A New Generation Anion Supplement for Transitioning Dry Cows

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INTRODUCTION

The transition from the dry period to lactation is the most stressful part of a dairy cow's life and the most critical period of the cow's production cycle. Physiological and hormonal changes accelerate as the cow prepares for birth. The last three weeks of the dry period are vital to setting the stage for a successful future lactation (Goff, Horst 1997).

Nutritional requirements are pivotal and essential to improve performance, health and longevity. The transition diet is critical in preventing a number of nutritional diseases. The onset of lactation requires a significant and rapid depletion of blood calcium required to produce milk. If the blood calcium is not produced as rapidly as it is reduced from bone calcium release or intestinal absorption of calcium, cows may become hypocalcemic with some developing clinical milk fever or other metabolic diseases such as retained placenta and displaced abomasum (Block, 1984).

Many years ago, researchers discovered that reducing dietary cation-anion difference (DCAD) to negative values prevents this rapid decline in blood calcium at calving, improves cow's calcium mobilization system in early lactation cows and reduces the incidence of milk fever (Ender et al., 1962, 1971; Dishington, 1975).

Research on the effect of DCAD is rather clear in indicating a diet with a negative DCAD is beneficial to the performance of transitioning dry cows 3 weeks to calving. The additions of anions to prepartal rations of dairy cows is a proven means of reducing DCAD and results in higher blood calcium at calving. (Oetzel et al., 1988).

Negative DCAD diets -10 meq to -15 meq/100g diet DM with proper management and nutrition are crucial for the transition dry period and obtaining maximum milk production in the following lactation. Nearly all milk cow forages are high in potassium and have a positive DCAD. It is unlikely to achieve a negative DCAD without the use of anionic salts or a specially formulated supplement containing anions.

Negative anions will acidify a cows system via blood and urine pH reduction required for calcium mobilization by reduction of blood buffers and hydrogen accumulation. Positively charged calcium ions need negatively charged anions to pull calcium from the bones into the blood stream. Reducing diet DCAD induces a metabolic acidosis in which calcium is resorbed from bone into the blood stream to compensate for calcium secreted in colostrum and milk (Charbonneau et al, 1997).

Dietary cation-anion difference can be used to determine the relationship between strong cations and anions and thus predict whether a diet will evoke an acidic or alkaline response when fed to a dairy cow. Urinary pH and DCAD are fairly linear and correlated to DCAD whereby urinary and blood pH can be predicted by knowing the DCAD intake of cows. The generally accepted recommendation is to achieve a urinary pH 6.2 to 6.8 for Holstein cows and 6.0 to 6.4 for Jersey cattle (Beede et al, 1992).

Anion sources to reduce DCAD include anionic salts which are not palatable and lead to decreased dry matter and feed intake. Commercial anion supplements such as those prepared by treatment of feedstuffs with anionic salts are found to be most effective with less risk to reduce feed intake than anionic salts alone. Anionic salts are hygroscopic and attract moisture leading to caking and are difficult to handle. In addition Ammonium salts pre-mixed into a concentrate mixture during warm weather may result in release of ammonia gas and feed refusal.

Minerals cannot be added to a diet in their elemental form, but can be added as salts that are combined with other minerals. Salts contain a positive and negative charged mineral. Different anion minerals have varying acidifying effect generally consistent with the impact of the combined positive charged mineral. Mineral values vary considerable. The importance of values of anionic minerals cannot be overstated. Whereby addition of more anionic salts is required to lower the DCAD causing the ration to become unpalatable and too expensive.

Chlorides are much better acidifiers than are sulfates or sulfuric acid as measured by urinary pH. Chlorides provide the highest impact on blood pH and calcium mobilization. Thus chlorides are more effective in preventing milk fever. The equation (Na+K) – (Cl+0.6S) has been proposed by Goff et. Al. 2004 which discounts sulfur by 60%. Where Chloride has 1.6x greater impact then sulfur. Optimal levels of chloride in relation to

other ions are needed to maintain acid-base balance. Sulfur will have similar impact to acidifying pH at low doses whereby the rest of sulfur addition seems to be overdose up to maximum tolerable amounts of sulfur (0.4%). Low doses of sulfate coming from calcium or magnesium sulfate appear to be equipotent to low doses of chloride sources, adding small amount of these salts is useful but must be below tolerable amounts (Oetzel et al., 1988).

Goff et al 2004 reported the relative acidifying effect of different anionic salts commonly used to prevent milk fever including magnesium sulfate, calcium sulfate, calcium chloride, ammonium chloride and hydrochloric acid. Elemental sulfur is not bioavailable and inclusion of elemental sulfur had the least impact on urine pH and was not effective to reduce DCAD or affect the cow's physiology, health or performance. All other anion sources significantly reduced urine pH from baseline levels. Urine pH of cows feed diets with HCl had lowest urine pH of 6.20, cows fed the next strongest acidifying anion ammonium chloride had next lowest urine pH of 7.05 and cows fed calcium chloride lowered pH to 7.14. Cows fed chloride salts were significantly lower than cows fed calcium sulfate and magnesium sulfate. Calcium and magnesium sulfate were not statistically different but both had acidifying effect to pH below 7.77. A combination of anionic salts specially designed for the transition cow is best.

MegAnion is a new generation anion supplement specially formulated by treatment of feedstuffs with anionic salts, uniquely processed in an organic complex for non-lactating transition cows. MegAnion was originated based on the relative acidifying activity of commonly used anionic salts to prevent milk fever as proposed by Goff et al 2004. MegAnion contains a very high level of chloride and enough sulfur to equally impact acidifying pH where chloride has been shown to impact blood pH and calcium mobilization 1.6x greater then sulfur. MegAnion contains the most potent acidifiers of chloride sources, hydrochloric acid and ammonium chloride, combined with the most potent acidifiers of sulfur sources, magnesium sulfate as shown by Goff and Horst 1998, Goff et al 2004 and Oetzel 1997.

MegAnion was designed as a nutritional tool to optimize transition cow health and performance with the economic advantages. MegAnion has a market advantage over other anion supplements in that it is specially formulated and processed with the most effective and potent acidifiers, the highest concentration of chloride available and an optimal level of sulfur to deliver the lowest DCAD available in palatable and stable organic complex. Other traditional anion supplements require more feed inclusion required to lower DCAD and can cause the ration to become unpalatable and too expensive. MegAnion is highly concentrated requiring lower feed supplementation of 1lb. per head per day for a cost effective supplement that delivers the recommended lowest blood pH from 6.0 to 6.8. MegAnion supplementation is proven to reduce urine and blood pH by increased calcium mobilization and concentration in blood. An effective, palatable and concentrated anion source, MegAnion delivers a negative DCAD and maintains DMI during transition. MegAnion maintains DMI to avoid off-feed issues, which can lead to rumen acidosis. Traditional anionic supplements often reduce dry matter intake in the dry cow and can cause health and production set-backs. MegAnion is manufactured thru wet extrusion with a drying process that causes carmelization and a maillard reaction for toasty granules with a touch of sweet cool taste. MegAnion maintains DMI pre-calving and increases DMI post calving as a result of improved blood calcium levels.

MegAnion is easy to use. MegAnion is a stable and complete mixed anionic supplement in an organic complex. It is a consistent and uniform small tan extruded prill for ease of handling and storage. MegAnion has a consistent, homogeneous chemical and nutrient blend and allows for precise blending and mixing. MegAnion is stable in vitamin and TMR mixes. MegAnion can be used in a mixed ration or as a top-dressing.

MegAnion provides additional nutrient benefits to the diet beyond negative DCAD. MegAnion offers complimentary addition of protein from an organic protein source and as a non-protein nitrogen in a unique processing system to provide better protein status at calving. MegAnion also offers complimentary magnesium supplementation. Inadequate magnesium supplementation can be detrimental and disrupt the transitioning cow's ability to maintain normal blood calcium levels. MegAnion has a very soluble and palatable source of magnesium.

DCAD Nutrition for Dairy Cattle Research Summary

(Block, 2011) reported the following information on the incidence of clinical and subclinical hypocalcemia (milk fever), the impact on milk production and cost of milk fever per case. A 2007 survey by the USDA reported nearly a 5% incident rate of clinical milk fever in US dairy farms. The average cost per case of milk fever was estimated to be $334.00 (Guard, 1996). There is an estimated 66% incident rate of subclinical milk fever in multiparous dairy cows following calving (Beede, et al., 1992). Just as clinical milk fever, subclinical low blood calcium can lead

to low dry matter intake (DMI) postpartum and other metabolic disorders. Research has shown that cows with even subclinical levels of milk fever are likely to produce several hundred pounds less milk over the course of lactation and 14% less milk in the subsequent lactation.

MegAnion encourages DMI in early lactation and focuses on proper mineral balance which is key to reduce the risk of metabolic upsets in early lactation. Supplementation of 1 lb. per head per day of MegAnion, will significantly reduce and prevent milk fever which will increase milk yield by about 14% in those cows that would have succumbed to the disease, will extend the cow's productive life (Block, 1984; Curtis et al., 1984) and will reduce the incidence of other postpartum disorders.

CONCLUSIONS

MegAnion success can be measured by evaluating urine and/or blood pH once or twice per week. Urinary and blood pH can effectively measure whether DCAD diet has been properly adjusted for required calcium mobilization to reduce the incidence of milk fever and post-calving metabolic disorders associated with hypocalcemia (low blood calcium) and to optimize the health and performance of the transition cow.

REFERENCES

Beede DK, Risco CA, Donovan GA, Wang C, Archibald LF, Sanchez WK. Nutritional management of the late pregnant dry cow with particular reference to dietary cation-anion difference and calcium supplementation, in *Proceedings*. 24th Annual Convention Am Assoc Bovine Practitioners; 1992;51.

Block E. Manipulating dietary anions and cations for prepartum cows to reduce incidence of milk fever. *J Dairy Sci* 1984;67:2939.

Charbonneau E, Pellerin D, Oetzel GR. Impact of lowering dietary cation-anion difference in non-lactating dairy cows; a meta analysis. *J Dairy Sci* 2006;89:537.

Goff JP and Horst RL. 1998. Use of Hydrochloric Acid as a Source of Anions for Prevention of Milk Fever. *J Dairy Sci* 1989;81:2874.

Goff JP, Ruiz R, and Horst RL 2004. Relative Acidifying Activity of Anionic Salts Commonly Used to Prevent Milk Fever. *J Dairy Sci* 2004;87:1245. Lecerc H, Block E. 1989. Effect of reducing dietary cation-anion balance for prepartum cows with specific reference to hypocalcaemic parturient paresis. Can J Anim Sci 1989;69:411.

Moore SJ, VandeHaar MJ, Sharma BK, Pilbeam TE, Beede DK, Bucholtz HF, Liesman JS, Horst RL, Goff JP. Effects of altering dietary cation-anion difference on calcium and energy metabolism in peripartum cows. *J Dairy Sci* 2000;83:2095

National Research Council. *Nutrient Requirements of Dairy Cattle*, 7th revised ed. National Academy of Sciences, Washington, D.C., 2001.

Oetzel GR, Olson JD, Curtis CR, Fettman MJ. Ammonium chloride and ammonium sulfate for prevention of parturient paresis in dairy cows. *J Dairy Sci* 1988;71:3302.

Oetzel GR, 1997. Use of Acidifying Diets for Prevention of Milk Fever in Dairy Cattle. Department of Medical Sciences. School of Veterinary Medicine.