Effect of Sidedressed Liquid Potassium Fertilizer for Corn in Northern Iowa

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Introduction

Extensive Iowa research has investigated the corn yield response to different pre-plant potassium (K) placement methods or to starter K. The placement methods for the primary K application used granulated potash fertilizer broadcasted and deep-banded in the fall or early spring or banded with planters equipped with attachments for application 2 in. beside and below the seeds (2 in. by 2 in. method). Starter research has evaluated granulated liquid K fertilizers applied to the seed furrow or with the 2 in. by 2 in. method. Post-planting sidedress application of nitrogen for corn is a common practice in the north-central region, and its effectiveness under some conditions has been demonstrated by Iowa research. However, no Iowa State University (ISU) study has evaluated the value of sidedress K application. Because of lower grain prices and more uncertain soil-testing results for K compared with phosphorus or pH, growers are asking if K sidedress could be of value to increase yield and perhaps reduce the overall K application rate. Therefore, the objectives of a study conducted at this research and demonstration farm was to evaluate how sidedressed liquid K fertilizer affects corn yield and K tissue concentrations when different rates of granulated fertilizer are applied before planting corn.

Materials and Methods

The study consisted of two similar field trials with corn conducted in 2017 and 2018. Both trials were on areas with Nicollet and Webster soils and soybean was the previous crop. There were 10 treatments replicated four times at each trial. Eight treatments consisted of four K rates (granulated potash 0-0-62 fertilizer at 0, 45, 90, and 135 lb K_2O/acre) broadcast in the spring before disking each without or with sidedressed liquid K fertilizer (potassium acetate 0-0-24 at 45 lb K_2O/acre). The liquid K fertilizer was injected at the center of each inter-row at the V6 growth stage to a depth of 4 to 5 in. The two other treatments involved only sidedress K (with/without) for plots testing high in K due to a history of high K application rates.

Initial soil-test K (6-in. depth, ammonium-acetate test on dried samples) of plots that received the broadcast treatments and of high-testing plots that received no broadcast K, averaged 154 and 250 ppm for the 2017 trial and 155 and 220 ppm for the 2018 trial, respectively. According to interpretations in ISU Extension publication PM 1688, soil-test K levels of 121 to 160, 161 to 200, 201 to 240, and higher than 240 ppm are classified as low, optimum, high, and very high, respectively. Corn Pioneer 0157AMX was planted using a 30-in. spacing in both trials. The blades of corn ear leaves were sampled at the silking stage (R1) and were analyzed for total K concentration. Grain yield was adjusted to a 15 percent moisture content.

Results and Discussion

Figure 1 shows that broadcast preplant K application greatly increased the corn ear-leaf K concentration of both trials. A large ear-leaf K response to preplant K application is commonly observed, because the K uptake and accumulation in vegetative tissues increase even if K fertilization does not

increase yield. The leaf K response to the liquid sidedressed K fertilizer was small and approximately similar for both trials. The leaf K increases were statistically significant only for broadcast rates of 0, 45, and 90 lb K_2O/acre. The figure shows the broadcast preplant 45-lb rate increased leaf K much more than a similar sidedressed rate in both trials.

Figure 2 shows there was a large corn grain yield response to the K treatments but the increases were greater in 2018. The initial soil-test K of plots that evaluated broadcast preplant applications was low in both years. In 2017, the broadcast preplant 45-lb rate resulted in the greatest yield increase. There was a small statistically significant additional increase from the 90-lb rate, and a small but not statistically significant additional increase for the 135-lb rate. In 2018, yield increases from the preplant K applications were much greater. The greatest increase was for the 45-lb rate, and there was an additional smaller increase only for the 90-lb rate. As the ISU Extension publication PM 1688 indicates, previous research at numerous trials showed a 68 percent for the low soil-test K category, for which 90 lb K_2O/acre is recommended for corn. The yield for the high-testing plots of both trials was similar to the yield attained with the 90-lb and 135-lb broadcast preplant rates applied to the low-testing plots. This is consistent with extensive previous research showing only a 5 percent probability of a small response for the high soil-test K category.

The corn yield response to sidedressed liquid K fertilizer at both trials was the greatest (and statistically significant) when no broadcast preplant K was applied, and decreased as the preplant K rate increased. In 2017, small additional responses to sidedressed liquid K when the higher broadcast preplant rates were applied were not statistically significant. In 2018, there was a moderate additional yield increase to sidedressed liquid K when the 45-lb preplant rate was applied, but there were no additional increases for the two higher rates.

Figure 2 also shows a broadcast preplant application of 45-lb increased yield more than the similar sidedressed K rate when no preplant K was applied. In 2017, the 45-lb preplant rate increased yield by 40 bushels/acre whereas the similar sidedressed rate increased yield by 19 bushels/acre. In 2018, the 45-lb preplant rate increased yield by 67 bushels/acre whereas the similar sidedressed rate increased yield by 33 bushels/acre. We are studying rainfall patterns for both years because these can affect the effectiveness of K fertilization.

Conclusions

The corn yield increases from broadcast preplant K application using granulated potash fertilizer in two trials having low-testing soils showed the expected moderate-to-large responses. Liquid K fertilizer sidedressed by injection into the soil at the V6 growth stage resulted in additional yield increases only when no broadcast preplant K or a too low and deficient rate was applied. Furthermore, a rate of 45-lb K_2O/acre preplant resulted in much higher yield increases (40 to 67 bu/ac) than a similar sidedressed rate (19 to 33 bu/ac). Therefore, the results showed sidedressed K fertilizer is a beneficial practice only in low-testing soils that for some reason did not receive preplant K fertilization or received a too low deficient rate. Producers are encouraged to use preplant K fertilization because the results showed a much lower efficiency of the sidedressed K fertilizer.

Acknowledgements

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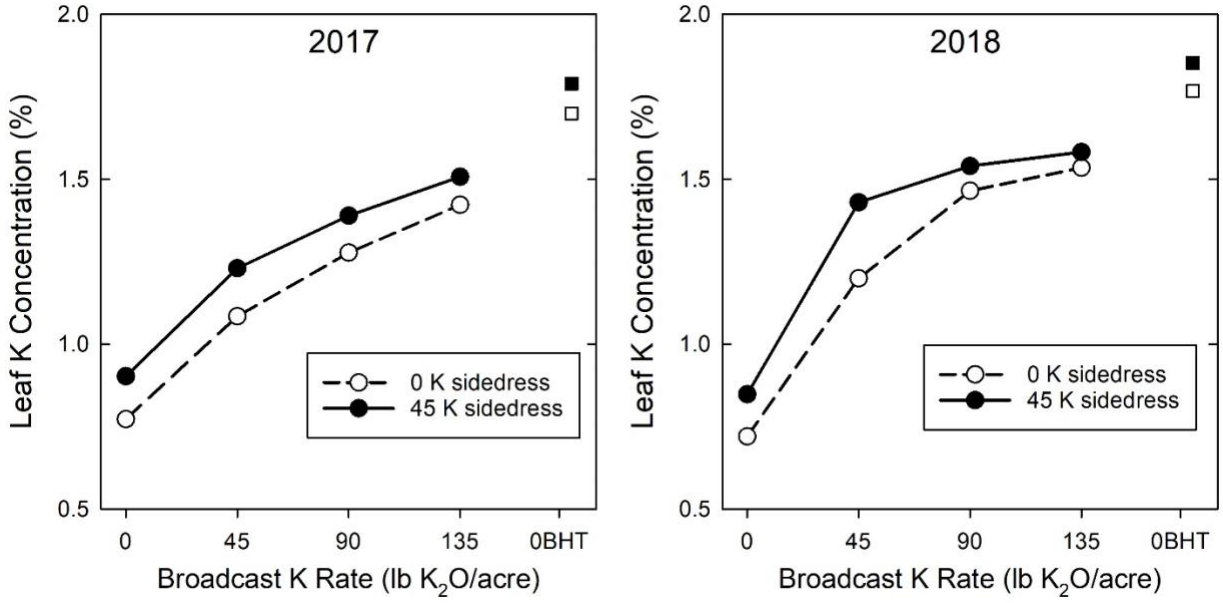

Figure 1. Corn ear-leaf K concentration response to preplant broadcast granulated K fertilizer with or without sidedressed liquid K fertilizer injected at the V6 growth stage in two trials, and response to only sidedressed K in plots of each trial testing higher in K (0BHT) due to a history of large K application rates.

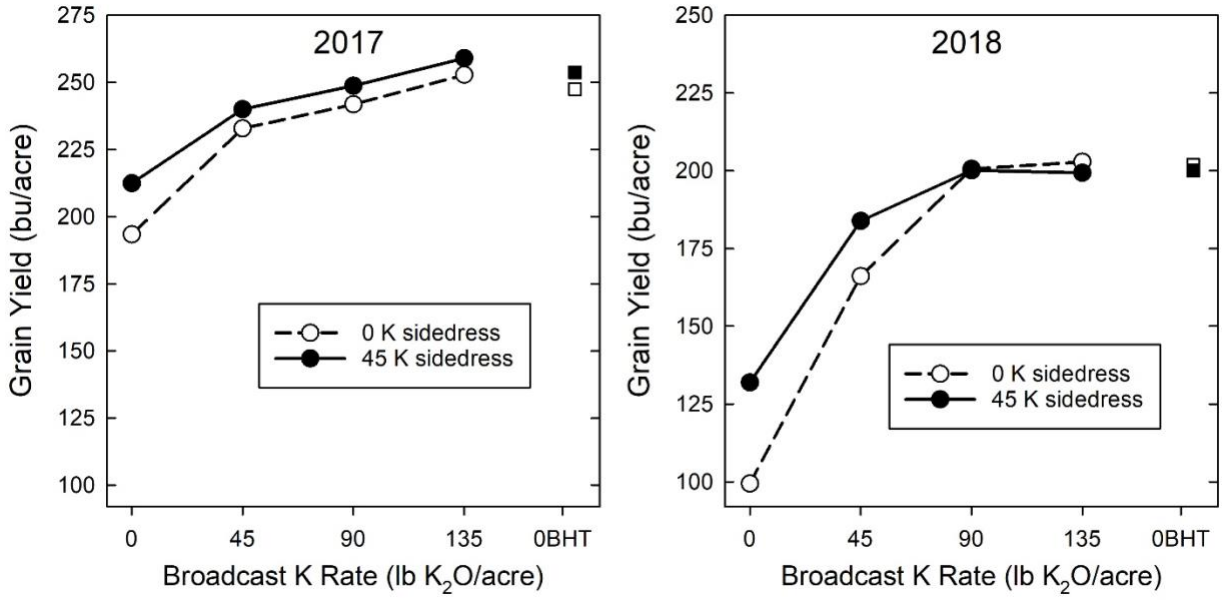

Figure 2. Corn grain yield response to preplant broadcast granulated K fertilizer with or without sidedressed liquid K fertilizer injected at the V6 growth stage in two trials, and response to only sidedressed K in plots of each trial testing higher in K (0BHT) due to a history of large K application rates.