Proceedings, Western Section, American Society of Animal Science

Vol. 59, 2008

USING A YEAST PREPARATION AND FIBROLYTIC ENZYME AS REPLACEMENTS FOR GROWTH HORMONE AND ANTIBIOTIC IN NATURAL BEEF PRODUCTION

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Abstract: Spring-born x-bred steers (n=80; 279.6 kg) were assigned to an 84d field pea-co-product growing study to evaluate replacing growth hormone and ionophore with phosphorylated mannan oligosaccharide (MOS) and fibrolytic enzymes (FIB). In a complete randomized design, a control (C) rearing method (Revelor-IS implant + Rumensin) was compared to three natural (N) replacement rearing methods: 1) MOS, 2) FIB, and 3) MOS + FIB. The objectives were to identify backgrounding performance, efficiency, and economics and to document subsequent carryover effect in a commercial feedyard on finishing performance, carcass closeout, and economics. Steers were double vaccinated and the C group was implanted with trenbelone acetate. The C steer diet included monensin sodium at the rate of 30g/T and MOS and FIB were fed at the rate of 10mg/h/d. Steers were backgrounded in North Dakota and finished in Kansas (Decatur County Feedyard); harvest end point was determined using MicroBeef Technologies' ECM system. Treatment differences were determined using SAS PROC MIXED. Backgrounded C steers gained an average 0.313kg/h/d faster ($P < 0.01$) than steers receiving yeast and enzyme; an 18.9% improvement. Treatment differences for ADFI were similar ($P > 0.10$). The C group tended to be more efficient ($P = 0.18$). Backgrounding ending weight was greater for the C steers, i.e. 423, 391, 393, and 389 kg for the C, MOS, FIB and MOS+FIB, respectively ($P < 0.01$). Feed cost/kg gain was also significantly lower for the C group ($P <0.01$). During finishing, the backgrounding weight advantage of the C steers carried over into finishing. Control steers were heavier at final harvest ($P < 0.01$) and were harvested 4.9 days earlier than the N backgrounded steers. Hot carcass weight of the C steers was also heavier ($P < 0.01$); however, no other carcass measurements differed ($P > 0.10$). Closeout margins favored the C steers. Net returns were $54.22, -$33.62, -$20.65, and -$48.69 for the C, MOS, FIB, and MOS+FIB, respectively. Pea-co-product yield was acceptable. Natural programs require substantial premiums to offset reduced performance.

Keywords: Natural Beef, Yeast Extract, Enzyme

Introduction

The cattle feeding industry has experienced significant growth in "natural beef" as cattle producers respond to increasing consumer concerns over the use of growth promoting hormones and antibiotics in cattle feeding. Alternatives to antibiotics and growth hormones have the potential to be replaced with phosphorylated mannan oligosaccharides and fibrolytic enzymes that in separate research investigations have been shown to reduce stress, enhance immune response, inhibit intestinal binding, enhance ruminal degradation of fiber, and increase feed intake, average daily gain, and feed efficiency (Anderson and Schoonmaker, 2004; Spring et al., 2000; Newman, 1994; Grieshop, 2002. Cellulase enzymes have been shown to effect digestive function, energy intake, and growth performance in cattle (Howes et al., 1998; Lewis et al., 1999; Zinn and Salinas, 1999; Zinn and Ware, 2002; Ware et al., 2002; Johnson and Shivas, 1999).

The research objective is to determine the effectiveness for using mannan oligosaccharide and fibrolytic enzymes (cellulase and xylanase) to replace hormone implant and ionophore during backgrounding and to document the subsequent effect on finishing performance.

Materials and Methods

Eighty spring-born crossbred steers averaging 280 kg were weaned the first week of November and fed in an 84d receiving-backgrounding study using a complete randomized design with four treatments and four pen replicates per treatment. The investigation was conducted using sixteen 32' X 112' pens at the Dickinson Research Extension Center's feedlot located near Manning, North Dakota. Each feedlot pen was equipped with continuous steel fence, anti-siphoning frost-free water fountains, slotted sheet metal windbreak, and a tree windbreak oriented northwest of the feedlot.

Treatments-
1. Control - Revelor-IS® + Rumensin®
2. Natural - Fibrolytic Enzyme (Fibrozyme®10 gm/head/day; no implant or ionophore)
3. Natural - Mannan Oligosaccharide (Bio-MOS®10 gm/head/day; no implant or ionophore)
4. Natural – Bio-MOS® + Fibrozyme® (10 gm/head/day; no implant or ionophore)

Mannan oligosaccharide and fibrolytic enzyme preparations were blended with cracked corn, shredded beet pulp, corn oil, and molasses (Table 1) as a carrier and top-dressed over chopped hay at the rate of 454 gm per head per day to provide 10 grams per head per day of each additive. The field pea-co-product receiving-backgrounding feed was prepared as a pelleted complete feed (Table 2) that was top-dressed over medium quality alfalfa-bromegrass hay (CP - 9.1%; ADF – 35.0%; NDF – 59.4%; TDN – 57.4; NEg Kcal/lb – 0.31). After backgrounding, the steers were transferred to Decatur County Feedyard, Oberlin, Kansas for finishing and final harvest. End point was determined using MicroBeef Technologies' ECM system.

Receiving, backgrounding, and finishing data were analyzed using pen as the experimental unit for both growth and carcass closeout data. The MIXED procedure of SAS was used to separate means using a non-repeated measures procedure.

Results and Discussion

Eighty-four day backgrounding performance, feed efficiency, and partial feeding economics are shown in Table 3. Control steers that were implanted with Revelor-IS® and fed diets containing Rumensin® medication gained an average 0.31 kg faster ($P < 0.01$) than steers fed a microbial additive and enzyme, an18.9% improvement in average daily gain. Average daily feed intake did not differ between treatments ($P = 0.85$). Feed per pound of gain tended to be improved in the control group; however, the advantage measured did not differ ($P = 0.198$). Feed cost per kg of gain amounting to \$0.836, \$1.035, \$1.00, and \$1.071 for the control, Bio-MOS®, Fibrozyme®, and Bio-MOS+Fibrozyme®, respectively, was significantly lower for the control group.

Had the natural reared steers in this study been marketed at the end of the backgrounding phase, natural steers would have returned -\$13.55, -\$9.56, and -\$21.46 less for the Bio-MOS®, Fibrozyme®, and Bio-MOS+Fibrozyme®, respectively.

Within the parameters of the project, field peas and co-product ingredients fed in both the conventional and natural programs yielded excellent steer performance.

The weight advantage observed among conventionally raised steers, during the backgrounding phase, carried over to the final harvest weight. Control steers gained faster ($P < 0.05$), were heavier ($P< 0.01$), consumed more feed ($P<0.01$), and hot carcass weight was heavier ($P <0.01$) than steers backgrounded with natural additives. Except for hot carcass weight, all other carcass measurements did not differ, i.e. fat depth ($P = 0.535$), REA ($P = 0.532$), yield grade ($P = 0.787$), quality grade ($P = 2.14$), and percent of carcasses grading Choice or higher ($P = 0.807$).

The total carcass value was greater for steers that were reared conventionally ($P <0.01$). Marketing analysis comparing conventional and natural production resulted in a profit of \$54.22 per head for control steers whereas net losses were realized for all carcasses from naturally reared steers. Compared to conventional Revelor-IS® implanted steers fed Rumensin® medication, losses per head among naturally reared steers were -\$33.62, -\$20.65, and -\$48.69 per carcass for Bio-MOS®, Fibrozyme®, and Bio-MOS+Fibrozyme®, respectively.

Implication

Producers growing cattle for natural markets need to be prepared to feed cattle longer to attain similar market weight, and will need premiums ranging from \$87.00 to \$102.00 per head from natural markets to offset lost revenue available using conventional rearing methods.

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Table 1. Conventional and natural topdressed supplement ingredient composition (As Fed).

	Conventional	Bio-MOS	Fibrozyme	Fibrozyme +Bio-MOS
Cracked Corn, %	46.0	44.9	44.9	43.8
Shredded Beef Pulp, %	46.0	44.9	44.9	43.8
Corn Oil, %	3.0	3.0	3.0	3.0
Molasses, %	5.0	5.0	5.0	5.0
Bio-MOS, %	---	2.2	---	2.2
Fibrozyme, %	---	---	2.2	2.2

Table 2. Pelleted conventional and natural supplement ingredient composition (As Fed).

	Conventional	Natural
Soybean Hull, %	30.753	30.80
Field Peas, %	20.00	20.00
Corn, %	15.00	15.00
Barley Malt Sprouts, %	10.00	10.00
Wheat Midds, %	10.00	10.00
Distillers Dried Grain w/ Solubles, %	8.00	8.00
Decoquinate-6%, %	0.54	---
Monensin (80 gm/lb), %	0.40	---
Analysis: CP, %	15.10	15.1
TDN, %	70.20	70.25
Fat, %	2.65	2.65
Fiber, %	15.57	15.58
Acid Detergent Fiber, %	18.03	18.05
NEm, Mcal/lb.	0.785	0.785

[a]Beet Molasses, 5.0%; Calcium Carbonate, 0.50%; Salt, 0.50%; Dicalcium Phosphate 21%, 0.10%; Feedlot Trace Mineral Premix, 0.075%; Feedlot Vitamin Premix, 0.025%.

Table 3. Eighty-four day natural versus conventional backgrounding.

	Control – Medicated	*Bio-MOS®*	*Fibrozyme®*	*Fibrozyme + Bio-MOS®*	*SEM*	**P-Value**
***Growth*:**						
No. Steers	20	20	20	20		
Days on Fed	84	84	84	84		
Start Wt, kg	284.2	278.8	277.8	278.0	3.16	0.432
Final 84d Wt., kg.	423.4[w]	390.8[x]	393.1[x]	389.3[x]	4.63	<0.01
Gain, kg	139.1[w]	112.0[x]	115.3.[x]	111.3[x]	3.44	<0.01
ADG, kg	1.66[w]	1.33[x]	1.38[x]	1.33[x]	0.041	<0.01
Feed:Gain, kg	6.06	7.12	6.86	7.11	0.371	0.198
Feed Cost/Day, $	1.388	1.377	1.380	1.425	0.0275	0.603
Feed Cost/kg. Gain, $	0.8361[w]	1.035[x]	1.00[x]	1.071[x]	0.0088	<0.01
Net/Hd, $	34.58	18.03	25.02	13.12		
Difference Versus Control, $	---	-13.55	-9.56	-21.46		

Table 4 Natural versus conventional finishing growth, feed intake, and efficiency.

	Conventional		*Natural*			
	Control – Medicated	Bio-MOS®	Fibrozyme®	Fibrozyme + Bio-MOS®	SEM	P-Value
Days on Feed	116.3	122.2	120.1	121.2		
Start Wt., kg	410.3[w]	381.3[x]	383.6[x]	376.3[x]	18.50	<0.01
Harvest Wt., kg	615.1[w]	576.0[x]	583.7[x]	572.4[x]	15.67	<0.01
Gain, kg	204.8	194.7	200.1	196.1	5.80	.308
ADG, kg	1.76	1.59	1.67	1.62	0.399	.022
Fd/Hd/Day, kg	9.95[w]	9.64[x]	9.60[x]	9.55[x]	0.170	<0.01
Feed:Gain, kg	5.65	6.06	5.75	5.90	0.122	.231

Table 5 Natural versus conventional carcass closeout values.

	Conventional		*Natural*			
	Control – Medicated	Bio-MOS®	Fibrozyme®	Fibrozyme + Bio-MOS®	SEM	P-Value
Hot Carcass Wt., kg	390.4[w]	361.8[x]	366.8[x]	362.2[x]	9.83	<0.01
Fat Depth, cm	1.32	1.32	1.32	1.27	1.04	.535
Ribeye Area, cm^2	84.6	80.0	79.9	81.5	2.61	.532
Yield Grade	2.95	2.80	3.05	2.80	0.2508	.787
Quality Grade	4.35	3.4	4.8	5.05	0.8091	.214
Percent Choice, %	75.0	70.0	65.0	58.8	12.26	.807

Table 6 Natural versus conventional finishing economics.

	Conventional		*Natural*			
	Control – Medicated	Bio-MOS®	Fibrozyme®	Fibrozyme + Bio-MOS®	SEM	P-Value
Total Carcass Value, $	1243.55[w]	1149.52[x]	1153.66[x]	1130.98[x]	3.58	<0.01
Feeder Calf Cost, $	680.77	667.73	665.55	665.55		
Bkg. Feed. and Yardage, $	141.85	140.89	141.13	144.91		
Feedlot Cost/Head, $	325.71	333.52	326.63	328.21	6.73	0.784
Transportation, $[a]	41.00	41.00	41.00	41.00		
Net Return (Loss), $	54.22	-33.62	-20.65	-48.69		

[a]Transportation from Dickinson, North Dakota to Oberlin, Kansas