Effects of Chloride Fertilization on Alfalfa Cation-Anion Content

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Introduction

Producing low potassium (K) forages has increased due to demand for such forages in the dairy business. In the month prior to calving, a fairly anionic diet is recommended in dairy cows to avoid milk fever, a term used for hypocalcemia, a deficiency in plasma calcium (Ca) at the onset of lactation in dairy cows. This bovine disease affects approximately 6 to 8% of all U.S. dairy cows annually, directly costing the dairy industry up to $200 million/year. As dairy cows enter the lactation stage prior to calving, large amounts of calcium leave the blood and enters milk faster than it can be replaced. This decreased calcium concentration in the blood lowers the pH, causing nerve disorders, muscle weakness, loss of appetite, paralysis, and subsequent death if not treated immediately. Treatment typically includes an intravenous dosage of a calcium solution, usually including a mixture of phosphorus (P), K, magnesium (Mg) and dextrose. Cationic diets, such as forages high in potassium (>2.5%) are meant for the post-calving, lactation stage because of the dairy cow's diet requirement in producing milk.

Having steadily available supply of low potassium forages is difficult because producers typically fertilize for high forage yields with animal manure and/or potassium fertilizer without regard to actual soil test levels, and often have limited land base for manure application. Through soil testing, lower potassium concentrations in forages are possible by keeping forage-producing fields at crop maintenance potassium levels while still maintaining optimum yields. Alternative methods to adjust and improve the dietary cation-anion difference (DCAD) are to remove sources of dietary Na (NaCl, sodium bicarbonate, etc.), feed supplemental sources of anions, or fertilize to create high chlorine (Cl) feedstuffs.

Materials and Methods

An alfalfa test plot was planted at Ames and Nashua with Pioneer 5454 alfalfa in the spring of 2000 and treatments were set up in a randomized complete block design with four replications in 2001. Treatments were NH^4Cl, $CaCl^2$, or $CaCl^2/NH^4Cl$ (mix) at 4 rates (0, 50, 100, and 150 lbs Cl per acre). Treatments were applied once in the spring of 2001. Four cuttings were made per plot throughout 2001 at the bud stage of maturity with a Carter Harvester® with tissue samples from harvested forage dried at 60 C, ground, and analyzed for Ca, Mg, Na, K, Cl, P, and Sulfur (S) to quantify cation-anion balance.

Results and Discussion

Adjusting dietary cation-anion difference (DCAD) can have significant effects on the calcium status of transition dairy cows (Figure 1). Chloride fertilization of alfalfa plots in the spring resulted in increased plant chloride and decreased DCAD, an effect that was maintained throughout the cutting season (Figure 2). Chloride fertilization had no effect on plant concentrations of S, P, Ca, Mg, K, and Na (Table 1). Chloride concentrations were maximized at the 100 lbs Cl/acre level (Figure 3) with no difference in the source of chloride used in this experiment on either plant chloride or DCAD (Figure 4).

To expand the research in this area, we established another study at Nashua. Four forage species (smooth bromegrass, orchard grass, reed canary grass, and alfalfa) were planted in Fall 2002. Four potassium/chloride treatments will be imposed in 2004 to study forage quality and digestibility and the reduced cation:anion balance appropriate for feeding these 4 forage species to dry dairy cows to prevent milk fever.