The Effects of Direct-fed Microbials on Feedlot Performance and Carcass Characteristics of Finishing Steers Fed Wet Corn Gluten Feed

A.S. Leaflet R1833

Allen Trenkle, professor of animal science

Summary

This experiment was conducted to evaluate the efficacy of daily feeding a live microbial preparation containing live organisms fed to finishing cattle. Additions of live organisms to the rumen are thought to improve the fermentation and overall digestion. Three strains of a lactobacillus and a propionibacterium were studied in this experiment. The study was conducted with Angus steers with an average initial weight of 625 lbs and fed a finishing diet containing on a dry basis 30% wet corn gluten feed, 60% rolled corn, 8% chopped hay and 2% supplement for 174 days. Feeding the microbial product being marketed for feeding cattle improved daily gain and feed efficiency 2.2% and 1.1%, respectively, but the differences were not statistically significant. The microbial preparation increased carcass weights 1.1% and tended to increase carcass fat. Use of different strains of lactobacillus with the propionibacterium did not improve performance or affect carcass grades. It is concluded that potential benefits of feeding the live microbial product may be somewhat less when a portion of the corn is replaced with corn gluten feed.

Introduction

Direct fed microbial products have been developed for feeding livestock. The potential benefits for finishing cattle are more consistent intake of high-grain diets, increased gain, and improved feed efficiency. One product that is being marketed to beef feedlots is Bovamine® Rumen Culture which contains live, naturally occurring organisms, *Lactobacillus acidophilus* and *Propionibacterium freudeneichii*. Lactobacillus organisms normally inhabit the small intestine and can aid in stabilization of digestive processes. *Propionibacterium freudeneichii* can grow in the rumen and has the ability to metabolize lactic acid to propionic acid that can be used as a source of energy by the animal. In studies to determine efficacy of the product cattle have been fed diets containing grain, typical of many feedyards. We have conducted one study in which the cattle were fed diets containing 50% of diet dry matter as wet corn gluten feed. The objective of this study was to evaluate different strains and combinations of *Lactobacillus acidophilus* and *Propionibacterium freudeneichii* in steers fed diets containing 30% wet corn gluten feed on a dry basis. The microbial preparations tested contained live, naturally occurring organisms.

Materials and Methods

One hundred sixty-one Angus steers were purchased from two adjoining ranches (118 and 43 head, respectively) as newly weaned calves and delivered to the research farm at Ames, IA in late October 2001. After arrival the calves were adjusted to being fed in pens, received their second immunizations, were treated for internal and external parasites and started to have grain and wet corn gluten feed introduced into their diet. Thirty-two predominantly Angus and Angus crossed preconditioned and weaned steers were purchased at auction in late November. All the cattle were weighed in early December and one hundred ninety-two were allotted six to a pen to thirty-two pens based on this weight. The cattle were weighed again a week later on two consecutive days at the beginning of the feeding trial. Eight pens containing a total of forty-eight steers were assigned to each of four treatments. The starting weight of each steer was the average of the three weights taken early in the morning prior to feeding. The average starting weight of the steers was 625 lbs. Steers were subsequently weighed at approximately 28-day intervals during the trial in the morning prior to feeding. They were implanted with Component E-S on December 12 and reimplanted on March 5 with Component TE-S. The final weight of each steer was the average of two weights taken at the end of the trial after being fed for a total of 174 days.

The steers were fed the finishing diet shown in Table 1. The concentrate portion of the diet was prepared as a mix and weighed separately from the wet corn gluten feed and chopped hay. The three were mixed in a mixer wagon prior to delivery to the cattle. The four treatments compared in this experiment were control mixture containing lactose (Red), 5×10^6 LA 45 + 5×10^6 LA 51 + 1×10^9 PF 24 (Yellow), 2×10^9 LA 51 + 1×10^9 PF 24 (Blue), and 2×10^9 LA M35 + 1×10^9 PF 24 (Green). All the pre-weighed treatments were stored in a freezer until used. At each morning feeding each dry mixture containing lactose (control) or live organisms was activated by suspension in one gallon of warm water and sprinkled on top of the feed in the mixer wagon and mixed into the total diet. The quantity of the culture fed was a constant amount per head per day throughout the experiment. The cattle were fed twice per day and the amount of feed offered the cattle was gradually increased until their appetite was satisfied. Then they were fed according to appetite. If the amount of feed consumed decreased, they were offered less feed and feed accumulated in the bunks was removed, weighed and sampled for determination of dry matter. The mixed concentrate portion of the diet, hay and wet corn gluten feed, were periodically sampled for determination of dry matter.

To facilitate collection of carcass data the steers were sold in two groups to one commercial beef packer. The cattle were shipped late in the afternoon of June 6 and 10 to enter the plant early the following mornings. Equal numbers of steers were sold from each of the four treatments within a sale date so time of selling would not affect the dietary comparisons within the experiment. Weights of hot carcasses were taken after slaughter, and measurements on the carcasses were obtained after a 24-hr postmortem chill. The federal USDA graders in the plant called marbling score, percentage of kidney, pelvic and heart fat (KPH) and yield grade. The grader working on June 7 did not call KPH so 2.5 was used to calculate yield grade for those carcasses. Area of ribeye and fat thickness over the ribeye between the 12^{th} and 13^{th} ribs on the left side of each carcass were measured. Yield grade of each carcass was calculated from carcass measurements using the standard yield grade equation: Yield grade = 2.5 + 2.5 (fat thickness, inches) + 0.2 (percent kidney, pelvic and heart fat) + 0.0038 (hot carcass weight, pounds) – 0.32 (ribeye area, square inches). Liver abscesses were scored A-, A and A+ based on increasing severity of the abscess.

Two steers were removed from the experiment for reasons not related to diet or treatments. Average feed intake was calculated from the total feed consumed by a pen of steers divided by the number of steer days in the pen. Daily gain was calculated by deleting all weights of the steers removed from the study.

Pen means were used as the experimental unit in the statistical analysis. Data were analyzed by analysis of variance. Treatment means and probabilities of difference due to treatment are presented.

Table 1. Composition of diet, dry basis

Ingredient	Percent
Cracked corn	59.63
Chopped hay	8.00
Molasses	0.40
Wet corn gluten feed	30.0
Urea	0.15
Ground limestone	1.40
Trace mineral premix	0.024
Salt (NaCl)	0.30
Rumensin premix[a]	0.0195
Vitamin A premix[b]	0.08

[a]Provided 15.6 mg of monensin sodium per pound of dry matter (28 g per ton - 90% DM complete feed.
[b]Provided 1,400 IU of vitamin A activity per pound of dry matter.

Results

The feedlot performance of the steers is summarized in Table 2. There were no statistically significant differences in feed consumption, rate of gain or feed efficiency. Daily gain and gain/feed of steers fed the yellow treatment were 2.2% and 1.1% improved, compared with steers fed the control treatment (red). Calculating daily gains based on a shrunk starting weight (95% of live weights taken) and final weight based on carcass weight (carcass weight/0.63) resulted in daily gains, and gain/feed of 3.91 & 4.03 (2.9% improvement) and 0.1867 & 0.1904 (2.0 % improvement) for red and yellow treatments respectively. Overall 14.7% of the steers had liver abscesses and three (1.6%) were A+. There was no relation of liver abscess to treatment.

Table 2. Performance of finishing steers fed naturally occurring live microbials.

Item	Treatments				P <
	Red	Yellow	Blue	Green	
Number of steers	48	47	47	48	
Start weight, lbs	627.2	620.9	628.0	626.4	.98
End weight, lbs	1309.1	1317.7	1302.1	1307.4	.93
Days fed	174	174	174	174	
Gain, lbs/d	3.92	4.00	3.87	3.91	.54
Feed intake, lb DM/d	21.0	21.2	21.0	21.0	.93
Feed/gain	5.35	5.30	5.42	5.37	.69
Gain/feed	0.187	0.189	0.185	0.186	.65
Number liver abscesses	8	8	6	6	

Treatments were lactose (Red), 5×10^6 LA 45 + 5×10^6 LA 51 + 1×10^9 PF 24 (Yellow), 2×10^9 LA 51 + 1×10^9 PF 24 (Blue), and 2×10^9 LA M35 + 1×10^9 PF 24 (Green).

Table 3. Carcass data from steers fed live microbials.

Item	Treatments				P <
	Red	Yellow	Blue	Green	
Number of steers	48	47	47	48	
Carcass weight, lbs	804.4	813.1	805.0	805.5	.91
Dressing percent	61.46	61.73	61.84	61.63	.78
Back fat, in.	0.47	0.51	0.50	0.50	.73
Ribeye area, sq. in.	13.2	13.3	13.0	13.3	.40
Marbling score[a]	522	539	529	524	.58
Quality grades					
Prime		1		1	
Choice +			1		
Choice	7	5	7	4	
Choice -	31	34	27	29	
Select	10	7	11	14	
Standard			1		
% Choice – or greater	79.2	85.1	74.5	70.8	
Yield grade					
1	3	1	2	4	
2	22	18	18	21	
3	22	26	25	21	
4	1	2	2	2	
Called yield grade	2.44	2.55	2.34	2.48	.41
Calculated yield grade	2.94	3.05	3.05	3.00	.83

Treatments were lactose (Red), 5×10^6 LA 45 + 5×10^6LA 51 + 1×10^9 PF 24 (Yellow), 2×10^9 LA 51 + 1×10^9 PF 24 (Blue), and 2×10^9 LA M35 + 1×10^9 PF 24 (Green).
[a]400 = slight^0, 500 = small^0, 600 = modest^0, 700 = Moderate^0.

The carcass measurements and carcass grades are summarized in Table 3. There were no statistically significant differences in carcass measurements due to treatment. The steers fed the yellow treatment had numerically higher carcass weight, average marbling score and percentage of USDA Choice- or higher grading carcasses. The higher marbling score was related to numerically higher backfat thickness and fewer yield grade 1 and 2 carcasses. The numerical differences however were not statistically significant.

Discussion

The yellow treatment is the commercially available product (Bovamine®) that has been evaluated in six previous cattle feeding trials. A summary of these six trials prepared by personnel at Michigan State University indicated an improvement in rate of gain (0.12 lb/d, $P < .02$), improved feed efficiency ($P < .1$) and greater carcass weight (9.3 lb, $P < 0.08$) of cattle fed Bovamine® compared with cattle not fed microbials. There were improvements in rates of gain and carcass weights in each of the six trials. In the current study, feeding Bovamine® increased gain 0.08 lb/d and carcass weight 8.7 lbs, slightly less than the average of the previous experiments, but in agreement with a small but consistent improvement by feeding Bovamine®. In the five trials in which corn gluten feed was not fed, feeding Bovamine® increased gain 0.13 lb/d and carcass weight 9.8 lb compared with 0.07 lb/d and 7.9 lbs for the two trials in which corn gluten feed was fed. This difference suggests that there might be somewhat less response to the added microbials when corn gluten feed replaces a portion of the corn in diets fed to finishing beef cattle. Less response to microbials when cattle are fed corn gluten feed might result because of the reduced dietary intake of starch, which is readily fermented in the rumen to lactic and propionic acids.

Implications

The results of this study suggest that addition of a live microbial preparation to cattle finishing diets containing high concentrations of corn gluten feed are likely to result in less improvement in performance than cattle fed high grain diets.

Acknowledgments

This experiment was partially funded by financial support from Nutrition Physiology Corporation, Indianapolis, Ind. The assistance of Cargill Corn Processing, Blair, Neb. in delivery of the corn gluten feed is recognized. Materials were supplied as follows: Implants, VetLife, Overland Park, Kan.; Rumensin, Elanco Products, Indianapolis, Ind.; and vitamin A, Roche Animal Nutrition and Health, Paramus, N.J. The assistance of Rod Berry man, research farm superintendent; Julie Roberts, Beef Center secretary; and the animal caretakers at the ISU Beef Nutrition and Management Research Center is appreciated.