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# Managing Potassium (K) Content in Forages for Dry Cows

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The management of potassium (K) in forages can be critical. There is a trade-off between meeting the metabolic requirements of the alfalfa plant and those of the dairy cow. Alfalfa requires a K content of 1.7% to 2.0% to meet the requirements for growth, vigor and winter hardiness. In the close-up dry cow, the level of potassium impacts on animal health. One of those factors is the impact that it has on milk fever (MF).

The K content in first cut legume forages in Ontario averages 2.55% with a standard deviation (SD) of 0.51. The resulting range is K content at 2 SD of 1.53% to 3.57% K. The nutrient uptake requirement of alfalfa is large, K<sub>2</sub>O in the range of 50 to 60 lbs per dry ton. Soil test K, application rates of commercial fertilizer and manure, timing, soil moisture, root surface area, stand composition and weather determine K content.

In dry cows, the issue is the impact that high K diets have on incidence of MF. MF occurs when the cows start lactating after freshening. The cows can not move enough calcium from their bones or adsorb sufficient quantities from their diets to match that lost to milk.

The impact of elevated K is on blood pH. Elevated pH impairs the functioning of a parathyroid hormone responsible for mobilizing calcium from bones and soft tissue to the blood stream.

The opportunity is to understand the impact that cations and anions have on blood pH. When cations exceed anions the blood pH increases when anions exceed cations blood pH declines. This fact can be used to help control MF.

The opportunity is to limit cation uptake and perhaps increase anion intake to affect blood pH. One of the calculations that can be performed on a forage analysis or ration is the **Dietary Cation/Anion Balance (DCAB)** expressed as milliequivalents per kg. The major cations are K, Ca, Na, Mg the major anions are Cl, SO<sub>4</sub>, and P. The sum of the anions is subtracted from the sum of the cations to determine the balance. In the ruminant diet, the level of calcium is critical, there is a minimum requirement for magnesium and very little sodium is present in forages. That leaves K as the

only cation to manage effectively. Plants will take up more K than they require when it is present at levels exceeding the demand.

DCAB in the 200 to 300 range is desirable for dry cows, this usually relates to K in the forage of < 1.7%. DCAB in the 300 to 500 range usually indicates K in the 3% to 4% range. Raising the chloride level can lower the DCAB.

## Dietary Management of DCAB

Anionic salts of calcium chloride, calcium sulphate, ammonium chloride and magnesium sulphate are the typical salts used to increase anions. The problem is that these salts are unpalatable and may cause decreased feed intake making MF worse.

## Field Management of DCAB

There are several opportunities to lower forage K without sacrificing forage stand longevity.

- 1) Soil test to avoid excessive soil K levels, use fertilizer where it is needed on lower testing fields and first year stands.
- 2) Test manure and give full credit for manurial K.
- 3) Cut later, K declines with maturity, highest at bud stage lower at 50% bloom. Second cut is the ideal time, this allows for replenishment of energy in the crown and less effect on forage quality.
- 4) Sample all hay stocks for DCAB and set aside the lower testing DCAB inventory for dry cows.
- 5) Determine how much dry cow hay is needed and leave that portion for later cutting.
- 6) Use grassy stands for dry cow hay; grass has lower K than alfalfa at later maturity stages.
- 7) Use a portion of 3<sup>rd</sup> and 4<sup>th</sup> year stands with low or no fertilizer K for dry cow hay.
- 8) Use 2<sup>nd</sup> cut hays, dry summer weather lowers K uptake by reducing root extension and absorbing surface of the root.
- 9) Consider alternative feed sources such as corn silage (1.0 to 1.5 % K) and straw with DCAB at 180 (not oat straw as it can contain 2.5% K).

- 10) Use the expertise of a nutritionist, veterinarian and an agronomist as a team to meet herd health objectives.

Chloride levels in Ontario legume forages average 0.34% with a SD of 0.18 resulting in a range at 2 SD of 0.10 to 0.69%. This represents an anion milliequivalent of 28 to 194. Raising Cl levels significantly can lower the DCAB into a more favorable range. The issue of palatability is also removed.

A few research papers have been published on applying calcium chloride to soil to raise the Cl level. Although not a wide spread or recommended practice it appears to be effective. This is worthy of small scale test strips on farm with appropriate controls and forage tests to confirm and validate the effect. Likely candidates are farmers who have tried the previous 10 points and have still K > 2.5 % and may be experiencing MF at mid-lactation.

Using calcium chloride, soil applied, at rates of 150 lbs per acre (100 actual Cl) has been researched and has proven effective in increasing Cl content of forages from 0.3% to 0.7%. Applied in early spring, it had a season-long effect on Cl levels but no effect on K, Ca, Na or P levels in the forages. The original thought was to apply limestone or gypsum to increase calcium uptake in the forage and decrease K uptake. Calcium uptake is largely genetically controlled and most of Ontario soils have ample calcium. The impact of extra calcium did not improve calcium or lower K content. Applying extra limestone to the cows' diet has not been successful in raising blood pH. The room that the extra limestone occupied in the ration is better allocated to energy feeds.

The opportunity exists to manage forage K through a combination of factors using agronomy and animal nutrition. Farmers should seek the expert opinion of a Certified Crop Adviser in Ontario, an animal nutritionist and veterinarian before attempting any major changes in forage and dry cow management. The issue of milk fever and related Periparturient Disease is complex and deserves more attention than is afforded in this publication. Managing K is an important component but so is a holistic approach to herd health management.

#### REFERENCES:

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