	30.8	27.0	24.1	24.2	22.9	24.0
FIS	27.0	19.3	19.6	27.6	26.1	21.1	23.0	23.4	23.4
CRN	22.9	21.8	21.6	29.8	26.9	20.1	26.3	24.5	24.2
CAA	23.7	21.0	18.5	29.8	26.6	24.8	25.9	25.0	24.4
AVG.	24.4	20.7	19.6	29.7	26.7	22.5	25.1	24.0	24.0

TABLE 4. AVERAGE DAILY GAIN, CONSUMPTION OF SUPPLEMENT, AND CONVERSION RATIOS OF PROTEIN SUPPLEMENTS FED TO CALVES GRAZING BERMUDAGRASS PASTURES

Average Treatment	Average Daily Gain	Average Daily Consumption	Increased Gain	Supplement: Increased Gain Ratio
	Pounds			lb:lb
PAS	1.03d	0	0	0
PDQ	1.22cd	.43	.19	2.26
FMB	1.20cd	.45	.17	2.65D
DPDQ	1.51b	1.92	.48	4.00
AA	1.40bc	2.21	.37	5.97
FM	1.92a	1.12	.89	1.25

TABLE 5. VISUAL CONDITION SCORE AND RUMP FAT THICKNESS OF CALVES GRAZING RYE-RYEGRASS PASTURES

Treatment	Visual Condition Score*		Rump Fat Thickness
	Initial (d=0)	Final (d=90)	Via Ultrasound inches
PAS	6.10a	6.80a	1.00a
FIS	5.75a	6.95a	1.09a
CRN	5.95a	7.85b	1.21b
CAA	5.85a	7.15a	1.08a

a,b = Means in same column differ, $p<.05$.
* Visual, 1-10 range with 10 being extreme fat condition.

significantly higher ($P<.01$) VCS (Table 5). Measurement of rump fat thickness via ultrasound confirmed the results of VCS, as CRN had a higher ($P<.01$) rump fat thickness than other treatments (Table 5).

Fishmeal was fed via Pinpointer 4000 to determine individual daily supplement intake. Results indicated that ADG was positively related ($P<.01$) to ADC (ADG = 0.82 + 0.6 ADC; r = .73) of the fishmeal supplement (Figure 1). Results of this trial indicated that calves grazing rye-ryegrass pastures may be deficient in energy or protein intake for maximum weight gain. Although supplemental dietary energy increased ADG, the increase in performance may have been due to an increased efficiency of microbial protein synthesis.

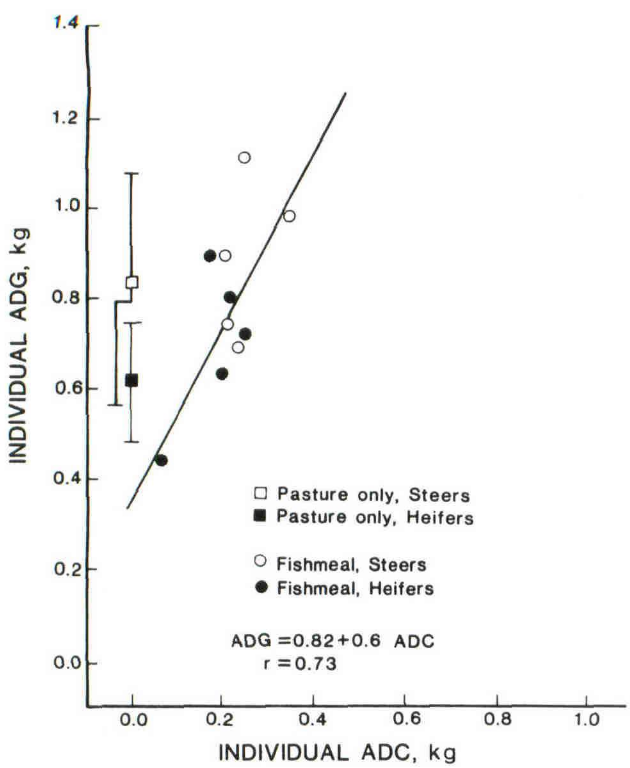

Figure 1. Influence of average daily consumption on average daily gain of steers and heifers.