Comparison of Dry and Liquid Protein Supplements Fed to Stocker Cattle Consuming Low-Quality Native Grass: Performance and Digestibility

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Story in Brief

Two studies were conducted to determine the effect of differing amounts of degradable intake protein (DIP) from liquid or dry supplements on performance and digestibility by stocker cattle consuming low-quality forage. Supplements were a liquid feed formulated to provide .72 lb/d of DIP (LIQ1), a liquid feed formulated to provide .44 lb/d of DIP (LIQ2), or a cottonseed meal/soybean meal blend to provide .44 lb/d of DIP (DRY). In a metabolism study, supplemented cattle had greater hay OM intakes and fecal OM outputs than cattle not supplemented. Furthermore, cattle supplemented with LIQ2 had greater hay OM intakes and fecal OM outputs than cattle supplemented with LIQ1. During an individual feeding study there were no differences in initial and final body weights between treatments. Across the supplemental feeding period, average intake was only 41 and 82% of feed offered for LIQ1 and LIQ2, respectively. Total gain and ADG were greater for supplemented steers than for steers not supplemented, and steers receiving DRY had greater total gains and ADG than steers receiving liquid. There was no difference between LIQ1 and LIQ2 for total gain or ADG. This limited intake could explain the decrease in ADG and total gain with liquid supplementation compared with DRY. These data suggest that intake of liquid supplements limited performance of grazing cattle in this experiment. Also, different amounts and/or types of protein may influence digestion and performance.

Key Words: Degradable Intake Protein, Grazing Cattle, Liquid Supplements, Low-Quality Forage

Introduction

During winter dormancy, cattle gains are often limited by the lack of degradable intake protein (DIP). Therefore, the stocker cattle industry relies heavily upon the ability to supplement cattle grazing low-quality forages. Most large stocker cattle operations strive to minimize capital equipment and labor inputs. Liquid feed may offer the opportunity to supplement cattle with minimal labor and input costs. The impact of molasses-based supplements on forage use and animal performance has been variable (Bowman et al., 1995; Pate et al., 1995), and intake has been a concern with cattle supplemented with various liquid feeds. The objective of this study was to determine the influence of liquid feed supplements at two levels of DIP on performance and digestibility by stocker cattle grazing dormant-native grass.

Materials and Methods

Metabolism Study. Seven ruminally and duodenally cannulated crossbred steers were randomly allotted to one of four treatments in an incomplete Latin square design. Steers were allowed ad libitum access to a basal diet of low-quality prairie hay (CP = 5.0%), which reflected the nutrient quality of winter tallgrass prairie. Treatments (DM basis) were: 1) 1.6 lb/hd/d of liquid feed

supplement containing .72 lb/d DIP (LIQ1); 2) 1.6 lb/hd/d of liquid feed containing .44 lb/d DIP (LIQ2); 3) 1.6 lb/hd/d of a cottonseed meal/soybean meal blend containing .44 lb/d DIP (DRY); or 4) no supplement (CON). Nutrient composition is shown in Table 1. Supplements were dosed through the ruminal cannula due to intake difficulties experienced during the individual feeding study. The steers were allowed 10-d adaptation to the supplements before a total fecal collection period. Total feces were collected over 5 d, weighed, mixed, subsampled, and dried for subsequent lab analysis. Supplements, hay, and feces were analyzed for dry matter (DM), ash, and organic matter (OM) content to determine apparent tract organic matter digestibility.

Individual Feeding Study. This study was conducted at the Oklahoma State University Research Range (OSURR) located approximately 10 miles southwest of Stillwater, in Payne County, OK. The vegetation is typical tallgrass prairie in high seral state of good to excellent range condition. Dominant grass species consist of greater than 50% tallgrass species such as big and little bluestem, switchgrass, and indiangrass with the remainder including tall dropseed, midgrasses, forbs, shortgrasses and annual grasses. No fertilization or herbicide application was performed during the trial period. Fifty crossbred steers (initial BW = 431 lb ± 15.8) were stratified by initial BW into four groups and each group was randomly assigned to one of four treatments. Treatments were identical to the metabolism study. All cattle had ad libitum access to fresh water and salt. Cattle were gathered 5 d/wk at 8:00 am and sorted by treatment into individual stalls. All animals remained in the stalls for one and no more than four hours. Even after 4 h, some animals did not consume all of the liquid supplements. The rate of intake by individual animals varied from day to day. Feed refusals were weighed and recorded to determine actual supplement intake, and steers were released and allowed to graze.

All cattle were received, processed, and weighed at the OSURR. Weights were taken February 6 and again on April 2, 2001, at the completion of the trial. Both the initial and final weights were taken after a 14-h withdrawal from feed and water.

Statistical Analysis. Steer performance (individual feeding trial) data were analyzed as a completely random design, and digestibility (metabolism trial) data were analyzed as an incomplete Latin square design using the GLM procedure of SAS (SAS Inst. Inc., Cary, NC). For both experiments, single degree of freedom contrasts were used to compare CON vs supplement, DRY vs liquid, and LIQ1 vs LIQ2.

Table 1. Feedstuff and nutrient content of supplements

Ingredients	DRY	LIQ1	LIQ 2
Soybean meal, %	61.0	---	---
Cottonseed meal, %	39.0	---	---
Molasses, %	---	44.8	25.1
Sulfuric acid, %	---	.5	.5
75% Phosphoric acid, %	---	1.5	1.5
Salt, %	---	---	2.5
Water, %	---	9.78	14.23
Urea, dry, %	---	7.64	3.07

Trace mineral premix, %	---	.15	.15
Vitamin premix, %	---	.01	.01
Corn steep, %	---	10.0	10.0
Soybean oil, %	---	5.63	5.9
Feather meal, %	---	---	16.97
Sodium selenite, %	---	.02	.02
CONC 3060, %	---	20.0	20.0
Nutrient (DM basis)[a]			
Dry matter, %	89.7	65.0	65.0
Crude protein, %	52.0	48.0	48.2
NPN, %	5.14	38.3	18.0
DIP, %	32.2	43.6	29.7
Crude fat, %	1.89	8.88	10.5
TDN, %	82.0	80.0	80.0
NE_m, Mcal/lb	.83	.92	.92
NE_g, Mcal/lb	.51	.62	.61
[a]Calculated			

Results and Discussion

Metabolism Study. Supplemented cattle had greater (P<.05) hay OM intake (HOMI), total OM intake (TOMI), fecal OM output (FOMO), and digestible OM intake (DOMI) than CON cattle (Table 2). In addition, HOMI, TOMI, FOMO, and DOMI were greater (P<.05) for LIQ2 compared with LIQ1. There were no differences (P>.05) between DRY vs liquid supplementation for HOMI or FOMO. There were also no differences (P>.05) in total OM digestibilities (TOMD) among treatments. These data suggest that at equal DM intake, liquid and dry supplements will result in similar performance when level of DIP is similar. Moreover, steers consuming liquid and DRY supplementation have similar HOMI, TOMI, TOMD, and DOMI.

Table 2. Effects of supplementation on hay intake, fecal output, and digestibilities

	Treatments[a]					
Item	CON	DRY	LIQ1	LIQ2	SE	Contrast[bc]
Total OM intake, lb	5.97	8.96	7.66	9.19	.403	1, 3
Hay OM intake, lb	5.97	7.57	6.27	7.96	.338	1, 3
Fecal OM output, lb	2.55	3.64	3.09	3.81	.186	1, 3
Total OM digestibility, %	56.57	59.39	59.87	58.32	1.73	
Digestible OM intake, lb	3.42	5.25	4.57	5.37	.227	1, 3

[a]Actual DIP intakes: CON, no supplement; DRY, cottonseed meal/soybean meal blend providing .52 lb DIP/d; LIQ1, liquid supplement providing .29 lb DIP/d; LIQ2, liquid supplement providing

.40 lb DIP/d

[b]Contrast 1 = control vs all supplements; Contrast 2 = Dry vs Liquid supplements; Contrast 3 = LIQ1 vs LIQ2

[c]P<.05

Individual Feeding Study. Initial and final BW did not differ (P>.05) between treatments as shown in Table 3. Total gain and ADG were greater (P<.05) for supplemented cattle than for CON cattle. Steers receiving the DRY supplement had greater (P<.05) total gains and ADG than steers receiving liquid supplements, but there was no difference (P>.05) between cattle receiving LIQ1 and LIQ2. Figures 1 and 2 show the level of intakes throughout the study. Across the entire 56-d feeding period, total amount offered to cattle receiving LIQ1 and LIQ2 was 104 lb (as-is). However, average intake was only 41% and 82% of feed offered for LIQ1 and LIQ2, respectively. This limited intake could explain the decrease in ADG and total gain with liquid supplementation vs DRY.

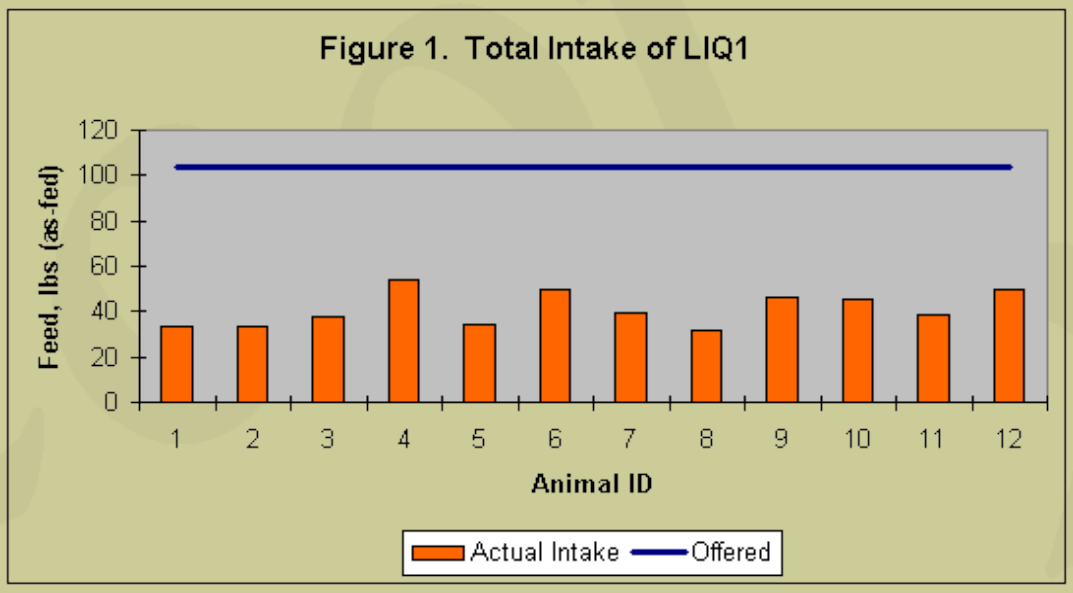
Table 3. Effects of supplementation on stocker cattle performance grazing low-quality native range

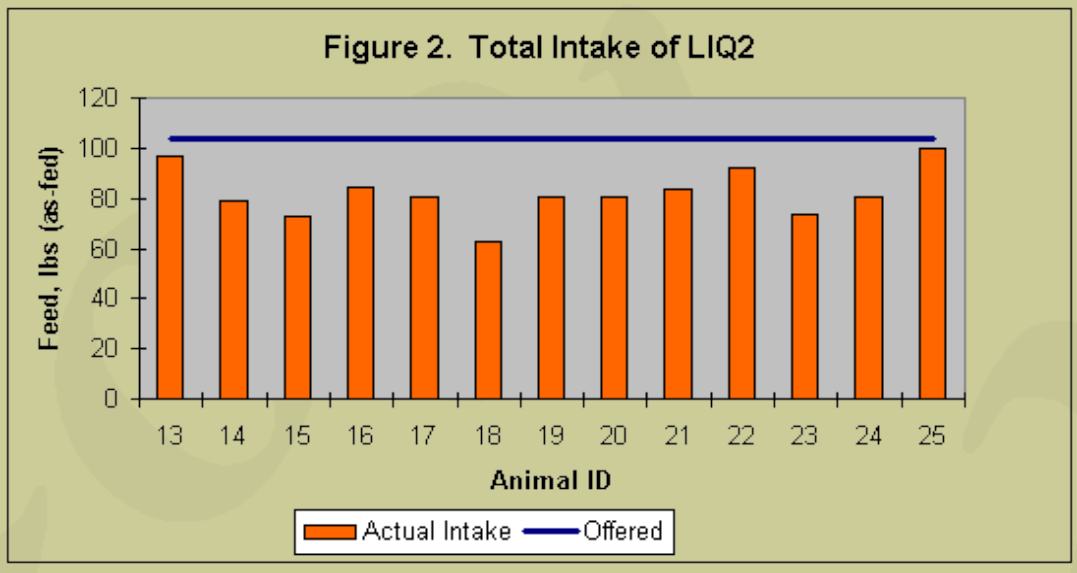
	Treatments[a]					
Item	CON	DRY	LIQ1	LIQ2	SE	Contrast[bc]
Initial weight, lb	438	421	428	436	16.9	
Final weight, lb	427	449	432	442	15.8	
Total gain, lb	-11.4	28.2	3.4	6.67	3.6	1, 2
ADG, lb	-.20	.50	.06	.12	.06	1, 2

[a]Actual DIP intake: CON, no supplement; DRY, cottonseed meal/soybean meal blend providing .52 lb DIP/d; LIQ1, liquid supplement providing .29 lb DIP/d; LIQ2, liquid supplement providing .40 lb DIP/d

[b]Contrast 1 = control vs all supplements; Contrast 2 = Dry vs Liquid supplements; Contrast 3 = LIQ1 vs LIQ2

[c]P<.05





Implications

Overall, intakes of prairie hay and total intake were significantly improved over controls when liquid feed was ruminally dosed. However, reduced intake of liquid supplements in the individual feeding study limited any response that might have been realized due to supplementation.

Literature Cited

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Acknowledgements

The authors thank American Feed Ingredient Association for financial support of this project, and the graduate students who helped during data collection.

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