Symptoms Associated with Potassium Deficiency in Corn

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Most agronomic textbooks describe the visual symptoms of K deficiency as chlorosis (yellowing of plant tissue due to a reduction in the chlorophyll formation process) or necrosis (death of plant tissue) on margins of lower, older leaves. In practice, such classic symptoms may not always be seen when there is a shortage of K.

For those scouting fields, it may prove useful to have photographs of visual K deficiency symptoms associated with end-of-season grain yields and tissue concentrations. This article presents pictures of K-deficient corn plants taken from research plots in eastern South Dakota during the 2000 growing season. Descriptions are provided, along with other management information whenever possible.

This article provides examples of visual symptoms of potassium (K) deficiency in corn.

In the following examples, average yields are shown (where available) for the treatments associated with the pictures. For comparison purposes, average yields and ear leaf K concentrations for the highest statistically significant treatment are shown in brackets [ ].

For digital images of these pictures, visit the PPI Northcentral Region website at http://www.ppi-ppic/northcentral and go to "Galleries."

Example 1. Visible K deficiency symptoms usually occur first on the lower, older tissue of the corn plant. At this South Dakota State University (SDSU) research location near White, SD, the K-deficient lower leaves show marginal chlorosis and necrosis. The lowest leaf has more necrotic leaf area than does the leaf above it (site 29300C, plot number 102).
Planting date: 5-22-2000
Planted population, seeds/A: 24,500
Hybrid: Pioneer 37R71
Growth stage when photo taken: R2-R3
Soil test K level, parts per million (ppm): 114
Rate of K applied, lb K_2O/A: 60
K placement: Broadcast and incorporated
K form: 0-0-60
Leaf K concentration, % – ear leaf: 1.04 [1.04]
Grain yield, bu/A: 119 [119]
Grain yield reduction, bu/A: 0

Example 2. At the same location as **Example 1**, K fertilizer (0-0-60) was broadcast at incremental rates and then incorporated. The leaf in this picture is from a check plot where no K was applied. This K-deficient leaf shows marginal chlorosis and necrosis, worse at the leaf tip, and becoming progressively less intense down the margin of the leaf (site 29300C, plot number 104).
Planting date: 5-22-2000
Planted population, seeds/A: 24,500
Hybrid: Pioneer 37R71
Growth stage when photo taken: R2-R3
Soil test K level, ppm: 114
Rate of K applied, lb K_2O/A: 0
Leaf K concentration, % – ear leaf: 0.78 [1.04]
Grain yield, bu/A: 100 [119]
Grain yield reduction, bu/A: 19

Example 3. At this SDSU research location, 40 lb K_2O/A was applied to the corn on the right, and no K was applied to the corn on the left. Potassium fertilizer was 0-0-30 (a liquid mixture of potassium hydroxide and potassium carbonate), applied 2 in. to the side and 2 in. below the seed. All corn is the same hybrid. Plot length is 50 ft. Many ears in the fertilized plot are higher from the ground than in the unfertilized plot. When ears grow too low to the ground, they become difficult to harvest and losses can occur. Such differences are influenced not only by K fertility, but also by hybrid. Some hybrids in this trial did not show such marked differences (site 29900, plot number 327 left and 328 right).
Planting date: 5-22-2000
Planted population, seeds/A: 24,500
Hybrid: Garst 8830
Growth stage when photo taken: R6
Soil test K level, ppm: 114
Rate of K applied, lb K_2O/A: 0 (left); 40 (right)
K placement: 2x2 starter (right)
K form: liquid mixture (0-0-30)
Leaf K concentration, % – ear leaf: 0.87 (left); 1.11 (right)
Grain yield, bu/A: 69, (left); 83 (right)
Grain yield reduction, bu/A: 14

Example 4. In this farmer field, corn the previous year was K deficient and ears were low to the ground. The combine missed many of the ears, resulting in harvest losses. Grain left in the field created a significant volunteer corn problem in the subsequent soybean crop. This illustrates the impacts of K deficiency on management areas other than soil fertility and plant nutrition (area to left of site 29100R).
Growth stage when photo taken: R2
Soil test K level, ppm: 126
Soybean yield, bu/A: 21 (field average)

Example 5. The leaf in the top of the picture is from a check plot where no K was applied. The lower leaf is from a plot where K was considered non-limiting. Both leaves are from the same hybrid and are from adjacent plots. Plot widths are 25 ft. The K-deficient leaf shows marginal chlorosis and necrosis. It is also more affected by disease. Potassium deficiency has long been associated with increased susceptibility to certain diseases (site 29300C, plot number 104).
Planting date: 5-22-2000
Planted population, seeds/A: 24,500
Hybrid: Pioneer 37R71
Growth stage when photo taken: R2-R3
Soil test K level, ppm: 114
Rate of K applied, lb K_2O/A: 240 (healthy leaf); 0 (deficient leaf)
K placement: Broadcast, incorporated (healthy leaf)
K form: 0-0-60 (healthy leaf)
Leaf K concentration, % – ear leaf: 1.28 (healthy leaf); 0.78 (deficient leaf)
Grain yield, bu/A: 115 (healthy leaf); 100 (deficient)
Grain yield reduction, bu/A: 15 (deficient leaf)

Example 6. Marginal chlorosis may be accompanied by other symptoms, such as this red striping exhibited by some hybrids (site 29199).
Planting date: 5-17-99
Planted population, seeds/A: 29,991
Hybrid: Pioneer 37R71
Soil test K level, ppm: 133
Grain yield, bu/A: 45 [50]
Grain yield reduction, bu/A: 5

Example 7. Marginal chlorosis may not always be present during K deficiency. The leaf on the right has an overall lighter green appearance, difficult to detect unless healthy plants are nearby.

Example 8. As a rescue treatment, 100 lb K_2O/A was broadcast and then hoed in by hand at growth stage V6 to simulate shallow tillage. The ears in the top row are from the rescue treatment, and the ears below are from the check plot (site 30300).
Planting date: Week of May 8
Harvested population, plants/A: 22,391
Hybrid: DeKalb 477
Soil test K level, ppm: 73
Rate of K applied, lb K_2O/A: 0 (no rescue K applied); 100 (rescue K applied)
K placement: broadcast/hoed (rescue K applied)
K form: 0-0-60 (rescue K applied)
Leaf K concentration, % – ear leaf: 0.51 (no rescue K applied); 0.72 (rescue K applied)
Grain yield, bu/A: 86 (no rescue K applied); 117 (rescue K applied)
Grain yield reduction, bu/A: 31

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*Starter Fertilizer Application Effects...**(continued from page 11)*

did not yield as well as starters that contained both N and P. For example, in the 2x2 starter placement, 30 lb N/A alone increased average yield by 18 bu/A, 30 lb P_2O_5/A by 11 bu/A, while a combination of 30 lb N and 30 lb P_2O_5/A increased yield by 34 bu/A. The yield increase from the N and P combination exceeds the additive effect of each individual nutrient, thus illustrating the importance of nutrient interaction and balanced starter fertility in optimizing grain yield.

The higher N starters were the most efficient in reducing the number of days from emergence to mid-bloom (**Table 3**). When averaged over starter treatment and years, there was no difference between 2x2 applied starter and surface dribbled starter in early season dry matter and days from emergence to mid-bloom. When averaged over tillage treatment and method of application, starter fertilizer containing 30 lb N and 30 lb P_2O_5/A decreased the number of days from emergence to mid-bloom by over 11 days compared to the no-starter check treatment. All starter fertilizer treatments increased V6-stage whole plant dry matter over the no starter check. The starters containing either 30 or 45 lb N/A with 30 lb P_2O_5/A resulted in the greatest V-6 whole plant dry matter accumulation. Grain moisture at harvest was lower in the higher N starters that also included P.

Grain moisture in the 30-30 starter treatment was lower at all sample dates compared to the no-starter check, the P alone treatment or the treatment that included only 15 lb N. Starter containing both N and P had a substantial impact on hastening grain sorghum maturity. BC

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