Effect of Protein Level and Source in Molasses Slurries on Performance of Growing Cattle Fed Hay During the Winter

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Gains of growing cattle offered hay and molasses-based supplements increased .13 lb/d when soybean meal was added, and .23 lb/d when blood–feather meal was added to molasses–urea supplement.

Summary

Four molasses slurries of varying protein level and source were fed to growing steers (539 lb) during the winter of 1991/1992. Treatments consisted of

control (hay only)	....	*con*
molasses	....	*mol*
molasses-urea	....	*mol-urea*
molasses-soybean meal	....	*mol-sbm*
molasses-bypass	....	*mol-bp*
(blood meal + hydrolyzed feather meal)		

Molasses supplements were limit-fed at 6 lb/d (as-fed) and effects on forage intake, daily gain, body condition score, hip height, and plasma urea nitrogen were measured during the 102-d trial. Energy supplementation in the form of molasses increased shrunk weight gains .71 lb/d over control gains (.84 vs .13 lb/d). The addition of a protein source containing undegraded intake protein to molasses (mol–sbm and mol–bp treatments) increased gains .13 and .23 lb/d, respectively, over molasses. Molasses–urea supplementation did not show an advantage over molasses supplementation, and plasma urea nitrogen levels were adequate (>10mg/dl) for molasses-supplemented cattle, indicating that rumen-available protein was not limiting in the hay diet supplemented with molasses. A decrease in body condition score was observed for all treatments; however, energy supplementation slowed ($P<.05$) loss of body condition. Hip height increase in supplemented cattle was greater ($P<.05$) than in control cattle (2.6 vs 1.7) during the 102-d trial. Supplementation at 6 lb/d (as-fed) decreased forage consumption 12% (10.0 vs 8.8 lb/d; $P<.01$).

Introduction

Florida cattle producers typically breed their cattle during the spring. This requires heifer development through the winter when quality and quantity of warm-season forages are low but requirements for growth are high. Thus, producers find it necessary to supplement their heifers through this period in order to breed them to calve at 2 years of age. Rate of gain required for heifers to calve at 2 yr is often not achieved with residual pasture or hay. Therefore, additional sources of supplemental energy and protein are usually needed to achieve gains of 1.0 to 1.5 lb/d.

Molasses, a high-energy and relatively low-cost byproduct of sugar production, has been shown to improve gains of heifers grazing bahiagrass pasture during the summer. Addition of soybean meal to molasses improved gains further. Previous research on molasses slurries has focused primarily on natural protein sources supplemented during summer and fall. This study was designed to evaluate the effects of molasses and molasses slurries containing different protein sources on performance of growing cattle fed hay during the winter.

Procedure

This study was conducted at University of Florida's Pine Acres Research Unit, located in northern Marion county, from 26 December 1991 to 9 April 1992 on residual bahiagrass pasture frosted before the trial. Slurries were fed on Monday, Wednesday, and Friday of each week at levels equivalent to 6 lb/d in open-trough feeders. Bermudagrass hay harvested in June (Quality Index 1.3) was weighed, core sampled, and offered free-choice in round-bale feeders. Complete mineral mixture containing 25% salt, 20% calcium, 9% phosphorus, and magnesium, iron, copper, cobalt, manganese, iodine, selenium and zinc was offered free-choice.

This experiment utilized a randomized block design in which five treatments were randomly assigned to 2.5-acre pastures (very little forage available) within three blocks. Seventy-one Brahman×Angus steers of varying percentages, 22 Angus steers, and 12 Hereford×Angus steers (mean initial body weight 539 lb; age 9 to 12 months) were stratified across treatment and block with respect to source, breed, and weight. Cattle were separated into treatment groups 2 wk before starting the trial and received their assigned supplements during this period. Statistical analysis was conducted using the GLM procedure of SAS with least-squares means and contrast statements using pen as the experimental unit.

Supplements (Table 1) consisted of fortified molasses with urea (16% CP as-fed), fortified molasses (no urea), corn meal, soybean meal, blood meal, and hydrolyzed feather meal. The basal feed was hay without supplement, and thus was the control for this experiment. The energy control treatment (mol) received fortified molasses. The remaining treatments were formulated to provide adequate rumen-available protein (RAP) for fermentation of rumen-available nutrients (RAN). Current research indicates that an 8:1 ratio of rumen-available total digestible nutrients (RATDN) to rumen-available crude protein (RACP) is required for efficient fermentation of carbohydrates in the rumen.

Full body weights and blood samples for plasma urea nitrogen (PUN) analysis were taken on Days0, 27, 55, and 101. Shrunk weights were recorded on Days1 and 102. Hip heights were measured on Days0 and 1, and Days101 and 102. Body condition was scored on Days1 and 102 using a scale of 1 through 9 to evaluate body condition score (BCS; 1=thin, 9=fleshy), in increments of .25.

Results

Molasses supplementation (mol) increased (P<.05) gains over unsupplemented cattle during all periods of the trial, indicating that energy was limiting in the hay being fed (Table 2). The addition of undegraded intake protein (UIP; mol–sbm and mol–bp treatments) increased shrunk weight gains further (.13 and .23 lb/d respectively; P<.05). This suggests that UIP was the second-limiting nutrient in the hay fed. There was no difference in gains between mol and mol–urea treatments, indicating that the hay was providing sufficient RAP. There was a tendency (P=.11) for shrunk weight gains of mol–bp cattle to be greater than those of mol–sbm cattle (1.07 vs .97 lb/d). However, this added gain was likely due to forage intake, which tended to be greater (P=.13) for mol–bp cattle than mol–sbm cattle (9.3 vs 8.5 lb/d). Therefore, UIP requirement of these cattle appears to have been met by the mol–sbm slurry.

Energy supplementation decreased loss of body condition through the winter (-.6 vs -1.0; P<.05), and mol–bp supplements further reduced this loss (-.3 vs -.6; P<.05). Hip height growth was increased by energy supplementation (P<.05), but the addition of the UIP in mol–sbm and mol–bp treatments did not result in additional growth in height. Energy supplementation decreased voluntary intake of hay 1.2 lb/d (8.8 vs 10.0 lb/d; P<.01). At 4.6 lb/d (dry-matter basis) slurry supplementation, this represents a 28% replacement rate (lb/lb). Hay waste was similar for all treatments. Plasma urea nitrogen concentrations for cattle on all treatments except mol on Day0 were indicative of adequate rumen-degraded protein (PUN>10 mg/dL).

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Table 1. Composition of molasses slurries on an as-fed basis

Item	Treatment[a] MOL	MOL–UREA	MOL–SBM	MOL–BP
Ingredients, % (as-fed)				
Fortified molasses–urea[b]	—	56	—	56
Fortified molasses[b]	84	28	84	28
Corn meal	16	16	—	8
Soybean meal	—	—	16	—
Blood meal	—	—	—	4
Feather meal	—	—	—	4
TDN, % (as-fed)[c]				
Total (TDN)	58.2	58.2	57.4	56.8
Rumen-available (RATDN)	56.9	56.9	55.0	53.3
Protein, % (as-fed)[c]				
Total (CP)	8.0	12.5	13.6	18.4
Total available (ACP)[d]	3.0	7.4	8.8	13.4
Rumen-available (RACP)	2.3	6.8	6.7	8.0
Undegraded intake protein (UIP)[e]	.64	.64	2.1	5.3
RACP, % RATDN[f]	4.0	12.0	12.2	15.0
RATDN:RACP[e]	25:1	8.4:1	8.2:1	6.7:1
Dry matter, %[c]	77.1	77.1	77.4	77.4

[a]Complete mineral and hay fed free-choice; control treatment received hay and mineral only.
[b]Fortified with .5% phosphorus, .0005% copper, .00001% cobalt, .00007% iodine, .0025% zinc, and vitamins A, E, and D3.
[c]Calculated for slurry.
[d]Assumes 25% availability of nitrogen in molasses.
[e]RACP=rumen-available crude protein; RATDN=rumen-available total digestible nutrients.

Table 2. Effects of protein level and source in molasses slurries on performance of growing cattle fed hay during winter[a]

ITEM	Treatment CON	MOL	MOL–UREA	MOL–SBM	MOL–BP	SE[b]
Number of pens	3	3	3	3	3	—
Initial shrunk wt, lb[c]	501	509	496	508	525	4.2
Daily gain, lb						
0–27 (full wt)	.51[d]	.91[e]	.90[e]	1.37[f]	1.37[f]	.10
28–55 (full wt)	−.18[d]	1.04[e]	1.10[e]	1.30[e]	1.12[e]	.19
56–101 (full wt)	.26[d]	.93[e]	.75[e]	.83[e]	1.02[e]	.13
0–101 (full wt)	.21[d]	.96[e]	.90[e]	1.11[f]	1.15[f]	.04
1–102 (shrunk wt)	.13[d]	.84[e]	.79[e]	.97[f]	1.07[f]	.04
Initial hip height, in	44.8	45.1	45.0	45.3	45.3	.23
Hip height increase, in	1.7[d]	2.4[e]	2.5[e]	2.8[e]	2.8[e]	.14
Initial BCS[g]	5.3	5.3	5.2	5.3	5.3	.08
BCS[g] change	−1.0[d]	−.6[e]	−.6[e]	−.5[ef]	−.3[f]	.08
Forage consumed, lb/d (DM)[h]	10.0[d]	8.8[e]	8.7[e]	8.5[e]	9.3[e]	.32
Forage wasted, % offered	7.0	8.8	10.9	7.4	11.2	1.7
Slurry consumed, lb/d (as-fed)	—	6.0	5.7	6.0	6.0	.09
Plasma urea nitrogen (PUN), mg/dL						
Day 0	11.5[ef]	5.9[d]	10.9[e]	12.4[f]	12.0[ef]	.38
Day 27	21.5	13.8	20.7	16.3	19.8	1.7
Day 55	22.6	13.0	18.0	16.9	17.8	1.8
Day 101	20.2	14.0	18.3	16.2	18.9	1.3

[a]University of Florida, 1991–92.
[b]Standard error of the mean.
[c]27 December 1991.
[d,e,f]Means with different superscripts in the same row differ ($P<.05$).
[g]Body condition score; 1=thin to 9=fleshy, in increments of .25.
[h]DM=dry matter.