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Supplementation strategies for forage-fed beef steers

Abstract

A comparison was made of different supplementation strategies for steer calves wintered on brome hay for 109 days. Treatments consisted of no supplement, 1.33 lb/head daily of a 30% protein range cube, a commercially available free-choice block supplement containing 40% crude protein (19% as non-protein nitrogen), and a soy-based block supplement containing soy solubles and full-fat soybeans with 40% crude protein (25% as nonprotein nitrogen). Following the backgrounding phase, steers were placed onto finishing rations and fed for an additional 152 days before being slaughtered. Gain during the growing phase was greater for all supplemented cattle than for unsupplemented controls. Cattle fed blocks or no supplement tended to compensate during the finishing phase, suggesting that differences in gastrointestinal tract fill may have impacted body weights at the end of the back grounding phase. When performance was evaluated over the entire 261-day trial, cattle fed blocks were more efficient than controls, whereas efficiencies of cattle fed range cubes were essentially equal to those of cattle that previously received no supplement. Additionally, soybean solubles and full-fat soybeans were viable alternatives to traditional ingredients for manufacturing free-choice block supplements.

Keywords

Cattlemen's Day, 2000; Kansas Agricultural Experiment Station contribution; no. 00-287-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 850; Beef; Growing cattle; Forages; Blocks

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SUPPLEMENTATION STRATEGIES FOR FORAGE-FED BEEF STEERS[1]

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Summary

A comparison was made of different supplementation strategies for steer calves wintered on brome hay for 109 days. Treatments consisted of no supplement, 1.33 lb/head daily of a 30% protein range cube, a commercially available free-choice block supplement containing 40% crude protein (19% as nonprotein nitrogen), and a soy-based block supplement containing soy solubles and full-fat soybeans with 40% crude protein (25% as nonprotein nitrogen). Following the backgrounding phase, steers were placed onto finishing rations and fed for an additional 152 days before being slaughtered. Gain during the growing phase was greater for all supplemented cattle than for unsupplemented controls. Cattle fed blocks or no supplement tended to compensate during the finishing phase, suggesting that differences in gastrointestinal tract fill may have impacted body weights at the end of the backgrounding phase. When performance was evaluated over the entire 261-day trial, cattle fed blocks were more efficient than controls, whereas efficiencies of cattle fed range cubes were essentially equal to those of cattle that previously received no supplement. Additionally, soybean solubles and full-fat soybeans were viable alternatives to traditional ingredients for manufacturing free-choice block supplements.

(Key Words: Growing Cattle, Forages, Blocks.)

Introduction

Free-choice block supplements are convenient and require little labor. Low-moisture blocks, which are manufactured by cooking molasses and other liquid ingredients to very low moisture levels, are particularly attractive because consumption is very consistent. The liquid ingredients used typically contain a high proportion of simple sugars. When exposed to air, sugars bind atmospheric moisture, producing a thin layer of syrup on the block surface that is readily consumed by cattle. Consumption is controlled as a result of the rate at which the softened, syrupy layer develops on the block surface. Using this process, it is possible to regulate intake of costly nutrients, such as protein, vitamins, and minerals, with a free-choice system.

Soy solubles contain approximately 50% sugars, 20% protein, and appreciable levels of several important minerals. The majority of the sugars is sucrose, which is similar to other liquid ingredients used in blocks, such as cane or beet molasses. Consequently, our interest was in comparing blocks manufactured with soy solubles and full-fat soybeans to range cubes and to commercially available blocks containing high proportions of molasses, feather meal, and blood meal.

Experimental Procedures

Crossbred steer calves (618 head) were purchased from sale barns in Florida, transported to the K-State Beef Cattle Research Center, and placed on a common receiving

[1]Partial funding for this project was provided by the Kansas Soybean Commission.

diet for 35 to 40 days prior to initiating the growing experiment. At the beginning of the growing period, calves were weighed individually and allocated to 12 pens, with a total of 48 to 53 head per pen, and three pens per treatment.

Treatments included blocks made with a high proportion of soy solubles and full-fat soybeans (SOYBLOCK; 40% crude protein with 25% as nonprotein nitrogen), commercially available molasses-based blocks (CBLOCK; 40% crude protein with 19% as non-protein nitrogen), and commercially available range cubes (CUBES; 30% crude protein). These supplementation strategies were compared to a negative control (CONTROL) group that received only hay and salt. Brome hay (7.85% crude protein, 69.7% NDF, .46% calcium, and .17% phosphorus) was processed in a tub grinder to a chop length of 3 to 4 inches. Cattle had free access to the brome hay, which was fed twice daily in fence-line feed bunks. Fresh water and white salt were available at all times. Steers fed CUBES were given 1.33 lb/head daily (as-fed basis) of the supplement in conjunction with the morning feeding of hay. SOYBLOCK and CBLOCK were provided free choice throughout the 109-day growing phase. At the end of the growing period, steers were stepped up to common finishing diets, fed for 152 days, and slaughtered at a commercial facility in Emporia, Kansas. Average daily gains during the finishing phase were based on shrunk (4%) weights computed using carcass weight adjusted to a common dressing percentage.

Results and Discussion

Intake of hay and supplements, daily gains, and efficiencies for the growing phase are shown in Table 1. Intake of the SOYBLOCK was somewhat higher than intake of the commercial 40% block supplement. We attributed this to the softer texture of the SOYBLOCK in comparison to the CBLOCK. Additional experience with processing of soy solubles in block supplements likely would make it feasible to produce harder blocks that would lower consumption. Cattle fed the block supplements tended to consume less hay than the cattle fed CUBES or no supplement. Gains for cattle fed the two blocks were very similar. Steers fed blocks tended to gain faster than unsupplemented cattle and slower than cattle fed range cubes. Efficiency of gain paralleled rate of gain.

During the finishing phase (Table 2), cattle previously fed the SOYBLOCK gained faster and were more efficient than the other treatment groups. Efficiency was poorest for cattle previously fed range cubes, indicating some compensation by cattle in the other dietary treatments. We interpret these data to suggest that different supplementation strategies vary in their impact on gastrointestinal tract fill.

When performances during the growing and finishing phases were combined (Table 3), cattle that were supplemented during the growing period gained more rapidly than unsupplemented controls. However, cattle fed either of the block supplements were more efficient than controls, whereas those fed range cubes were essentially identical to unsupplemented controls. Cattle fed the SOYBLOCK gained more rapidly than those fed the commercial block supplement, but the two block supplements yielded comparable efficiency overall.

Free-choice block supplements represent a feasible alternative to hand-fed range supplements. Additionally, we conclude that soybean solubles and full-fat soybeans can effectively substitute for traditional ingredients in cooked, self-fed, block supplements.

Table 1. Performance of Steers Backgrounded (109 Days) on Forage-Based Diets Using Different Supplementation Strategies

	Treatment [a]				
Item	CONTROL	SOYBLOCK	CBLOCK	CUBE	SEM
No. steers	157	153	155	153	
Initial weight, lb	551	549	550	552	9.7
Ending weight, lb	634	645	647	671	14
Dry matter intake, lb/day					
Supplement	---	.96[b]	.60[c]	1.18[d]	.032
Forage	15.1[b]	14.2[bc]	14.0[c]	14.8[bc]	.36
Total	15.1[bc]	15.1[bc]	14.6[c]	16.0[b]	.37
Average daily gain, lb	.76[b]	.88[b]	.89[b]	1.09[c]	.069
Gain:feed	.051[b]	.058[bc]	.061[c]	.068[c]	.0039

[a]CONTROL: no supplement; SOYBLOCK: free-choice block supplement containing 40% crude protein with 25% as nonprotein nitrogen, made from soybean solubles, urea, and full-fat soybeans; CBLOCK: commercially available cooked molasses block containing 40% crude protein with 19% as nonprotein nitrogen; CUBE: commercially available range cube containing 30% crude protein with no nonprotein nitrogen.

[b,c,d]Means in the same row without a common superscript are different (P<.1).

Table 2. Finishing Performance (152 Days) of Steers Previously Backgrounded on Forage-Based Diets Using Different Supplementation Strategies

	Treatment [a]				
Item	CONTROL	SOYBLOCK	CBLOCK	CUBE	SEM
No. steers	157	153	155	153	
Initial weight, lb	634	645	647	671	14
Final weight, lb	1165	1188	1174	1188	13
Average daily gain, lb	3.12[b]	3.25[c]	3.13[b]	3.06[b]	.056
Dry matter intake, lb/d	19.3	19.1	19.2	19.8	.29
Gain:feed	.162[bc]	.170[b]	.163[bc]	.155[c]	.0041
Hot carcass weight, lb	709	729	719	727	7.9
Dressing percentage	60.8	61.3	61.2	61.2	.27
Ribeye area, in^2	11.8	11.9	11.7	11.9	.19
Fat thickness, in	.41	.44	.44	.45	.024
Kidney, pelvic, & heart fat, %	2.1	2.1	2.1	2.1	.09
Yield grade 1, %	6	5	4	8	2.4
Yield grade 2, %	37	31	34	28	4.3
Yield grade 3, %	52	56	51	52	5.5
Yield grade 4&5, %	6	8	12	12	2.6
Marbling score	Sl[46]	Sl[59]	Sl[55]	Sl[47]	8.6
USDA Choice, %	27	29	32	25	5.6
USDA Select, %	60	58	54	59	5.1
USDA Standard, %	12	12	13	14	3.4
Liver abscess, %	5.2[b]	2[c]	1.9[c]	.7[c]	.66

[a]CONTROL = no supplement; SOYBLOCK = free-choice block supplement containing 40% crude protein with 25% as nonprotein nitrogen, made from soybean solubles, urea, and full-fat soybeans; CBLOCK = commercially available cooked molasses block containing 40% crude protein with 19% as nonprotein nitrogen; CUBE = commercially available range cube containing 30% crude protein with no nonprotein nitrogen.

[b,c]Means in the same row without a common superscript are different (P<.1).

[d]Sl = Slight, Sm=Small amount of marbling.

Table 3. Performance for the Combined Growing and Finishing Periods (261 Days) of Steers Backgrounded on Forage-Based Diets Using Different Supplementation Strategies

	Treatment [a]				
Item	CONTROL	SOYBLOCK	CBLOCK	CUBE	SEM
No. steers	157	153	155	153	
Gain, lb/day	2.13 [b]	2.26 [c]	2.19 [d]	2.24 [c]	.02
Dry matter intake, lb/day	16.9 [bc]	16.8 [bc]	16.5 [b]	17.6 [c]	.30
Gain:feed	.127 [b]	.134 [d]	.133 [cd]	.127 [bc]	.0021

[a]CONTROL: no supplement; SOYBLOCK: free-choice block supplement containing 40% crude protein with 25% as nonprotein nitrogen, made from soybean solubles, urea, and full-fat soybeans; CBLOCK: commercially available cooked molasses block containing 40% crude protein with 19% as nonprotein nitrogen; CUBE: commercially available range cube containing 30% crude protein with no nonprotein nitrogen.

[b,c,d]Means in the same row without a common superscript are different (P<.1).