

Ionophores

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Introduction

Ionophores are feed additives used in cattle to increase feed efficiency and rate of gain. Ionophores when used as a part of feeding management can be an excellent way not only to increase production of animals, but also be a very effective way to make cattle more valuable from a cost of input standpoint. Some examples of ionophores are: monensin (Rumenson[®]), lasalocid (Bovatec[®]), and laidlomycin (Cattlyst[®]). Ionophores are antibiotics that were originally developed as coccidiostats for poultry. (Horton et al., 1992). Ionophores are a chemical compound classified as polyether antibiotics. (Hirohiko et al, 1994) Ionophores work in a number of different ways to improve growth rate and feed efficiency. Ionophores reduce protein degradation in the rumen thus aiding in post ruminal digestion (Horton, 1992). Ionophores also increase production of the VFA propionate by modifying the microbial fermentation in the rumen (Gates et al, 1989). Methane production is reduced thus lowering energy loss (Oehme and Pickrell, 1999). Ionophores will also prevent ruminal acidosis in animals that are rapidly changed from roughage diets to high carbohydrate diets (Oehme and Pickrell, 1999).

Literature Review

How Ionophores Work

Ionophores are classified as carboxylic polyether antibiotics. These compounds improve efficiency of production in ruminants (Bergen and Bates, 1984). Ionophores improve and increase efficiency in a number of different ways. In cattle, methane can represent as much as a 12% loss of feed energy (Russell and Strobel, 1989). Ionophores can decrease this loss by as much as 30% (Russell and Strobel, 1989). Ionophores also increase the VFA propionate, and decrease the VFA acetate (Bergen and Bates, 1984).

Propionate is commonly known as the best VFA for cattle to change into glucose. Propionate has the highest ability to be utilized from feed energy for productive purposes (Russell and Strobel, 1989). One study indicated a 76% increase in propionate production, a 16% decrease in acetate production, and a 14% decrease in butyrate production (Perry et al., 1976). Ionophores decrease protein deamination in the rumen (Morris et al., 1990). This increases the effectiveness of bypass protein in cattle. Bypass protein has been demonstrated to increase from 22% to 55% in various experiments (Bergen and Bates, 1984). Bypass protein is protein that is not broken down in the rumen but instead it is digested in the ileum of the small intestines. The basic affect of ionophores is to alter the flow of cations across cell membranes (Kirk et al., 1989). This leads to a reduction in gram-positive bacteria (Oheme and Pickrell, 1999). Gram-positive bacteria are known as the cause of bloat and other digestive problems associated with high carbohydrate diets. Ionophores decrease dietary problems from high carbohydrate diets (Hutjens, 1991). Ionophores are able to improve feed conversions, and enable cattle to get more metabolizable energy from feed. 20% more metabolizable energy was available when ionophores where in the diet (Bergen and Bates, 1984). One study indicates ionophores feed in combination with fat supplementation caused increased lipid flow to the small intestines (Clary et al., 1993). This can lead to potentially better utilization of fats in the diet of ruminants. Gain has been documented to be improved up to 17% in some studies, and feed conversion improved 20% (Potter et al., 1976). Time required to make gain will also be improved. A large study done with >1000 head showed not only increases in total gain, and pounds of feed per pound of gain, but also time to gain was increased by 12.3% (Dicostanzo et al., 1997). Research has shown no

negative side effects with proper usage of ionophores. Knowing the mode of action that ionophores have to help achieve increased gains and performance is only part of the equation in beef cattle production. The other side of the equation is the cost effectiveness of the increase in performance from ionophore utilization.

Cost and Benefits

Ionophores are a cost effective and successful way to increase average daily gain in cattle. Rumenson 80 ® is \$346.00 for a fifty pound bag as priced at Producers COOP in Bryan, TX (as of April, 2003). As per label instructions, cattle on pasture should be feed at a rate of 200mg per head per day. At that rate of consumption, cost per head per day is approximately \$0.003. One research trial done with monensin yielded a 6 to 14% increase in average daily gain with a cost of \$0.012 per head per day resulting in a 12: 1 benefit to cost ratio (Hutjens, 1991). Other studies have shown similar average daily gain increases (Bohnert et al., 2000). Rumenson® is labeled for use in cattle in almost all stages of production. Feedlot cattle, pasture cattle, growing heifers, growing steers, mature bulls and cows, and calves are all able to use Rumenson® according to the feed label. A tool such as ionophores that producers are able to use at a relatively low cost for return on the investment can be an integral part of cattle performance and economics.

Usage and Implication

Ionophores where first used in feedlot cattle and many are now labeled for use in cattle on pasture. Young growing animals, heifers and steers on pasture without high levels of supplementation have often been poor in performance as far as growth and average daily gain is concerned. This performance on pasture is crucial to heifer

development, and successful stocker operations. Heifers maintained on an adequate plane of nutrition have been shown to hit puberty at an early age than did heifers that did not receive ionophore supplementation (Sprott et al., 1988). In a trial done by researchers from Intervet, Gainpro® was compared to Rumenson® and Bovatec® for replacement heifer development. This study indicated that along with the expected gain effects of ionophores, Gainpro® seemed to yield a higher first service conception rate than did Rumenson® and Bovatec®. Also Gainpro® increased dry matter intake 3% above Rumenson® and Bovatec® on the set of heifers used in this 140 day trial (Reinhardt et al., 2002). One study indicated heifers with ionophore supplementation yielded heifers reaching puberty 23 days earlier than did heifers with no ionophores, also some indication that postpartum interval might have been decreased in these heifers as well (Dicostanzo et al., 1997). Ionophores can improve heifer and steer performance on pasture or stocker type settings as well as reduce supplementation levels (Horton et al., 1992). Ionophores were first used only in young animals but researchers have found benefits from utilizing ionophores on cow herds. Ionophores have shown positive reproductive effects on fertility and milk production (Sprott et al., 1988). The extent of improvements observed due to ionophore usage is dependant upon forage quantity and quality available to the animals (Sprott et al., 1988). Similar gains have been observed in cattle on both winter and summer grasses (Boquet et al., 1989). Ionophores have been shown to improve feed efficiency in cattle feed diets lower in crude protein(10.5%) even more so than cattle fed diets with higher crude protein(12.5%) (Bohnert et al, 2000). A reduction in dry matter intake has been observed in cows during the last third of gestation when the cows were supplemented with ionophores (Sprott et al., 1988). Some studies

indicate an increase in performance of ionophores as a result of rotating different types of ionophores on a weekly basis, as apposed to all being fed continuously (Morris et al., 1990). The theory behind this is that some of the microflora is not able to adapt to the ionophores when they are rotated verse being fed continuously.

Summary

Ionophores are antibiotics that manipulate the composition of the microflora of the rumen. The physiological changes from this manipulation yield higher feed conversion with a slight reduction in feed intake. The result of this plain and simple is an increased average daily gain in the animals given ionophores. With the common understanding of no adverse effects on carcass composition and quality ionophores are an excellent tool for increasing production and profitability in cattle at almost all segments of production. When used in conjunction with other proper management practices such as an adequate plane of nutrition, ionophores seem to both directly and indirectly have positive affects on all aspects of growth, development, production, and reproductive efficiency. Economically ionophores could be used to increase profit margins at all segments of the production supply chain due to the gain affects in both young growing animals as well as finishing animals. Increases in cow herd efficiency could also have a great economic affect on cow/calf producers and their ability to turn a profit. In closing, ionophore use should be an integral part of production by today's beef cattle producer due to its potential to increase profitability.

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