Sidedressed Liquid Potassium Can Partially Offset Deficient Preplant Fertilization for Corn

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Abstract
Iowa State University (ISU) research has evaluated corn and soybean response to preplant potassium (K) fertilizer placement methods and starter since the middle 1990s. These results have been used for developing guidelines in Extension publication PM 1688. In recent years, excessive fall and spring rainfall sometimes has precluded the normal K preplant fertilization. Therefore, growers and crop consultants have been asking if sidedressed liquid K fertilizer could alleviate deficiency or be a good complement to preplant K fertilization, as is commonly the case for nitrogen. A crop response to P sidedressing is unlikely, and preplant or starter fertilization is preferred, because sufficient P needs to be available very early for seedlings shoot and root growth and early cell multiplication to attain the hybrid and soil yield potential. This is not so much the case for K, however, which explains why very often there is corn response to starter P but only occasionally for K when soil-test K is very deficient.

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To study in-season K application, twelve 2-year field trials were conducted with corn to evaluate how sidedressed injected liquid K fertilizer interacts with pre-plant broadcast K fertilization and soil test K levels at affecting grain yield and tissue K test levels. Six trials were established in 2017 and six in 2018. The trials were at central, northeast, northern, southeast, southern (McNay), and southwest (Armstrong) ISU research and demonstration farms. Initial soil-test K across the trials ranged from the Very Low to the Optimum interpretation categories in the ISU Extension publication PM 1688 “A General Guide to Crop Nutrient and Limestone Recommendations in Iowa”.

Treatments were four broadcast preplant rates of 0, 45, 90, and 135 lb K₂O/acre using granulated potash fertilizer (0-0-62) and two K sidedress rates using potassium-acetate liquid fertilizer (0-0-24). All treatments were replicated four times. The preplant
treatments were broadcast in the spring two to three weeks before planting to soil with soybean residue that had no fall tillage. With the exception of one trial managed with no-tillage, all other plots were field cultivated before planting corn. After corn emergence all plots were subdivided into two subplots to apply either 0 or 45 lb K₂O/acre, which was injected to the center of every inter-row to a depth of 3 to 4 inches at the V₅ to V₆ growth stage. Corn leaf tissue K concentration was analyzed in ear-leaf blades sampled at the R₁ (silking) growth stage.

Results shown in Figure 1 are averages across nine trials that showed a statistically significant responses of leaf K concentration and grain yield. Two trials were affected by severe drought and corn at another trial was severely affected by strong wind and green snap. The graphs summarize the responses to applied K, although the magnitude of the responses varied across trials as affected by the initial soil-test K level and weather.

The yield and leaf K concentration increases from the broadcast preplant K application were within expectations given initial soil-test K levels and the rates applied. The largest yield increases were in soils testing Very Low, for which 130 lb K₂O/acre is recommended, and the smallest in soils testing Optimum, for which only a removal-based rate is recommended (see publication PM 1688). Sidedressed K fertilization increased average grain yield and ear-leaf K concentration further with all preplant K rates at all sites, but the apparent small increases for the 135-lb K₂O/acre preplant rate were not statistically significant.

Figure 1. Corn grain yield and ear-leaf K concentration responses to broadcast preplant K fertilization and liquid K fertilizer sidedressed at the V₅-V₆ growth stage. Vertical red (preplant) or blue (sidedress) lines indicate the
increases by applying a similar 45-lb rate sidedressed or preplant.

The results in Figure 1 show that a broadcast preplant rate of 45 lb K₂O/acre increased both grain yield and leaf K concentration much more than a similar sidedressed K rate. This was observed in most trials, even those testing Optimum. Therefore, sidedressed fluid K for corn at the rate used may be an option when recommended preplant K rates based on soil testing cannot be applied before planting (fall or spring). Results do not support, however, purposely withholding or reducing preplant K rates to be complemented by K sidedressing.

Category: Crop Production  Soil Fertility

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Crop: Corn

Tags: potassium application  potassium fertilization  preplant fertilization  Corn

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Dr. Antonio Mallarino is a professor of agronomy and nutrient management research and an extension specialist at Iowa State University. His programs focus on agronomic and environmental issues of nutrient management with emphasis on phosphorus, potassium, lime, and micronutrients. Issues addresse...