Potassium Nutrition in Plants

CERTIFIED CROP ADVISER

By Greg Patterson, *CCA*

Potassium is absorbed by plants in larger amounts than any other mineral element except nitrogen. For optimal growth, potassium levels in plants should be between 2% and 3% of the dry weight. When potassium is limited, essential plant life processes, from photosynthesis to moisture regulation, are affected.

In soils, only a fraction of the potassium is available to the plant for uptake. In fact, many soils containing large amounts of total potassium will respond to additional potassium fertilizer due to its increased availability. Soil potassium exists in three forms: relatively unavailable; slowly available; and readily available.

The unavailable form is contained in unweathered or slightly weathered minerals and is not available to plants. This accounts for 90% – 98% of the total potassium in soils.

Slowly available potassium is gradually taken up or fixed depending on the soil type and equilibrium of the soil. This portion accounts for 1% – 10 % of the soil potassium.

Readily available potassium is a combination of water soluble and exchangeable potassium. In some soils reversion back to a slowly available form can occur in the process of fixation. This accounts for only a small portion of the total soil potassium at 0.1% – 2% depending on the soil type.

In soils, potassium never comes to equilibrium because of the removal by plants, leaching and the addition potassium fertilizers. A constant conversion of potassium from the unavailable forms to the readily available forms takes place, with some conversion from readily available back to slowly available with heavy applications of fertilizers in some soils. The readily available form of potassium that is measured in the laboratory is the portion that is available to plants.

Potassium is instrumental in the process of photosynthesis. A plant that has an optimum level of potassium in its cytoplasm will be more efficient in photosynthesis.

As we increase the level of potassium in the leaf, the rate of photosynthesis also increases.

Potassium is also responsible for regulating the salt concentration in cells and the cytoplasm, and, so plays a major role in the water retention and uptake of the plant. Therefore, a plant that has adequate potassium nutrition will be able to withstand longer periods of low soil moisture. A typical symptom of potassium deficiency is the wilting of plants in prolonged dry weather.

This high requirement for potassium in the leaf tissue protects the plant during other adverse weather conditions such as frost. It acts as an anti freeze to the leaf tissue and protects it from frost to a certain degree.

Another significant function of potassium is in the construction of the cuticle layer. This cuticle layer is the plant's first line of defense to disease and insect attack. Plants receiving adequate potassium nutrition have a stronger enzyme activity and are capable of withstanding more fungal attack. Increasing potassium will reduce the amount of disease both in the root and in the above ground parts of the plant. The most significant impact that we see is that the plant has an increased defense against sucking insects. When potassium levels are adequate and the sap pH is in the 7 – 8 range, sucking insects are not attracted to the sap.

High produce quality is essential for profitable production. Quality can be measured in many ways. High on the list for consumer acceptance is produce of uniform size, colour, and maturity, with enhanced flavour, free of blemishes or unusual markings, and devoid of any sign of disease. Potassium plays a significant role in all of these characteristics.

In summary, potassium does not work alone; rather, it functions with other essential nutrients and crop management inputs to produce the final product. The importance of balanced nutrition and efficient use of all plant nutrients must be recognized. The special role of potassium in crop quality is of particular importance for overall production.

POTASSIUM PLAYS A ROLE IN:	AFFECTING:
Photosynthesis	• coloration of leafy vegetables (healthy green colour) • uniformity of ripening • growth rate
Syntheses of amino acids and proteins	• food quality
Carbohydrate synthesis and translocation	• bud development • sugar content • enhanced flavour
Lignin and cellulose development	• firm stems and stalks • resistance to bruising and physical breakdown • longer shelf life
Disease and insect resistance	• thicker epidermal layer • fewer blemishes • higher market grade • less culls and waste • better insect tolerance • better frost protection
Root growth	• more effective utilization of soil moisture • improved nutrient uptake • greater vigor

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