



Agronomic Spotlight

Foliar Symptoms of Corn Nutrient Deficiencies

- Foliar nutrient deficiency symptoms can be the result of agronomic and environmental factors.
- Root injury from various reasons can cause foliar nutrient symptoms to develop.
- Soil and tissue analysis can help determine the cause of foliar nutrient deficiency symptoms.

Deficiency Symptoms

Agronomic and environmental factors can cause nutrient deficiency symptoms to appear on corn leaves. Depending on the cause of the symptom, the symptoms may be temporary or last throughout the growing season. Determining the symptom cause is important as it may not be caused by an actual nutrient deficiency. Nutrient deficiency symptoms have been caused by:

- Soil pH that is too high or too low.
- Reduction in plant metabolism and photosynthesis from environmental conditions such as cool nighttime temperatures, cloudy weather, and saturated soils.
- Plants growing rapidly when warm temperatures follow slow growth during cool weather.
- Slow release of nutrients from residue caused by a reduction in microbial activity from cool, saturated soils.
- Restricted nutrient uptake resulting from compacted soils.
- Soils that are low in organic matter, are acidic, or have a high pH may be deficient in sulfur (S), magnesium (Mg), and zinc (Zn), respectively.
- Insects, disease, fertilizer burn, or chemicals can injure roots and result in reduced nutrient uptake.
- Uptake of an herbicide from a previous crop.

Deficiency Symptoms for Common Nutrients

- **Nitrogen (N):** Oldest corn leaves turn pale or yellowish-green and develop a "V" shaped discoloration starting at the tip of the leaf (Figure 1).¹
- **Phosphorus (P):** Leaves of young plants may appear purplish (Figure 2).
- **Potassium (K):** Leaf margins become yellow and brown (Figure 3).
- **Sulfur:** Youngest leaves become yellow because S is not easily translocated within the plant.
- **Zinc:** Interveneal chlorosis on the upper leaves with veins, midrib, and leaf margins remaining green. Bands or stripes develop on either side of the midrib and leaves may turn nearly white if the deficiency intensifies. Stunted plants may be apparent because of shortened internodes.
- **Magnesium:** Plants initially become pale because of a shortage of chlorophyll. Severe deficiencies result in leaves developing full-length striping with green veins and yellow tissue between the veins. Lower leaves show striping first.

Contributing Factors

Anaerobic (without oxygen) conditions can develop when soils become saturated which can limit the ability of roots to effectively absorb nutrients. Cold soils can enhance this condition. When these combined conditions exist, N and P deficiency symptoms are common. Compaction caused by equipment can last for several seasons and result in the root mass being somewhat flattened and unable to reach non-mobile nutrients. Anhydrous knives can smear and compact the sidewalls when soils are too wet and result in the inability of roots to penetrate through the sidewalls to find available nutrients. Roots growing under this situation typically fail to spread out and become vertically flat in appearance (Figure 4).

It is important to determine the cause of the foliar symptoms. Injury to the roots from insects, fertilizer, or chemicals can restrict root growth and their ability to absorb nutrients. Leaf purpling, which is symptomatic of P deficiency, is common when roots are restricted. Additionally, leaves can show symptoms that are similar to nutrient deficiencies but are caused by carryover from foliar applied herbicides, or could be a result of insecticide and herbicide interactions. A late application or dry soil conditions after an application of a fomesafen-based soybean herbicide the previous season can cause corn leaf streaking similar to a Zn deficiency except that the midveins are yellowish to white and the interveneal tissue is green (Figure 5).² If appropriate label directions are followed for the herbicide the previous



Figure 1. Nitrogen deficiency.



Figure 2. Phosphorus deficiency.



Figure 3. Potassium deficiency.

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year, the likelihood of carryover is reduced. Be aware that dry environmental conditions can increase the likelihood of injury from carryover.



Figure 4. Vertical roots from sidewall compaction.



Figure 5. Symptoms of fomesafen herbicide carryover.

Testing for Nutrient Deficiencies

Soil and crop tissue testing can help determine if a deficiency exists and if it is due to soil availability or restricted plant uptake and metabolism. Tissue samples taken during the growing season can provide the nutrient levels within the plant at the time of sampling.³ Tissue analysis procedures vary by lab, but generally, the corn ear leaf at silking should be sampled for S, Mg, and Zn levels.⁴ An early-season tissue analysis can be done after the seedling stage, but prior to tasselling. When plants with a suspected nutrient deficiency are sampled, it is recommended a sample of unaffected plants at a similar stage also be collected. Early-season testing results can be used to determine if a supplemental fertilizer should be applied. A tissue test, in combination with a soil test, may provide answers as to why plant nutrient levels are high or low. Alone, soil test results can be the most useful for predicting nutrient needs for the following growing season, but may not give reliable results for S levels. Corn responds best

with soil pH levels range between 5.6 to 7.5. A pH goal for continuous corn or a corn-soybean rotation should be about 6.0 on acid soils. If alfalfa or clover are in the rotation, the pH goal should be 6.5 to 7.0. Appropriate amounts of lime can increase soil pH and help increase the availability of plant nutrients.

Summary

Nutrient deficiencies are often outgrown when soils become warmer and drier because root growth, microbial activity, and the breakdown of organic material to release nutrients is enhanced. Unrestricted root growth can allow roots to reach water-soluble nutrients such as S and N that may have moved deeper into the soil profile with wet conditions. Corn between the V3 to V5 growth stages transitions from depending on the seed for energy to acquiring energy from photosynthesis. The cosmetic appearance of plants during these stages is often variable and can be due to an environmental effect. A wait-and-see approach can be taken during the vegetative stages, and a tissue analysis may be conducted at silking stage if symptoms persist into the season. Correcting the problem for the current season may not be feasible, but soil preparation for next season can include fertilizer applications based on soil test recommendations and compaction alleviation or prevention.

Sources

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 - ⁴Thom, W.O., Brown, J.R., and Plank, C.O. 2000. Sampling for corn plant tissue analysis. NCH-15. National Corn Handbook. Iowa State University Extension.
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For additional agronomic information, please contact your local seed representative. **Individual results may vary**, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

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