ROLE OF CALCIUM IN CANOLA

Source: https://www.canolacouncil.org/canola-encyclopedia/crop-nutrition/crop-nutrition/#calcium-ca

Calcium is a macronutrient absorbed in relatively large amounts by canola. However, deficiencies in western Canada are rare due to ample soil reserves. Calcium is often referred to as a 'secondary' nutrient, probably due to uncommon deficiencies and non-specific roles in the plant.

Calcium performs several roles in the plant. In contrast to other macronutrients, a high proportion of Ca is found as a structural component in cell walls. Calcium's structural function is to provide stable but reversible molecular linkages. Pectins are calcium compounds in cell walls that strengthen the wall and contribute to tissue resistance against fungal and bacterial infections. Calcium also plays a fundamental role in membrane stability and maintains cell integrity. This membrane protection is important under low temperature or saturated soil stress. Calcium bound at membrane surfaces can be exchanged with other cations (such as K^+, Na^+ and H^+). Calcium exchange with sodium (Na) at membrane surfaces is a main factor in salinity stress. Also, Ca replacement with Al^{+3}(or blocking of Ca channels) is a factor in aluminum toxicity in acid soil.

Symptoms of calcium deficiency include purple, crisp leaves, interveinal chlorosis and "ribbon stems."

Cell extension requires Ca. Rapidly growing parts are, therefore, most affected by Ca deficiency. Root extension, shoot elongation and pollen growth are dependent on adequate Ca. The secretion of mucilage by root caps (that help root tips penetrate through soil) also needs Ca. Downward root growth (gravitropic response) relies on adequate Ca in the root caps. Callose formation is another example of a process involving Ca. In response to injury, cells will produce callose instead of cellulose, which helps wounds to heal and reduce infection.

Most plant Ca is present in leaf vacuoles where it likely contributes to the cation-anion balance. Calcium also stimulates a range of enzymes, but generally is not a constituent of enzymes. Calcium plays a key role in plants as a secondary messenger in turgor regulated processes such as stomata opening and closing.

Canola roots mainly absorb calcium as the Ca^{+2} cation dissolved in the soil water. Plant available Ca also exists as exchangeable Ca adsorbed on soil organic matter, silt and clay surfaces.
The amount of dissolved Ca^{+2} depends on the amount of Ca-containing minerals, the soil cation exchange capacity and soil pH.

High pH soils (>7.5) usually contain the highest Ca due to significant amounts of precipitated Ca salts (lime and gypsum).
Since Ca is absorbed out of the soil water, the dominant processes controlling the supply to roots are mass flow, diffusion and root interception. Therefore, Ca availability is dependent on adequate soil moisture.

Unusual situations that can create calcium deficiency in canola in western Canada are Solonetzic soils (sodium induced Ca deficiency), acidic soils (hydrogen / aluminum induced Ca deficiency), and waterlogged soils (restricted root uptake of Ca inducing temporary Ca deficiency).
The Ca content varies between different plant parts and ages, ranging from 0.2% to 5%. The highest Ca contents are found in old leaves. At maturity, only about 10% of plant Ca is found in the canola seed.

Symptoms of calcium deficiency include "ribbon stemming," and interveinal chlorosis https://www.realagriculture.com/2015/02/canola-school-diagnosing-calcium-deficiency/

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