Use Of Rumensin In Dairy Diets

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This fact sheet reflects the best available information on the topic as of the publication date.
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USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

Introduction

This fact sheet has been developed to support the implementation of the Natural Resources Conservation Service Feed Management 592 Practice Standard. The Feed Management 592 Practice Standard was adopted by NRCS in 2003 as another tool to assist with addressing resource concerns on livestock and poultry operations. Feed management can assist with reducing the import of nutrients to the farm and reduce the excretion of nutrients in manure.

Ionophores have been fed to beef cattle in the U.S since 1977. In 2004, monensin sodium (Rumensin®—trademark name marketed by Elanco) was approved by FDA to be fed to lactating and dry cows in the U.S. Rumensin® the trade name will be used in this fact sheet instead of chemical name monensin. Areas of interest and concern when using Rumensin® raised by dairy managers, consultants, and veterinarians will be summarized in this paper.

Effects of Rumensin®

Rumensin® is an ionophore, which can be classified as an antibiotic, that is produced naturally by the bacteria strain (*Strept cinnamonensis)* and is typically fed as the sodium salt. Rumensin® functions by creating a shift in ion transfer across the cell's membrane. In order to maintain cell ion equilibrium, the affected bacteria must use an considerable of energy to correct the ion imbalance thereby reducing bacteria growth. Gram negative bacteria (i.e. starch fermenting bacteria) are more resistant to the action of Rumensin® than the gram positive bacteria (i.e. fiber fermenting bacteria).

Rumensin® selectively inhibits gram positive bacteria thereby shifting the rumen population to produce a different volatile fatty acid profile. Rumensin® is known to inhibit the lactic acid producing strains of bacteria, such as *Streptococcus bovis,* while at same time to not inhibit the major stains of lactic acid utilizing bacteria in the rumen. In beef cattle, Rumensin® also reduced variation in feed intake by causing cattle to eat smaller and more frequent meals. Both responses could reduce the risk of sub acute rumen acidosis (SARA) in dairy cows.

Impact of Rumensin in Lactating and Dry Cow Rations

The improvement in feed efficiency shown in Table 1 reflects the shift in VFA (volatile fatty acid) production towards producing more propionic acid and reducing methane loss, improved nitrogen metabolism (less degradation of amino acids and peptides to ammonia), reduction of rumen bloat (cattle on pasture), and a decrease in lactic acidosis (shifting microbial population to reduce lactic acid accumulation). The increase in propionic acid results in higher blood glucose levels as the liver converts propionate to glucose. Deceases in ruminal production of acetic and butyric acids may also occur. Limited studies have shown that Holstein cows responded to Rumensin® more favorably than Jerseys.

In field studies using transition dairy cows, subclinical ketosis (when measured as 1200 to 2000 umol per liter of beta hydroxybutyric acid or BHBA), was reduced by 50 % in 1010 cows from 25 commercial Canadian herds using a control release capsule (CRC) which provides 330 mg of Rumensin per day. In addition, the duration of subclinical ketosis and the incidence of displaced abomasums (DA) were reduced. Serum glucose levels in cows after calving receiving the CRC were increased 15%. Another Canadian study reported a 40 % reduction in both clinical ketosis and DA's. Retained placenta were numerically lower for cows fed Rumensin.

It was reported that body condition score (BCS) had an impact on milk production response. Cows classified as thin (BCS < 3.0) at three weeks before calving had no significant milk production response in the first 90 days after calving to Rumensin while cow's classified with good BCS (3.25 to 3.75) had a significant increase in milk yield of 1.9 pounds or 0.85 kg, and heavy cows (> 4.0 BCS) increased milk by 2.6 pounds or 1.2 kg.

In a Dutch study, Rumensin reduced the rate of intra mammary infections (which was defined as above or below 250,000 somatic cells) by 13 percent (31 percent in control cows compared to 18 percent in supplemented cows). No changes were reported on the duration of intra mammary infections, lameness, cystic ovarian disease, or reproduction (days to first observed estrus and first service conception) when cows were fed Rumensin.

Changes in Milk Yield and Components

Research under pasture and confinement feeding systems has reported an average increase of 2.2 pounds (1.0 kg) of milk. Milk protein levels parallel milk volume increases while the milk protein

percentage was constant. If a milk protein test response occurs, it could reflect improved amino acids available to the mammary gland to synthesize milk protein. Milk fat yield and percentage can vary when cows are fed Rumensin. Feed characteristics, type of oil, starch content, and/or NDF levels can lead to lower milk fat tests.

- The amount of feed particles over 0.75 inch retained on the top screen on the Penn State Box can impact fat test due lower rumen pH.
  When Rumensin was supplemented to a low fiber ration, cows averaged 3.68% milk fat while cows fed Rumensin averaged 3.36%. Cows fed normal fiber diets however experienced smaller milk fat reductions compared to control cows 3.44 versus 3.60%

- High levels of rumen fermentable starch can reduce rumen pH thereby leading to lower milk fat test with Rumensin due to excessive lactic acid and VFA production, less buffering from reduced saliva production, and changes in rumen turnover and passage rates.

- Feeding unsaturated fatty acids can lead to excess formation of CLA or conjugated linoleic acids (trans-10, cis-12 C-18:2) when the rumen pH is low. Two conditions are needed for the production of trans-10, cis 12 CLA: an altered rumen fermentation and a source of polyunsaturated fatty acids. For example, feeding soy oil lowered milk fat tests in combination with Rumensin further depressed fat test. In this study, cows fed the control diet produced 3.76 % fat while cows fed control with Rumensin average 3.74%, however when soy oil was added to the control ration, fat test dropped to 3.14% fat, and the combination of soy oil and Rumensin resulted in cows producing milk with 2.43% fat. Feeding distillers grains (over 5 pounds of dry matter) has been shown to lower milk fat tests in combination with Rumensin in field observations. If dairy herds are at breed average or higher milk fat, no significant milk fat test drop occurred compared to herds that were 0.2 fat percentage point or more below breed average (for example, Holstein herds at or below 3.5% may experience lower milk fat tests).

Levels of Rumensin

The amount of Rumensin fed to lactating cows can vary from 11 to 22 gram per ton of TMR dry matter per day. Managers and nutritionists targeting the lower level of 11 grams per ton will add approximately 250 to 300 mg per cow per day for lactating cows. Following a step up program is legal for component fed herds. Allowing rumen fermentation to adjust to lower Rumensin levels can reduce the impact on milk fat tests. Because dry cows consume half of the dry matter of lactating cow, the higher level of 22 gram per ton is recommended which is approximately 250 to 275 mg/head/day. Another guideline is to add Rumensin at the rate of 0.3 milligrams per pound of body weight. For example, a 1000 pound Jersey cow would calculate to be 300 milligrams.

To calculate the amount of Rumensin fed, divide the level of Rumensin added to a ton of TMR dry matter (11 mg per ton for example) by two to get the milligrams per pound of TMR dry matter (for example, 11 mg per ton / 2 equals 5.5 mg per pound of dry matter times 50 pounds of TMR equals 275 mg per cow per day). If excessive levels of Rumensin are accidentally fed, cows will go off feed in 24 hours, develop loose manure in 36 hours, and become sick in 48 hours.

Economic of Rumensin

Adding 250 to 300 milligrams of Rumensin can cost 2 to 4 cents per cow per day. Table 1 indicates an increase of 0.7 pound of 3.5% fat corrected milk which results in an increase of 8 to 12 cents per day (5:1 benefit to cost ratio). Feed efficiency calculated as pounds of 3.5% fat correct milk per pound of dry matter increased from 1.50 to 1.56. Each increase of 0.1 feed efficiency point is worth 15 to 20 cents. Energy efficiency values in Table 1 reflect the increase in milk yield, gain in body condition, and decrease in feed intake. In a Canadian field study of 95 herds, the return over feed costs for Rumensin was 69 cents (Canadian dollar) per day including milk improvement, rumen health, and BCS impact.

Label Changes with Rumensin

In December, 2005, FDA approved the feeding of Rumensin to dairy cows in component feeding systems. This new approval allows Rumensin to be top dressed, fed in a partial TMR, such as pasture or separate hay bunk, fed in parlor grain feeding systems, and in electronic feeders. The new guidelines allow for a rate of 185 mg to 660 mg for lactating cows and 115 to 410 mg per day per dry cow. These amounts of Rumensin are to be fed using a minimum one pound feeding rate of Rumensin-containing feed to each animal per day. Broader labeling for replacement heifers was also added to cover more heifer feeding approaches (freestall barns, tie stall systems, group pens, heifers on pasture, and heifers on dry lot).

Future Applications and Consideration

Dairy managers and consultants should considering strategic addition of Rumensin to dry cow and lactating cow rations. The impact of Rumensin on lowering lactic acid levels could reduce subacute rumen acidosis diminishing the need for direct fed microbial (DFM) products. The CRC used in Canada for dry and fresh cows that dispenses 330 mg for 90 days on a 24 hour/7 day basis is impressive for transition cows. Approximately 18 percent of Canadian dairy herds use CRC. Reducing methane production and increasing feed efficiency (less dry matter per pound of milk produced) will be environmentally important.

Summary

- Rumensin is a feed additive that can be included in lactating and dry cow rations at 250 to 300 mg per day or 11 to 22 mg per ton of ration dry matter.
- The benefit to cost ratio (5:1) and feed efficiency (2 to 4 percent) responses to adding Rumensin are favorable.

- Monitoring milk fat test is critical to insure a positive economic response.
- Less ketosis, displaced abomasums, and rumen acidosis and improve transition cow health support the use of Rumensin in dry, transition, and lactating cow rations.
- Rumensin can reduce the amount of manure and methane gas thereby improving environmental status.

Table 1. Summary of effectiveness of monensin by level (nine studies).

Level of monensin (g/ton)	Control	11g/t	15g/t	22g/t
Dry matter intake (lb/day)	43.9	43.4	42.8	42.3
Milk yield (lb/day)	65.0	66.7	66.8	67.5
Milk fat (%)	3.65	3.53	3.49	3.38
Milk protein (%)	3.15	3.13	3.13	3.10
Solids corrected milk (lb)	58.2	58.6	58.0	58.0
3.5% FC milk (lb)	66.1	66.8	66.7	66.0
Feed efficiency (lb 3.5/lb DM)	1.50	1.54	1.56	1.56
Energy efficiency (%)	control	+2.0	+2.5	+4.0

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Project Information

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