Potassium Nutrition of Sugar Beets

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Sugar beet (Beta vulgaris L.), a member of the family Chenopodiaceae, is a biennial plant that normally flowers in the second year. The first year’s growth is utilized when sugar beets are grown as a food crop. Sucrose produced in leaves accumulates in a storage root and adjacent epicotyl and hypocotyl tissues during this vegetative stage. The sugar-containing storage organ is harvested, transported to a factory, and processed for sucrose recovery.

The crown is the part of the beet to which petioles are attached and has traditionally been partly or fully removed during harvesting. Although the crown contains relatively high concentrations of impurities, including K+ and Na+, which detrimentally affect factory efficiency, the modern trend, to maximize sucrose recovery, is to remove leaves completely with little loss of hypocotyl tissue (Billington & Butler, 1982; Cole, 1980). The term tops usually refers to petioles and blades and any part of the hypocotyl or epicotyl region removed during harvesting (Hartmann, 1977). Tops are either left in the field as a green manure crop, consumed in the field by cattle or sheep, or removed for feeding to animals in a confined area. The rate of depletion of soil K and Na reserves is intensified appreciably if tops are taken from fields.

The sugar beet crop is different from most other crops discussed in this text in that field requirements of K fertilizer at certain levels of deficiency can be nearly replaced by Na; use of NaCl may be more economical than K salts under certain British and European conditions (Tinker, 1965; Werner, 1977). Recent British work (Draycott & Durrant, 1976; Draycott, 1983) has indicated that both K and Na salts are usually required on soils containing low soil levels of NH4-extractable K+.

Potassium deficiency has been reported to affect sugar beet production on some organic soils in Michigan (Shepherd et al., 1959) and California (Brown et al., 1968) and on some mineral soils in Minnesota (Moraghan & Cole, 1978) and Washington (James, 1972). However, K deficiency affects production to a greater extent in Europe than in North America. In contrast to the situation in the USA and Canada, where sugar beets are usually grown in arid regions under irrigation, on soils with medium to high levels of available K+ or Na+, or both, sugar beets in Europe are often grown in humid climates on soils low in K+, Na+, or both. Continual cropping without K fertilization in humid areas, particularly, on coarse-textured soils, increases the likelihood of K deficiency. Sugar beets grown in rotations with wheat (Triticum aestivum L.) or barley (Hordeum vulgare L.) gradually responded to K fertilizer in a long-term (22-yr) experiment in France, whereas wheat and barley did not (Lefevre & Hiroux, 1976).