Effect of Increasing Levels of Monensin in an Energy Supplement for Cattle Grazing Winter Wheat Pasture

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Story in Brief

One hundred eighty-four crossbred steers were used to evaluate growth performance over a 120 d grazing period. Four supplemental treatments were as follows: free-choice, non-medicated mineral (**MIN**), and three energy supplements formulated to provide 0 (**EN0**), 100 (**EN100**), or 200 (**EN200**) mg monensin/steer/d. Energy supplements were fed every other day at the rate of 3.0 lb/steer. Actual intake of the EN0 and EN100 supplements was 1.5 lb/steer/d, while EN200 averaged 1.42. Mineral consumption averaged .34 lb/steer/d. During the initial part of the grazing season, EN0 steers gained .23 lb/d more than MIN steers. Addition of monensin to the energy supplement increased ADG by .20 and .18 for the EN100 and EN200 supplements, respectively. During the late grazing season, no treatment effect on ADG was observed. Overall, energy supplementation increased weight gain by .29 lb/d, compared to MIN, with no significant improvement from the addition of monensin. The addition of monensin to the energy supplements improved supplement conversion from 6.5 to 3.4 during the initial grazing period. Overall supplement conversions improved sequentially with increasing levels of monensin. These data suggest that the recommended level of monensin in the Oklahoma Green Gold supplement should perhaps be decreased from 90 – 100 mg/lb to 75 mg/lb in order to provide a targeted dosage of monensin of 150 mg/hd/d. However, supplement conversion was improved by the higher dosages of monensin.

Key Words: Monensin, Steers, Supplement, Weight Gain, Wheat Pasture

Introduction

The Oklahoma Green Gold supplement is a monensin-containing energy supplement designed to increase weight gain and decrease bloat in growing cattle on wheat pasture. It was initially designed to contain 90 to 100 mg monensin/lb (as-fed) and to be fed at the rate of 2 lb/hd/d or 4 lb/hd every other day (Horn, 2001). In four of the five trials the supplementation program increased weight gain by .42 ± .10 lb with a supplement conversion of 4.7 (i.e., lb of supplement per lb of increased gain per steer; Horn, 2001). Fieser et al. (2003) modified the formula by increasing the monensin concentration to 160 mg/lb and fed it at the rate of 2 lb/hd every other day. Mean supplement intake was .89 lb/d (142 mg of monensin) and the weight gain response (.25 lb/d) was less than obtained with the Green Gold supplement. Inclusion of monensin in a free-choice mineral mixture provides an alternative means for delivering monensin to stocker cattle. Horn et al. (2002) reported results of a two-year study in which weight gain of wheat pasture stockers given free-choice access to a “R-1620” monensin-containing mineral mixture (1,620 g monensin/ton) was increased .30 (yr 1) and .15 lb/d (yr 2) as compared to the same mineral mixture without monensin. Monensin intake averaged 83 (yr 1) and 125 (yr 2) mg/steer/d. This study raised new questions relative to the optimal dosage of monensin for wheat pasture stocker cattle. Therefore, the objective of the present study was to determine the effect of increasing levels of monensin in an energy supplement on growth performance of steers on wheat pasture.

Materials and Methods

Study site and treatments. Seventeen clean-tilled winter wheat pastures at the Wheat Pasture Research Unit near Marshall, OK were used. All pastures were planted to a single variety, OK101, at a seeding rate of 120 lb/acre (2 bu/acre) on Sept. 5, 2003. Pastures were fertilized according to soil test and N, P, and K were applied in amounts for production goals of 3,000 lb of forage DM/acre and 50 bu of grain per acre. Supplementation treatments were: (1) high calcium, low-phosphorus non-medicated mineral fed free choice (**MIN**; Wheat Pasture Pro Mineral; Land O'Lakes Farmland Feed LLC); (2) energy supplement with no added monensin (**EN0**); (3) energy supplement formulated to deliver 100 mg monensin/steer/d (**EN100**); (4) energy supplement formulated to deliver 200 mg monensin/steer/d (**EN200**). The four treatments were randomly assigned to the pastures, with the restriction that the same treatments were not in adjacent pastures. There were four pastures per treatment with the exception that the EN100 treatment was assigned to five pastures. Steers grazed the wheat pastures for 120 d from November 10, 2003 to March 9, 2004.

Cattle. One hundred eighty-four predominantly black, crossbred steers originating in South Dakota were used. Additionally, 20 steers were used in a put/take manner to adjust stocking rates and forage allowance among pastures in accordance with forage clipping data. The put-and-take steers were not used in calculation of weight gain. After a receiving period in which the steers were fed Deccox® for prevention of coccidiosis, steers were implanted with Component E-S, stratified by weight and randomly assigned to pastures. Initial stocking rate was 1.75 acres per steer. Steers were weighed full on Nov. 10, 2003 and a 2% pencil shrink was used to calculate initial weights. Steers were not shrunk overnight to minimize the risk of bloat when initially placed on wheat pasture. Subsequent weights on January 15 and March 10 were measured after an overnight (about 15-hr) shrink without feed or water.

Supplements. Ingredient and nutrient composition of the supplements is shown in Table 1. The energy supplements (5/32nd inch pellets) were designed to be fed at the rate of 1.5 lb/steer/d for the first 5 d after turnout and 3.0 lb/steer every other d for the remainder of the study. The EN0, EN100, and EN200 supplements were formulated to contain 0, 67, and 133 mg monensin/lb as-fed, respectively. Analyzed monensin concentrations from 21 supplement samples taken either during sacking of supplements at our feedmill or weekly supplement samples when feeding on pasture were 61 ± 3.9 and 122 ± 7.7 mg monensin/lb, respectively. Consumption of the non-medicated mineral and supplements was measured weekly. The mineral mixture was fed in covered feeders (one/pasture); whereas energy supplements were fed in 12 ft long round bottom feeders which provided one-sided bunk space of about 1.2 ft per steer. Feed bunks and amounts of remaining supplement were observed daily. If supplements became wet from rain and/or snow, wet material was removed, weighed, and sampled for DM analysis in order to calculate supplement intake on an air-dry (90% DM) basis. The mineral and bunk feeders were located near the single water source in each pasture. Because of an outbreak of respiratory disease (one steer dead and several others showing clinical signs of disease) all steers were fed 2 lb/d of a medicated, soybean hull and cottonseed hull supplement that contained 3 g chlortetracycline/lb of supplement from December 23 – 28. This medicated supplement was fed in place of the other experimental supplements. Because of continuing problems with complete consumption of the EN200 supplement, 3% Diamond V Yeast Culture was added to all three of the energy supplements in place of soybean hulls on January 15, 2004 for the remainder of the study.

Table 1. Ingredient and nutrient composition of supplements

Ingredient	% as-fed	Nutrient	DM Basis
Ground Corn	43.1	NEm, Mcal/cwt	85.0
Soybean Hulls	44.4	NEg, Mcal/cwt	55.5
Cane Molasses	5.0	TDN, %	71.8
Salt	1.00	Crude Protein, %	9.60
Dicalcium Phosphate, 18.5% P	3.00	Potassium, %	.92
Limestone 38%	3.00	Calcium, %	2.32
Magnesium Oxide	.50	Phosphorus, %	.84
Copper Sulfate	.025	Magnesium, %	.50
Vitamin A-30,000	.100	Sulfur, %	.17
Rumensin 80[a]		Cobalt, ppm	.13
		Copper, ppm	84
		Iron, ppm	692
		Manganese, ppm	29.5
		Selenium, ppm	.13
		Zinc, ppm	34

[a]Rumensin 80 was added to the EN100 and EN200 supplements to result in monensin concentrations of 67 and 133 mg monensin/lb as-fed, respectively

Statistical Analysis. Individual steer ADG was averaged by pasture and analyzed as a completely randomized design using the MIXED model procedure of SAS. Least squares means were separated by using a protected Fisher's LSD with $\alpha = .05$. Raw means and standard deviations for supplement and mineral intakes are presented without further statistical analysis.

Results and Discussion

Supplement Intake. Supplement intakes are shown in Table 2. Daily mineral intake averaged .34 lb/steer. Mineral intake rose dramatically during the last third of the grazing season, averaging over .5 lb/steer per day for 2 wk during February. Average daily intake of EN0 was 1.5 lb/steer, and, in no instance was supplement not completely consumed. Furthermore, the EN0 supplement was always consumed within 24 h of feeding and generally consumed in only one feeding bout. As was the case with the EN0 supplement, the target intake of 1.5 lb/steer/d, was achieved for the EN100 supplement. In 97% of the feedings, the entire amount of EN100 was consumed within 24 h. It was not uncommon for steers fed EN100 to use multiple feeding bouts during the first 24 h to completely consume the supplement. Monensin intake by steers fed EN100 was 100 mg/d.

As shown in Figure 1, consumption of the EN200 supplement was erratic and the target supplement intake of 1.5 lb/steer/d was not achieved. Supplement consumption began falling off in December, frequently having supplement refusals after each 2-d period. During the first 66 d of the study (i.e., prior to adding yeast culture to the supplements), consumption of EN200 averaged 1.38 lb/steer/d, with only 3% of the feedings being completely consumed in the first 24 h. Consumption of the EN200 supplement averaged 1.46 lb/steer/d during the last 53 d when the supplements contained the added yeast culture, and the frequency of total supplement consumption after 24 h increased to 30%. Overall, EN200 consumption averaged 1.42 lb/steer/d, which provided 188 mg monensin/steer/d. Due to weather conditions (rain or snow) it is desirable for supplements to be consumed rapidly, preferably in a 24-h period to minimize the chance of wet and ruined supplements. Fieser et al. (2003) found that steers would not completely consume 1.0 lb/d of an energy supplement containing 200 mg monensin/lb as-fed. Supplement intake averaged .89 lb/steer/d in their study. In the present study, monensin concentration of the EN200 supplement was 133 mg/lb of supplement, which was intermittent to that used by Fieser et al. (2003; 160 mg/lb) and the recommendation of 90 – 100 mg monensin/lb for the Green Gold supplement. In general, as we have tried to decrease the amount of energy supplement fed/d and concomitantly increased the monensin concentration, rate of intake of our supplements has decreased and overall intake has been more variable.

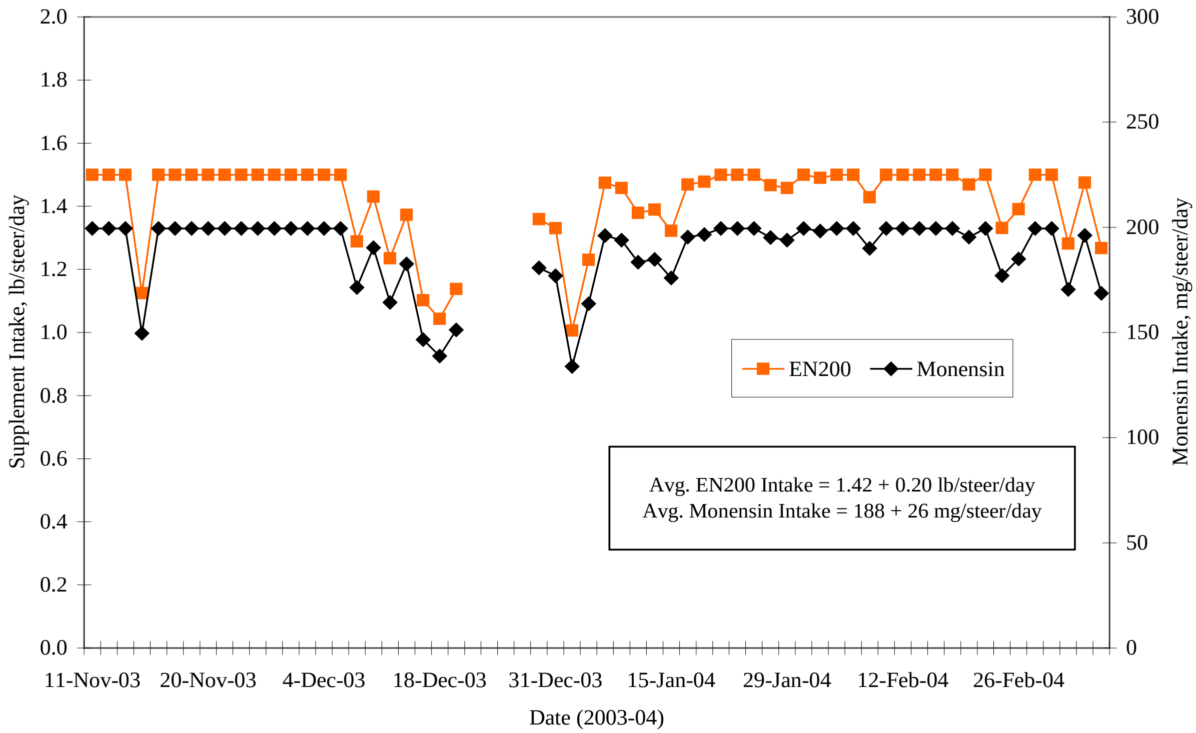

Figure 1. EN200 Supplement and monensin intake. Interrupted space in figure is when CTC-containing supplement was fed.

Animal Performance. Steer weights and ADG are presented in Table 2. During the initial grazing period, energy supplementation without monensin (EN0) increased ($P<.01$) ADG by .23 lb/steer, relative to the MIN treatment. Provision of 100 mg monensin/steer/d increased ($P<.05$) daily gain by an additional .2 lb. However, additional monensin (EN100 vs EN200) did not ($P=.80$) increase daily gain. Weight gain was increased .43 lb/d by the EN100 supplement compared with the non-medicated mineral. This response is very similar to that reported for the Green Gold supplementation program. Weight gains were not influenced by treatment ($P=.12$) during the latter part of the grazing period. To what extent treatment of the cattle with chlortetracycline for respiratory disease during late December and addition of yeast culture to the energy supplements confounded our treatments is unknown. Energy supplementation increased ($P<.01$) overall ADG by .29 lb/d compared with MIN. No differences ($P>.08$) in daily gains were observed between any of the energy supplements.

Table 2. Growth performance of steers grazing winter wheat and receiving either a non-medicated mineral or an energy supplement with increasing concentrations of monensin[a]

	Supplements[b]					
	MIN	EN0	EN100	EN200	SEM	P-value[c]
Pastures	4	4	5	4		

Steer Weight, lb						
Date						
Nov. 10, 2003	528	535	539	536	2.3	
Jan. 15, 2004	700	721	739	733	4.8	
Mar. 9, 2004	818	851	864	867	8.3	
Supplement Intake, lb/steer/day[d]						
Period						
Initial (11/10 – 1/15)	.27 ± .07	1.5 ± 0	1.5 ± 0	1.38 ± .24		
Late (1/15 – 3/9)	.43 ± .09	1.5 ± 0	1.5 ± 0	1.46 ± .12		
Overall (11/10 – 3/9)	.34 ± .11	1.5 ± 0	1.5 ± 0	1.42 ± .20		
Monensin Intake, mg/steer/day[d]						
Period						
Initial (11/10 – 1/15)	-	-	100 ± 0	184 ± 32		
Late (1/15 – 3/9)	-	-	100 ± 0	194 ± 16		
Overall (11/10 – 3/9)	.-	-	100 ± 0	188 ± 26		
Average Daily Gain, lb						
Period						
Initial (11/10 – 1/15)	2.59^{z}	2.82^{y}	3.02^{x}	$3.00^{x,y}$	.066	<.01
Late (1/15 – 3/9)	2.20	2.40	2.32	2.49	.081	.12
Overall (11/10 – 3/9)	2.41^{y}	2.63^{x}	2.70^{x}	2.77^{x}	.051	<.01
Supplement Conversion[e]						
Period						
Initial (11/10 – 1/15)	-	6.5	3.5	3.4		
Late (1/15 – 3/9)	-	7.5	12.5	5.0		
Overall (11/10 – 3/9)	-	6.8	5.2	3.9		

[a]Least squares means by treatment

[b]MIN - non-medicated wheat pasture mineral; EN0, EN100, EN200 - energy supplements fed at rate of 3 lb/steer every other day to provide 0, 100, or 200 mg monensin/steer/d, respectively

[c]Probability of a greater F-value for the main effect of treatment

[d]Supplement and monensin intakes reported as mean ± standard deviation

[e]Pounds of supplement per of additional weight gain over steers receiving MIN

[x,y,z]Means within a row with different superscripts differ (P<.05)

Supplement Conversion. Supplement conversions, expressed as lb of supplement per lb of additional weight gain over steers receiving MIN, were calculated for all periods as shown in Table 2. Addition of monensin to the energy supplement improved supplement conversion from 6.5 to 3.4. This conversion of 3.4 is better than that observed in the studies that led to the development of the Oklahoma Green Gold program (supplement conversions of 4.16 to 5.35), but is similar to the 3.6 reported by Fieser et al. (2003) for the modified Green Gold supplement. At a supplement cost of $150/ton and a conversion of 3.4, feed cost of the additional weight gain would be about $.26/lb. Supplement conversions were sequentially decreased by increasing amounts of monensin during the overall grazing period.

Implications

Addition of monensin to a hand-fed energy supplement improved both daily gains and supplement conversion by steers grazing wheat pasture in this study. However, the higher dosage of monensin (184, 194, and 188 mg/steer/d during the initial, late, and overall grazing periods, respectively) did not increase weight gain as compared with 100 mg monensin. These data suggest that the recommended level of monensin in the Oklahoma Green Gold supplement should perhaps be decreased from 90-100 mg/lb to 75 mg/lb in order to provide a targeted dosage of monensin of 150 mg/hd/d. However, supplement conversion was improved by the higher dosages of monensin.

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