Dosing with Lactipro Decreases Forage Intake and Manure Output

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

Introduction

High-concentrate diets consisting of cereal grains and grain byproducts have high energy density compared with forage-based diets. To avoid digestive disorders, cattle must be adapted to concentrates, which often entails feeding a series of step-up diets that contain progressively less roughage over a 2- to 3-week period. This allows the microbial population to adapt to fermentation of the starches and sugars that are present in high-concentrate diets. If cattle are not properly adapted to concentrate-based diets, lactic acid, which is produced by opportunistic starch-fermenting bacteria like *Streptococcus bovis*, can accumulate, predisposing the animal to acidosis. Diets used during the adaptation phase are by nature less digestible than the final finishing diet, which results in increased manure output and suboptimal performance during the adaptation period.

Lactipro, a relatively new probiotic drench containing the lactate-utilizing bacteria *Megasphaera elsdenii,* has been utilized effectively to accelerate the adaptation of cattle from roughages to concentrate-based diets. Our objective was to determine the impact on diet digestibility and manure output in cattle dosed with Lactipro (MS Biotech, Inc., Wamego, KS) and placed directly onto high-concentrate diets without prior adaptation.

Experimental Methods

Ninety crossbred steers were utilized in a randomized complete block design to determine the impact of dosing cattle with Lactipro and placing them directly onto a finishing diet on total tract diet digestibility. Upon arrival at the Kansas State University Beef Cattle Research Center, steers were placed into feedlot pens and offered free-choice access to moderate-quality brome hay. Approximately 24 hours after arrival, the 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 on the traditional step-up program (Control) were fed a series of three step-up diets for 6 days each followed by the final finishing diet for the duration of the study (Table 1). Steers in the Lactipro treatment were orally dosed with 100 mL of Lactipro at processing and placed directly onto a finishing diet. Steers were assigned to treatment based on order through the chute at processing, resulting in 6 pens for each treatment with 7 or 8 steers/pen. Diets were based on steam-flaked corn, wet corn gluten feed, and corn silage (Table 2).

Steers were housed in partially covered pens with concrete surfaces. Before placing steers into their respective pens, the surface of each pen was thoroughly cleaned to remove residual dirt and manure. Manure was removed each day for 24 days and weighed, thoroughly mixed, and sampled, then dried for analysis of dry matter, protein,

neutral detergent fiber (NDF), starch, and phosphorus. The amount of feed delivered to each pen was recorded daily, and the weight of unconsumed feed also was recorded daily for each pen. Samples of the diets and unconsumed feed were weighed daily and analyzed for concentrations of dry matter, protein, NDF, starch, and phosphorus. Feed and manure samples from each 6-day period (corresponding to each of the diets fed to the control group) were composited for analysis, making it possible to determine diet digestibility for each period. This resulted in one value per pen for days 1–6, 7–12, 13–18, and 19–24.

Results and Discussion

Control steers had greater dry matter intake ($P < 0.01$) and fecal output ($P < 0.01$) than Lactipro steers during the step-up period (Table 3). Lower fecal output by steers in the Lactipro group can be partially attributed to lower feed intake. Diet digestibility for the 24-day trial also tended to be greater for cattle on the Lactipro treatment ($P = 0.11$). Decreasing manure output without compromising cattle performance generally is positive, because it represents an improvement in utilization of feed resources. Additionally, the costs incurred by commercial feedlots for handling, storage, and transport of manure can be substantial, and technologies that make it possible to decrease manure output can have a favorable impact on cost of production.

Digestibility of NDF was greater ($P < 0.01$) for Control steers than Lactipro steers. This was most pronounced during the first 6-day period, during which digestibility of NDF actually was negative for steers in the Lactipro treatment. Steers were allowed free access to brome hay on arrival, and we speculate that the abrupt switch of Lactipro cattle to the finishing diet may have decreased digestion of the hay, delaying its passage through the gastrointestinal tract. Digestion of concentrates generally results in low ruminal pH, which can have adverse effects on the activity of fiber-digesting bacteria, potentially decreasing fiber digestion. Delayed passage of hay from the rumen (and high rumen fill) could explain the relatively low feed intakes observed for cattle in the Lactipro group during the first several days on feed. The bunk management protocol used for this study limited increases in daily dry matter feed deliveries to no more than 1 lb per animal. The substantially lower feed intakes of Lactipro cattle compared with the Control early in the study created a large differential in feed deliveries that remained for much of the trial period as a result of our bunk management protocol. Cattle were monitored closely for indications of digestive disturbances, but there were no visual indications of acidosis in either group during this time. This led us to speculate that a more aggressive bunk management protocol may be more suitable for cattle dosed with Lactipro and subsequently placed directly onto high-concentrate diets. Crude protein digestibility was greater ($P = 0.05$) for Lactipro steers than for Control steers, which is consistent with the proteolytic activity of *Megasphaera elsdenii*.

Implications

Hay consumption can be decreased substantially during the step-up period when cattle are dosed with Lactipro, which leads to decreased manure output and improved diet digestibility.

Table 1. Step-up regimes for the Control and Lactipro treatment groups

Days on feed	Control	Lactipro
0–6	Step 1	Finisher
7–12	Step 2	Finisher
13–18	Step 3	Finisher
19–115	Finisher	Finisher

Table 2. Composition of experimental diets on a 100% dry matter (DM) basis

	Step-up diets			
Ingredient, % of DM	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, %				
DM	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
Crude fat	3.3	3.4	3.6	3.7
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 cobalt, 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 on a dry matter basis.
[2] Formulated to provide 300 mg Rumensin and 90 mg Tylan (Elanco Animal Health, Greenfield, IN) per steer daily.

Table 3. Apparent total tract digestibility during the first 24 days on feed for steers fed a traditional step-up regimen (Control) and steers dosed with Lactipro at initial processing and placed directly on to a finishing diet (Lactipro)

Item	Control	Lactipro	SEM	*P*-value
Days 0–6				
Dry matter intake, lb/day	11.5	8.2	0.66	<0.01
Fecal output, lb/day	4.2	3.3	0.22	<0.01
Digestibility, %				
Dry matter	63.0	56.6	1.41	0.11
Crude protein	65.8	62.9	1.29	0.05
Neutral detergent fiber	28.0	-24.5	4.92	<0.01
Starch	99.9	99.8	0.08	0.31
Phosphorus	30.3	14.7	5.58	0.06
Days 7–12				
Dry matter intake, lb/day	18.1	14.3	0.66	<0.01
Fecal output, lb/day	4.2	2.6	0.22	<0.01
Digestibility, %				
Dry matter	76.8	81.9	1.41	0.01
Crude protein	75.0	80.4	1.29	<0.01
Neutral detergent fiber	56.3	56.4	4.92	0.99
Starch	99.8	99.8	0.08	0.61
Phosphorus	27.6	54.7	5.58	< 0.01
Days 13–18				
Dry matter intake, lb/day	22.9	21.4	0.66	0.12
Fecal output, lb/day	6.0	4.4	0.22	<0.01
Digestibility, %				
Dry matter	74.3	79.6	1.41	0.01
Crude protein	70.0	72.8	1.29	0.12
Neutral detergent fiber	49.2	56.2	4.92	0.30
Starch	99.9	99.8	0.08	0.26
Phosphorus	36.9	46.4	5.58	0.24
Days 19–24				
Dry matter intake, lb/day	26.5	23.6	0.66	<0.01
Fecal output, lb/day	6.0	4.9	0.22	<0.01
Digestibility, %				
Dry matter	77.6	80.0	1.41	0.25
Crude protein	69.2	71.3	1.29	0.24
Neutral detergent fiber	49.8	55.3	4.92	0.41
Starch	99.8	99.8	0.08	0.99
Phosphorus	35.8	44.9	5.58	0.26