Potassium Considerations for Nutrient Management

Nutrient Management Factsheet – No. 7 in Series

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High potassium forages are becoming increasingly of concern in intensively farmed areas of the province. Potassium is not considered to be a nutrient of environmental (water quality) concern. However, when potassium uptake in forages exceeds acceptable concentrations, there can be a significant impact on cattle health.

Primary Causes of Elevated Potassium in Forages

Soil test potassium levels become elevated when potassium is applied in manure or fertilizer over the long term at rates well above crop requirements.

The primary cause is over-application of potassium in manure. Farmers applying manure at rates targeted to meet the nitrogen requirements of a crop will generally be applying potassium in excess. In one long-term manure application study, soil potassium levels in manured treatments increased by 35% in only 3 years.

When soil potassium concentrations become elevated, forage grasses and alfalfa will take up this potassium in direct proportion to its concentration in the soil, far beyond the amount required for normal growth of the crop. This process is often referred to as 'luxury consumption.' The result is forages with potassium levels much higher than normal.

Impacts on Cattle Health from High Potassium Forages

When potassium concentrations in the diet exceed 3.5%, the potassium interferes with the uptake of calcium and magnesium in the cow's digestive tract. The cow is not able to keep these nutrients at the desired level in her body as there is so much competing potassium. This imbalance of calcium and magnesium can lead to many health problems in dairy cows including milk fever, calving problems and displaced abomasums. Dry cows are particularly sensitive to high potassium concentrations in forage.

A high potassium diet will also result in increased water consumption by affected cows, and increased urine output which puts stress on the kidneys. This in turn can have long-term implications for the health of the cow.

Challenges of Breaking the High Potassium Cycle

High soil potassium is often an indicator of farms that do not have an adequate land base for the amount of manure generated. These farms are often unable to produce enough home-grown feed and depend more on imported feeds that bring even more potassium onto the farm.

High potassium soils create a difficult to break cycle on a farm. Most of the potassium consumed by the cow in her ration is excreted in the urine and is re-captured in the manure. The manure is reapplied to the field, where forages take it up in 'luxury' levels again.

Very little potassium is lost during the storage and application of manure, and most soils have the capacity to hold large amounts of potassium. Once the soil level of potassium is elevated, the excess potassium is difficult to get rid of unless forage is sold off farm and low potassium forage is purchased and brought on farm.

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Management Practices for Reducing Potassium Concentrations

Soil

Soil testing is an important component of managing fields and crops to avoid potassium buildup. Table 1 provides general guidance to assist planners and farmers in developing a strategy for potassium management.

- If soil potassium levels are high or excessive, monitor the levels annually on the entire farm.
- If manure must be applied, calibrate application rates so that potassium application is equivalent to or less than crop requirement.
- If manure must be applied, favour fields with low soil potassium to receive higher rates of potassium.
- Stop any applications of potassium in commercial fertilizer or from off-farm manure sources.
- If soil test potassium level exceeds 320 ppm (Kelowna method; see Table 1), avoid manure application for one year and continue monitoring soil potassium levels.

Forage

- Set aside a specific field for feeding dry cows. Do not manure this field, and use no potassium fertilizer. If fertilized with nitrogen, the soil potassium level will likely decline to a safe level within a year or two.
- Dilute high potassium forages with low potassium feeds. If necessary, purchase forages from non-livestock operations where soil potassium levels should be lower.
- Develop a strategy to increase home-grown feed in the ration. Consider growing and harvesting winter cover crops or relay crops on corn land. If necessary, purchase or rent additional land.
- Harvest later if possible. Potassium levels in forage decrease with advanced maturity.

Table 1. Target indices for soil test potassium (K) for mineral soils in BC (0-15 cm sample depth). Soil test potassium extraction methods are provided in brackets.

Soil K (Kelowna)	Soil K (Mehlich 3)	Soil K (Ammonium Acetate)	Soil K (Modified Kelowna-95*)	Management Strategy
< 100 ppm	<133 ppm	<125 ppm	<131 ppm	**Low** – crop is likely to respond beneficially to additional potassium
100-250 ppm	133-333 ppm	125-312 ppm	131-329 ppm	**Optimal** – aim to maintain levels in this range
251-320 ppm	334-426 ppm	313-400 ppm	330-421 ppm	**High** – aim to reduce levels; try to avoid potassium applications (as manure or fertilizer) for one year
>320 ppm	> 426 ppm	>400 ppm	>421 ppm	**Excess** – aim to reduce levels; potassium applications can be avoided for two years

*Modified Kelowna method developed by Ashworth and Mrazek (1995)

Written by
Orlando Schmidt, PAg
Geoff Hughes-Games, PAg
Ministry of Agriculture and Lands

For more information
Local: 604.556.3001
Toll-free: 1.888.221.7141