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Abstract

The cost of roughages is relatively high in comparison to their contribution of nutrients to feedlot diets. Widespread drought has affected roughage supplies in the cattle-feeding regions of the United States, further increasing the cost of roughages for feedlots. Despite their relatively high cost, roughages are incorporated into finishing diets to maintain rumen function and to manage ruminal acidosis. The greatest proportion of roughage is utilized early in the feeding period when cattle are being transitioned from forage-based diets to concentrate-based diets, allowing ruminal microbes to adapt gradually to higher levels of starch and sugars. If cattle are not properly adapted to concentrate-based diets, undesirable lactic acid-producing microorganisms, such as *Streptococcus bovis*, can rapidly proliferate and produce large excesses of lactic acid in the rumen. This condition can precipitate feedlot acidosis, which can have serious consequences for health and performance of cattle. Lactipro (MS Biotec, Wamego, KS) is a probiotic drench containing *Megasphaera elsdenii*, which is a lactate-utilizing bacterium that prevents lactic acid accumulations in the rumen of grain-fed cattle. Lactipro has been used successfully to accelerate the adaptation of cattle from roughage-based diets to concentrate-based diets. The objective of this study was to determine if Lactipro could be utilized to eliminate the step-up period for feedlot cattle, and in so doing decrease the amount of roughage required during the finishing period.

Keywords

Kansas Agricultural Experiment Station contribution; no. 13-162-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1083; Cattle; Lactipro; Roughages; Steer performance; Carcass characteristics

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Orally Dosing Steers with Lactipro (*Megasphaera elsdenii*) Decreases the Quantity of Roughages Fed During Finishing

K.A. Miller, C.L. Van Bibber-Krueger, and J.S. Drouillard

Introduction

The cost of roughages is relatively high in comparison to their contribution of nutrients to feedlot diets. Widespread drought has affected roughage supplies in the cattle-feeding regions of the United States, further increasing the cost of roughages for feedlots. Despite their relatively high cost, roughages are incorporated into finishing diets to maintain rumen function and to manage ruminal acidosis. The greatest proportion of roughage is utilized early in the feeding period when cattle are being transitioned from forage-based diets to concentrate-based diets, allowing ruminal microbes to adapt gradually to higher levels of starch and sugars. If cattle are not properly adapted to concentrate-based diets, undesirable lactic acid-producing microorganisms, such as *Streptococcus bovis*, can rapidly proliferate and produce large excesses of lactic acid in the rumen. This condition can precipitate feedlot acidosis, which can have serious consequences for health and performance of cattle.

Lactipro (MS Biotec, Wamego, KS) is a probiotic drench containing *Megasphaera elsdenii*, which is a lactate-utilizing bacterium that prevents lactic acid accumulations in the rumen of grain-fed cattle. Lactipro has been used successfully to accelerate the adaptation of cattle from roughage-based diets to concentrate-based diets. The objective of this study was to determine if Lactipro could be utilized to eliminate the step-up period for feedlot cattle, and in so doing decrease the amount of roughage required during the finishing period.

Experimental Procedures

Four hundred and forty-three crossbred steers were utilized in a randomized complete block design to determine if steers given Lactipro at initial processing could be placed directly onto finishing diets to reduce the quantity of roughage fed during finishing. Steers were fed brome hay prior to arrival at the feedlot and were processed approximately 24 hours later. At processing, steers were weighed, given uniquely numbered ear tags, vaccinated against common viral and clostridia diseases, treated for internal and external parasites, and implanted with Revalor XS (Intervet Inc., Millsboro, DE). Steers were assigned to a traditional step-up program (Control) consisting of 3 step-up diets fed for 6 days each followed by the finishing diet for the remainder of the study, or were dosed with 100 mL of Lactipro at processing and placed directly onto the finishing diet (Lactipro). Steers were assigned to treatment based on alternating order through the chute, resulting in 24 pens with 14 or 15 steers per pen and another 12 pens containing 7 to 8 steers each, thus providing 18 replicates per treatment. Diets were based on steam-flaked corn, wet corn gluten feed, and corn silage (Table 1). Steers were fed once daily and had free-choice access to their respective diets for 115 days before being weighed and shipped to a commercial abattoir. At the time of slaughter, hot carcass weight and liver score data were collected. USDA yield and quality grades; 12th-rib fat

thickness; percentage kidney, pelvic, and heart fat; ribeye area; and marbling score were recorded after chilling carcasses for 24 hours.

Results and Discussion

A steer in the Lactipro group died on day 19, and gross necropsy revealed a preexisting bacterial infection as the cause of death. Another steer in the Lactipro group was euthanized on day 49 due to infectious lameness originating with a hoof abrasion. Digestive disorders and respiratory disease were not observed among animals in either treatment during the study.

Steer performance is summarized in Table 2. Steers placed on the traditional step-up program consumed 17% more roughage ($P < 0.01$) and tended ($P = 0.07$) to have greater dry matter intake compared with steers dosed with Lactipro and placed directly onto the finishing diet. Average daily gain and gain efficiency were similar for steers in the two treatments.

In previous research with Lactipro, we have observed similar feed intakes, gains, and efficiencies for cattle stepped-up traditionally compared with cattle dosed with Lactipro and placed directly onto feed. In the present study, no clinical symptoms of acidosis or behavioral abnormalities were evident in either treatment, but feed intake declined sharply for the first several days for the cattle that were dosed with Lactipro and placed directly onto the high-grain diet. The tendency for lower feed intake by Lactipro steers in the current study did not affect their growth performance compared with the control group, and the differences in feed intake were generally limited to the first 18 days on feed (Figure 1). The lingering differences in feed deliveries for the two treatments during the early part of the feeding period can be attributed to our bunk management protocol, which limited the daily increases in feed delivery to no more than 1 lb of dry matter per head daily. Essentially, cattle in the Lactipro treatment were not allowed to make up for this early deficit until feed intake plateaued two or more weeks later. This protocol has been implemented to prevent overconsumption when traditional step-up programs are utilized; however, we do not know if these same protocols are necessary when the cattle have been dosed with Lactipro.

Carcass characteristics are summarized in Table 3. Treatment did not affect carcass weight; dressed yield; ribeye area; percentage of kidney, pelvic, and heart fat; 12th-rib fat thickness; or the incidence of liver abscesses ($P \geq 0.23$). There were no differences in USDA yield grade, marbling score, or carcasses classified as USDA Prime and Certified Angus ($P \geq 0.31$). The percentage of carcasses grading Choice tended ($P = 0.07$) to be greater for the Lactipro group, and the percentage grading Select tended ($P = 0.06$) to be greater for cattle in the Control group.

Formation of liver abscesses is facilitated by acidosis, which damages the ruminal wall. As a result of this physical damage, bacteria can pass from the rumen into the bloodstream and subsequently are transported to the liver, where they colonize and form abscesses. The lack of difference in incidence or severity of liver abscesses suggests that Lactipro was effective in preventing ruminal acidosis in steers placed directly onto the finishing diet. We did observe a trend for improved carcass quality when steers were placed directly onto finishing diets, which may be the result of additional days on a

high-concentrate diet. This result is consistent with our observations in previous studies with heifers, where marbling score increased when heifers were given Lactipro and placed onto accelerated step-up regimens.

Implications

Roughage required during the finishing period can be decreased by dosing cattle with Lactipro and placing them directly onto high-concentrate finishing diets.

Table 1. Composition of experimental diets on a 100% dry matter basis

Ingredient, % of dry matter	Step-up diets			
	Step 1	Step 2	Step 3	Finisher
Steam-flaked corn	30.2	40.2	50.2	60.2
Wet corn gluten feed	25.0	25.0	25.0	25.0
Corn silage	40.0	30.0	20.0	10.0
Supplement ¹	2.64	2.64	2.64	2.64
Feed additive premix ²	2.16	2.16	2.16	2.16
Nutrient analyses, %				
Dry matter	53.9	58.0	62.7	68.3
Crude protein	13.5	13.7	13.8	14.0
Neutral detergent fiber	25.0	22.4	19.9	17.4
Calcium	0.77	0.75	0.72	0.70
Phosphorus	0.44	0.45	0.45	0.45
Potassium	0.92	0.85	0.77	0.70

¹ Formulated to provide 0.3% salt, 0.1 ppm Co, 10 ppm copper, 0.6 ppm iodine, 60 ppm manganese, 0.25 ppm selenium, 60 ppm zinc, 1,000 IU/lb vitamin A, and 10 IU/lb vitamin E in the total diet on a 100% dry matter basis.

² Formulated to provide 300 mg Rumensin and 90 mg Tylan (Elanco Animal Health, Indianapolis, IN) per steer daily.

Table 2. Performance of steers orally dosed with Lactipro¹ at initial processing and placed onto a finishing diet

Item	Treatment		SEM	P-value
	Control	Lactipro		
Initial weight, lb	887	879	5.4	0.12
Final weight, lb ²	1461	1449	11.7	0.21
Dry matter intake, lb/day	28.3	27.8	0.26	0.07
Dry matter silage intake, lb/steer	388.7	322.3	2.95	<0.01
Average daily gain, lb	4.99	4.96	0.076	0.65
Feed:gain, lb/lb	5.68	5.60	0.051	0.14

¹ MS Biotec, Wamego, KS.

² Gross live weight pencil shrunk by 4%.

Table 3. Carcass traits and liver abscess scores of steers orally dosed with Lactipro¹ at initial processing and placed onto a finishing diet

Item	Treatment		SEM	P-value
	Control	Lactipro		
Carcass weight, lb	887	881	7.1	0.23
Ribeye area, sq. in.	14.0	14.0	0.10	0.59
Kidney, pelvic, and heart fat, %	2.29	2.29	0.050	0.92
12th-rib fat thickness, in.	0.54	0.52	0.009	0.28
Marbling score ²	457	461	4.51	0.55
USDA Prime, %	1.4	0.5	0.64	0.31
USDA Choice, %	80.1	86.5	2.50	0.07
Certified Angus Beef, %	24.4	28.4	2.97	0.35
USDA Select, %	18.6	12.2	2.42	0.06
Liver abscess, %	11.8	10.8	2.14	0.75

¹MS Biotec, Wamego, KS.

²Marbling score values ranging from 400 to 499 represent a small degree of marbling.

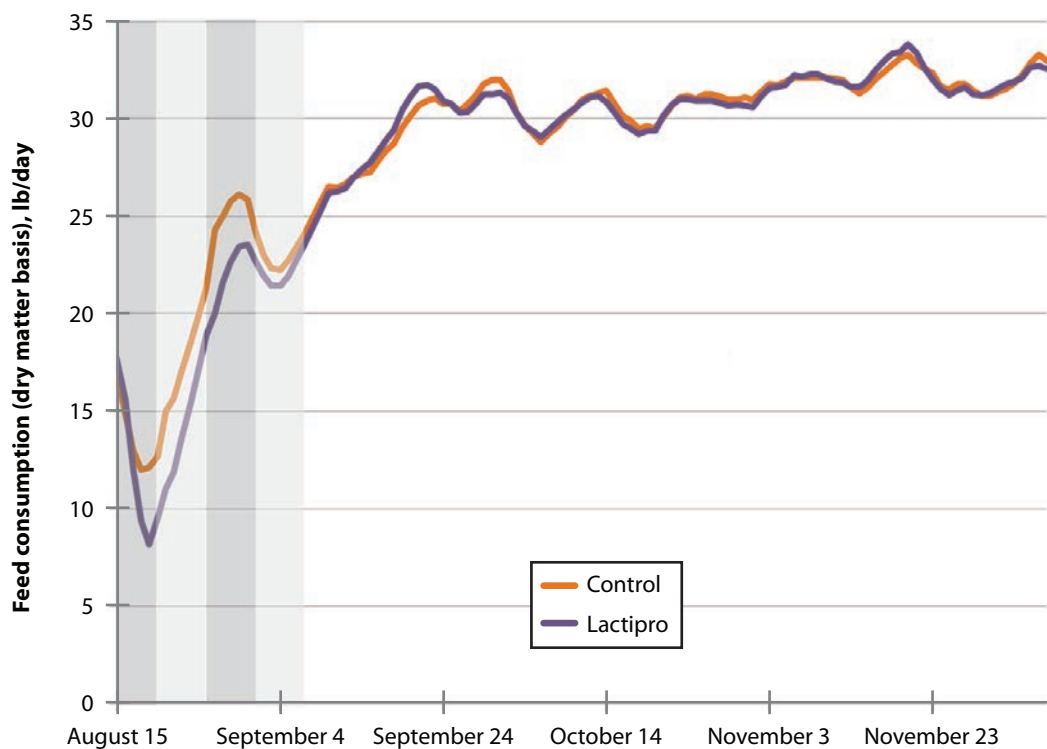


Figure 1. Daily dry matter feed deliveries of steers orally dosed with Lactipro (*Mega-sphaera elsdenii*; MS Biotec, Wamego, KS) at initial processing and placed directly onto a finishing diet. Shaded areas represent each of the step-up diets fed to Control steers.