BEEF CATTLE RESEARCH UPDATE

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Summary of Effect of Monensin on Beef Feedlot Cattle Performance

Canadian researchers recently conducted a meta-analysis of the impact of monensin (Rumensin®, Elanco Animal Health) on dry matter intake (DMI), average daily gain (ADG), and feed efficiency (Feed/Gain) of growing and finishing beef cattle.[1] A total of 40 peer-reviewed articles and 24 additional trial reports (169 trials) that were published from 1972 to 2010 with monensin and performance outcomes were included in this analysis. The average concentration of monensin fed across these trials was 22.9 grams/ton on a 90% dry matter (DM) basis (range of 2.4 to 80 grams/ton in these data). Monensin is currently labeled by FDA to improve feed efficiency in feedlot cattle when fed at a level of 5 to 40 grams/ton on a 90% DM basis.

Across all the trials, monensin significantly ($P < 0.0001$) reduced DMI by 3.1%, increased ADG by 2.5%, and improved feed efficiency by 6.4%. However, monensin improved feed efficiency by only 2.3 to 3.5% over the last 20 years (Table 1). This lower improvement in feed efficiency observed over the last 20 years is not surprising since feedlots currently feed considerably less roughage and more grain than they did 40 years ago. In the original 19-trial feedlot summary which led to the approval of monensin in December of 1975, the average roughage and grain levels fed were approximately 16.5 and 71.2% (DM basis), respectively. In contrast, a Texas Tech University survey of 29 consulting feedlot nutritionists published in 2007 reported that finishing diets (DM basis) contained from 0 to 13.5% roughage averaging 8.3 and 9% roughage in summer and winter, respectively.[2] This same survey showed that two-thirds of the nutritionists formulated diets containing 70 to 85% grain (80 to 85% = 34.5%, 70 to 80% = 31%). One of the major modes of action by which monensin improves feed efficiency is that it increases ruminal production of the volatile fatty acid, propionate. Feeding higher energy (grain) diets also increases ruminal propionate production. Thus, with the feeding of higher grain/lower roughage diets, there is less room for improvement in efficiency with the feeding of monensin.

Table 1. Effects of monensin on feed efficiency in feedlot cattle across 4 decades of research.

Decade	# Trials	Average Monensin Level, g/ton*	Control Mean Feed/Gain	Mean Difference in Feed/Gain	Change in Feed Efficiency, %
1970s	85	21.2	8.79	-0.715	+8.1
1980s	21	25.9	8.39	-0.539	+6.4
1990s	13	27.7	6.39	-0.148	+2.3
2000+	11	26.4	6.38	-0.229	+3.5

*Expressed on 90% DM basis.
Adapted from Duffield et al., 2012.

The data in Table 1 illustrate that feed efficiency improved dramatically (27%) from the 1970s to the 1990s. Management factors including improved cattle genetics, the use of growth implants, and the feeding of higher energy diets most likely explain this improvement in feed efficiency.

This meta-analysis also showed a linear effect of monensin dose on feed efficiency (Table 2), DMI, and ADG outcomes, with greater effects on improving feed efficiency and reducing DMI with larger doses of monensin but lesser improvement in ADG with increasing dose. The analysis suggested the monensin effect on ADG would be expected to be negative, beginning at a monensin level of ~37.6 grams/ton (90% DM basis).

These researchers also noted that the use of corn silage in the diet influenced the effect size of monensin for DMI and feed efficiency, with diets containing corn silage resulting in a greater improvement in efficiency and a larger effect on reducing DMI. They speculated that this might have occurred because corn silage in the diet may have simply served as a marker for identifying studies that used finishing diets vs. growing diets (more corn silage in growing diets). The expected monensin response would be greater in growing diets than finishing diets due to the lower grain content of grower diets. These scientists also reported that studies conducted with higher ADG in control animals (>2.58 lb/day) showed less effect of monensin on ADG. This result would be expected since lower control ADG can be attributed to lower energy diets being fed (more roughage/less grain) since research has shown that monensin gives greater ADG responses with higher forage, lower grain diets.

Table 2. Stratified meta-analysis of feed efficiency in feedlot cattle across dose ranges of monensin.

Monensin dose range, g/ton of feed 90% DM	# Trials	Weighted Mean Difference for Feed Efficiency, lb feed/lb gain
< 13.1	30	-0.532
13.1 to 24.5	36	-0.628
25.3 to 35.9	56	-0.455
> 35.9	8	-1.153

Adapted from Duffield et al., 2012.

In summary, these researchers concluded that their analysis clearly illustrates that monensin improves feed efficiency in growing and finishing beef feedlot cattle, and that this effect is linear with dose.

Effect of Monensin Supplied via Mineral or Pressed Protein Block with or without Growth Implants on Performance of Steers Grazing Wheat Pasture

Recent University of Arkansas research evaluated the effect of monensin supplementation with or without Component® TE-G with Tylan® implants (Elanco Animal Health) on the performance of steers grazing wheat pasture.[3] In this study, steers were given free-choice access to non-medicated mineral or were supplemented with monensin via mineral (810 mg monensin per lb of mineral) or pressed protein blocks (42% crude protein with 150 mg monensin per lb). Monensin is labeled by FDA to increase weight gain in pasture cattle when fed at a level of 50 to 200 mg per head per day.

In this study, intake of the non-medicated control mineral average 0.36 lb/day. Intake of the monensin mineral average 0.23 lb/day providing 181 mg of monensin, while intake of the protein block averaged 0.73 lb/day providing 109 mg of monensin. These researchers reported that average daily gains were significantly increased ($P < 0.01$) with monensin supplementation over controls by 5.9 to 8.3% (2.53, 2.68, and 2.74 lb/day, respectively, for controls, monensin mineral, and monensin block). Implanted steers gained 12.9% faster ($P < 0.01$) than non-implanted steers (2.81 vs. 2.49 lb/day). There was no interaction between monensin supplementation and implant ($P \geq 0.71$), indicating that the effect of these technologies are additive in nature. Steers that were implanted and fed monensin (via mineral or block) gained 21.4% faster than non-implanted steers fed the control mineral (2.84 vs. 2.34 lb/day).

These authors calculated that using ionophores and implants together for wheat pasture stocker cattle decreases cost of gain by 25%. They noted that implanting can increase net return per steer by $62 and monensin supplementation can increase net return per steer by $26 when supplied by blocks or $52 when supplied by mineral, depending on supplement cost. As a result, profitability may be increased by $88 to $114/steer when both technologies are used.

[1] Duffield, T. F., J. K. Merrill, and R. N. Bagg. 2012. Meta-analysis of the effects of monensin in beef cattle on feed efficiency, body weight gain, and dry matter intake. J. Anim. Sci. 90:4583-4592.

[2] Vasconcelos, J. T. and M. L. Galyean. 2007. Nutritional recommendations of feedlot consulting nutritionists: The 2007 Texas Tech University survey. J. Anim. Sci. 85:2772-2781.

[3] Beck, P., T. Hess, D. Hubbell, B. Fieser, and D. Hufstedler. 2012. Effect of Rumensin® supplied via mineral or pressed protein block with or without Component TE-G with Tylan® implants on performance of steers grazing wheat pasture. Arkansas Animal Science Department Report Research Series 606:15-17. Available: http://arkansasagnews.uark.edu/606-2.pdf.