Effects of Monensin and Protein Type on Performance of Yearling Steers Grazing Smooth Bromegrass Pastures

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Summary with Implications

Two-year study evaluated the effects of monensin on protein type, either rumen degradable or rumen undegradable, with yearling steers grazing smooth bromegrass pastures. Steers were supplemented soybean meal (rumen degradable protein) or non-enzymatically browned soybean meal (rumen undegradable protein) at isonitrogenous levels to dried distillers grains plus solubles provided at 0.50% BW. Likewise, steers were provided either zero or 200 mg/hd/d of monensin for a total of six treatments with a 2 × 3 (no protein, RDP, or RUP) factorial design. There was no interaction of monensin by protein type. Providing monensin to grazing yearlings did not improve ADG; however, monensin numerically improved steers daily gain by 7.64% when no protein supplement was provided. Previous research has demonstrated monensin supplementation in yearling grazing systems has improved rate of gain, though the improvement may be minimal. Both rumen degradable and rumen undegradable protein types improved daily gain by 31.15% compared to no protein supplement. Providing a rumen undegradable protein supplement improved daily gain by 5.63% compared to rumen degradable protein supplement. Therefore, providing protein, and especially a rumen undegradable protein, improved yearling steer performance on smooth bromegrass pastures.

Introduction

Monensin is a carboxylic polyether ionophore that selectively inhibits Gram-positive bacteria. In ruminant animals, monensin will alter the ratio of volatile fatty acids in the rumen, increasing propionate production and reduce acetate and butyrate production. Propionate can be converted to glucose, unlike acetate and butyrate. This provides the ruminant animal with more energy from increased glucose supply when using monensin.

Previous research has suggested monensin elicits a protein and energy response to average daily gain (ADG). Greater concentrations of glucogenic propionate may spare some glucogenic amino acids from degradation by the liver. Likewise, monensin decreases rumen microbial proteolytic activity. Therefore, some protein destined for rumen degradation may escape the rumen and become available to the animal. The purpose of this study was to observe the protein response of monensin when yearling steers grazing smooth bromegrass pastures were supplemented a rumen degradable protein (RDP) and rumen undegradable protein (RUP) types. To measure the impact of monensin on protein degradation in the rumen, RDP would be compared to RUP, a protein type that has far less degradability in the rumen. The hypothesis was that cattle supplemented monensin with either protein type (RDP or RUP) would have greater average daily gain (ADG) compared to cattle supplemented protein (RDP or RUP) without monensin.

Table 1. Ingredient composition of common supplements[1]

	Year 1		Year 2	
	0	200	0	200
Ingredient Composition, %				
Soybean Hulls	93.9	93.7	63.7	62.8
Dried Molasses	4.2	4.2	14.1	14.1
Liquid Molasses	-	-	4.1	4.1
Limestone	1.0	1.0	-	-
Salt	0.3	0.3	17.5	17.5
Beef Trace Mineral	0.66	0.66	0.66	0.66
Rumensin 90[2]	-	0.2205	-	0.2205

[1]Provided at 1 lb/hd/d (DM basis).
[2]Monensin provided to target 0 or 200 mg/hd/d (DM basis).

Procedure

A two-year experiment was conducted utilizing 144 yearling steers each year (year one initial BW = 746 lb, SD = 51 and year two initial BW = 717 lb, SD = 18) to study the effects of monensin on supplemented protein type, rumen degradable protein (RDP) or rumen undegradable protein (RUP), in a randomized complete block design on smooth bromegrass pastures. The study was arranged as a 2 × 3 factorial design. Treatments consisted of monensin at zero or 200 mg/hd/d and protein type of soybean meal (RDP) or non-enzymatically browned soybean meal (RUP) with a negative control consisting of no additional protein source (CON). Supplement was provided daily. A common supplement was provide to all groups containing soyhulls, molasses, salt, limestone (year 1 only), and mineral at 1 lb/hd/d (DM basis; Table 1). If steers were assigned to monensin, it was included in the common supplement and displaced soyhulls. If supplement included protein, the amounts were calculated to match crude protein supplied from DDGS (34% CP) at 0.50% of body weight (BW) for both soybean meal and non-enzymatically browned soybean meal (0.33 and 0.31% BW, respectively). Either protein supplement was added to the common supplement before being fed to their respective

Table 2. Performance of yearling steers grazing smooth bromegrass pastures

	Monensin Inclusion[1]									
	0			200						
	Protein Type[2]						SEM	*P*-value[3]		
Item	CON	RDP	RUP	CON	RDP	RUP		P	M	P × M
Head, n	48	48	48	48	46	48				
Pastures, n	7	7	7	7	7	7				
Initial BW, lb	731	733	731	732	733	730	1.6	0.43	0.86	0.82
Ending BW, lb	956[c]	1033[b]	1041[a]	975[c]	1029[b]	1050[a]	7.1	<0.01	0.19	0.28
ADG, lb/d	1.44[c]	1.92[b]	1.98[a]	1.55[c]	1.89[b]	2.04[a]	0.043	<0.01	0.17	0.26

[1]Monensin targeted at zero or 200 mg/hd/d (DM basis).

[2]CON = control with no protein supplement, RDP = rumen degradable protein from soybean meal, RUP = rumen undegradable protein from soypass

[3]P = protein main effect, M = monensin main effect, P × M = protein × monensin interaction

[abc]Means in a row with uncommon superscripts differ ($P \leq 0.05$)

group. Each year, steers were assigned to one of six treatments with four replications per treatment and six steers per pasture. Pastures consisted of approximately six acres and divided into three equal paddocks and rotationally grazed for 154 d (year one) and 161 d (year two) from May to October. In both years, all pastures were fertilized in mid-April with 80 lb N/acre. The grazing period was divided into cycles with the first cycle lasting approximately 31 d and cycles two through four lasting approximately 38 d, cycle five only occurred in year one and lasted approximately 23 d. In order to update supplement amount, BW was measured at the end of each cycle and shrunk four percent to account for gut fill.

Upon initiation of the trial steers were limit-fed a common diet containing 50% Sweet Bran (Cargill Corn Milling, Blair, NE) and 50% alfalfa hay (DM basis) at 2% of BW for five days followed by three days of weighing. The average of the three d weights served as initial BW. The same protocol was replicated at the end of the study to measure ending BW. Steers were implanted with 40 mg trenbolone acetate and 8 mg estradiol (Revalor-G; Merck Animal Health, De Soto, KS).

One steer was removed from RDP with monensin in year two due to bodily injury. One steer from treatment RDP with monensin in year two died with cause of death unknown. Both steers were replaced with non-experimental steers to maintain stocking rate for those pastures. Due to frequent inadequate consumption of supplement by one pasture in replication two of year two data from entire replication was removed from analysis. As a result, performance data were analyzed with seven complete replications.

Initial BW, ending BW, and ADG results were analyzed using GLIMMIX procedure of SAS (9.4, SAS Institute Inc., Cary, NC). Treatment, pasture block and year served as fixed effects in the model. The model included protein supplement, monensin inclusion level, the interaction of protein supplement and monensin inclusion level, pasture block, and year. Pasture nested within year was the experimental unit. Treatment means were calculated using the LSMEANS option of SAS. Treatment differences were significant at $\alpha \leq 0.05$ and tendencies were discussed when $0.05 < \alpha \leq 0.10$.

Results

There were no interactions detected for ending BW or ADG between protein type and level of monensin ($P \geq 0.26$; Table 2). Monensin inclusion had no effect on ending BW or ADG ($P \geq 0.17$). However, supplementing steers with 200 mg/hd/d of monensin with no protein supplement numerically improved ADG by 7.64% when fed without protein supplement. This response to monensin, an increase of 0.11 lb daily gain, was expected and agrees well with recent literature. When fed in combination with a protein supplement, the monensin response was 0 to 3% improvement in ADG. These data suggest further investigation into the interaction of protein supplement and monensin supplementation is required.

A protein type response was observed ($P < 0.01$) for ending BW and ADG. Steers provided protein (RUP or RDP) were, on average, 73 lb heavier at the end of the grazing season compared to CON. Steers provided protein, either RDP or RUP, had a 31.15% (0.46 lb/d) improvement in ADG compared to CON steers. Similarly, steers consuming a RUP supplement were 15 lb heavier than steers consuming a RDP supplement (1045 vs. 1030, respectively; $P = 0.01$). By supplementing RUP, steers gained 5.63% (0.11 lb/d) more than steers provided RDP. Steers responded in large part to protein supplementation (either RUP or RDP). Depending on the individual producer's goals, protein supplementation could be considered for improvements in ADG when grazing yearling steers on smooth bromegrass pastures.

Conclusion

Overall, supplementing protein, either RDP or RUP, to yearling steers grazing smooth bromegrass will improve ADG. Additoinally, providing an RUP type of protein will supply more dietary metabolizable protein and improve animal performance compared to an RDP type. Overall, there was no response to monensin. However, when monensin was included without protein supplementation, ADG was improved. Because the expected response to monensin relative to protein supplement is small, more replication may be necessary to detect a response in animal performance. Supplementing with monensin, RDP, RUP, or no supplement at all are viable options that producer's should consider when evaluating their goals and target endpoints for their yearling cattle.

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