Northcentral Region
Observations

Recognizing Potassium Deficiencies

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Occurrence

Potassium (K) deficiencies have been occurring more frequently in the Northcentral region. Visual deficiency symptoms have been observed in western Iowa, eastern South Dakota, and eastern Nebraska. Several conditions can cause K deficiency. In the Northcentral region, many producers have not paid close attention to their K soil fertility. The drier climate has historically kept potassium in good supply. However, without replacement of the K removed by harvested plant portions, soil supplies of K have become depleted in some areas.

The occurrence of deficiency symptoms can vary widely. For instance, in South Dakota, soils formed from glacial till may test lower in K and exhibit deficiencies on only side slopes or eroded areas. Non-eroded areas usually have considerably higher, adequate available K. On coarse-textured soils, such as those formed in glacial outwash areas, whole fields may be affected.

Other factors may also be responsible for the potassium deficiencies observed. Compacted soil conditions restrict root growth and hinder a plant's ability to take up nutrients and water. Certain tillage systems may also make potassium positionally unavailable during part of the growing season. No-till and ridge-till systems may require sub-surface banding of potassium to make it available to the plant, especially under drier conditions.

Visual Symptoms

In the initial stages of visual expression of K deficiency, yellow mottled areas may occur on the edges of the leaves. As the expression progresses, the yellow areas coalesce to form a yellow border on the leaf (chlorosis). Chlorosis is followed by cell death (necrosis), and the leaf edges turn brown. The dead tissue may fall away, leaving a jagged border around the affected leaf.


Soybean leaf gallery


Corn leaf gallery

Potassium is taken up by the plant as the positively charged ion (cation) K+. Potassium is mobile in the plant, so as new (meristematic) tissue is developed, K+ is translocated from the older tissue (lower leaves) to newer tissue (upper leaves). Consequently, chlorosis and necrosis are usually first observed on the lower tissue. However, when the growth rate of plants is depressed, plants take up less K+ and their ability to translocate K+ to the shoots is especially impaired (Mengel and Kirkby, 1978). This may partly explain why in some situations, chlorosis and necrosis have been observed only on the upper part of soybean plants. In some cases, marginal chlorosis and necrosis can occur on younger as well as older leaves. From field observations, the degree to which plants are stressed by potassium deficiency appears to vary with hybrid or variety.

Soybean plant gallery

Gallery of soybean rows

Corn plant gallery

Prognosis

Any plant that is deficient in nutrients is expected to be lower yielding and have lower quality products. Additionally, plants deficient in K may have weakened stems, making them more susceptible to lodging. They can also be less drought tolerant. In corn, stunted growth can result in ears lower to the ground. In severe cases, ears may be so low to the ground that they cannot be easily harvested, resulting in large losses. Besides reducing corn yield, ears remaining in the field can lead to significant volunteer corn in the following crop. Soil testing and an agronomically sound nutrient application are required to rectify deficiencies.

Pictures of volunteer corn from harvest losses due to potassium deficiency

Selected References

Mengel, K. and E.A. Kirkby. 1978. Principles of plant nutrition. International Potash Institute, Berne, Switzerland.

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Sinclair, J.B. 1993. Soybeans. p. 99-103. *In* W.F. Bennet (ed.) Nutrient Deficiencies & Toxicities in Crop Plants. APS Press, The American Phytopathological Society, St. Paul, MN.

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