Corn Response to Sidedressed Liquid Potassium Fertilizer in Northeast Iowa

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Introduction

Many field trials in Iowa have assessed the corn response to different pre-plant potassium (K). The placement methods for the primary K application have used granulated potash fertilizer broadcast 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). Research evaluated liquid K starter fertilizers applied to the seed furrow or with the 2 in. by 2 in. method. No Iowa State University (ISU) study has evaluated the value of post-planting sidedress K application. Nitrogen sidedressing for corn is a common practice in the north-central region, and its effectiveness has been demonstrated by Iowa research. Since grain prices have dropped significantly and soil-testing for K involves a great deal of uncertainty, growers are asking if K sidedress could be of value to increase yield and perhaps reduce the overall K application rate. Therefore, the objectives were to evaluate how sidedressed liquid K fertilizer affects corn yield and K tissue concentrations when different rates of K fertilizer were applied preplant.

Materials and Methods

The study consisted of two similar field trials with corn. One was conducted in 2017 on an area with Kenyon loam soil and the other in 2018 on an area with Kenyon and Floyd loam soils. Soybean was the previous crop. There were 10 treatments replicated four times at each trial. Eight treatments consisted of four broadcast 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 two other treatments involved only sidedress K (with/without) for plots testing very high in K due to a history of high K application rates. The liquid K fertilizer was injected at the center of each inter-row to a depth of 4 to 5 in. at the V6 growth stage.

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 117 and 280 ppm for the 2017 trial, and 106 and 279 ppm for the 2018 trial, respectively. According to interpretations in ISU Extension publication PM 1688, soil K levels of the low testing plots were in the upper very low category, and soil K of the high-testing plots were very high, much higher than the high category (201 to 240 ppm).

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 broadcast preplant K application greatly increased the corn ear-leaf K concentration of both trials (2017 and 2018). In the 2018 trial, the response was greater to a higher K rate with the highest response for the high-testing plots with or without sidedress K fertilization. This large ear-leaf K response to preplant K, even in

high-testing soils, is common because crop tissues have a high limit for K uptake, even if fertilization does not increase yield.

The leaf K response to the liquid sidedressed K fertilizer differed between the trials. In 2017, sidedressed K resulted in very small increases (not statistically significant) and no increases for the highest broadcast K rate and for the high-testing plots. In 2018, however, the response in leaf K concentration to the sidedressed K was the greatest when no broadcast preplant K was applied. It decreased as the preplant K rate increased. The increases due to the sidedress K application were statistically significant only for broadcast rates of 0, 45, and 90 lb K_2O/acre. The broadcast preplant 45-lb rate increased ear-leaf K concentration more than the sidedressed 45-lb rate in both trials.

Figure 2 shows the corn grain yield response to the K treatments also was smaller in 2017 than in 2018. In 2017, the broadcast preplant 45-K rate resulted in the greatest yield increase, and there were very small additional increases from the higher rates (not statistically significant). In 2018, the response to the broadcast preplant K application also was the greatest for the 45-lb rate, but there were moderate additional yield increases up to the highest rate used. The initial soil-test K values were slightly lower in 2018, which may explain the greater response. The recommended K application rates in ISU Extension publication PM 1688 are 130 lb K_2O in soils testing very low and 90 lb K_2O/acre in soils testing low. It is noteworthy that yield for the plots of both trials testing very high was similar to the yield attained with the highest broadcast rate applied to the low-testing plots.

The corn yield response to sidedressed liquid K fertilizer at both trials was the greatest when no broadcast preplant K was applied and decreased as the preplant K rate increased. For both trials, the increases due to the sidedress K application were statistically significant only for the low-testing plots that did not receive broadcast preplant K. In 2017, there was a small additional response to sidedressed liquid K (not statistically significant) when the 45-lb preplant rate was applied, but this was not observed in 2018.

Figure 2 shows the preplant 45-lb rate increased yield more than the similar sidedressed K rate when no preplant K was applied in both trials. In 2017, the 45-lb preplant rate increased yield by 22 bushels/acre and the similar sidedressed rate increased yield by 10 bushels/acre. In 2018, the 45-lb preplant K rate increased yield by 47 bushels/acre and the similar sidedressed rate increased yield by 28 bushels/acre. Rainfall patterns are being studied for both years because these can affect the effectiveness of K fertilization.

Conclusions

The results from two trials with soils testing very low in K showed the large expected corn yield responses to broadcast preplant K application using granulated potash fertilizer. There was a clear yield response to liquid K fertilizer sidedressed at the V6 growth stage only when no preplant K was applied. Furthermore, a rate of 45 lb K_2O/acre resulted in higher yield increases (22 to 47 bu/ac) than a similar sidedressed rate (10 to 30 bu/ac). Therefore, the results showed sidedressed K fertilizer is a beneficial practice only in low-testing soils that did not receive preplant K fertilization. Producers are advised to use preplant K fertilization, however, because the results showed a much lower efficiency of sidedressed K fertilizer.

Acknowledgements

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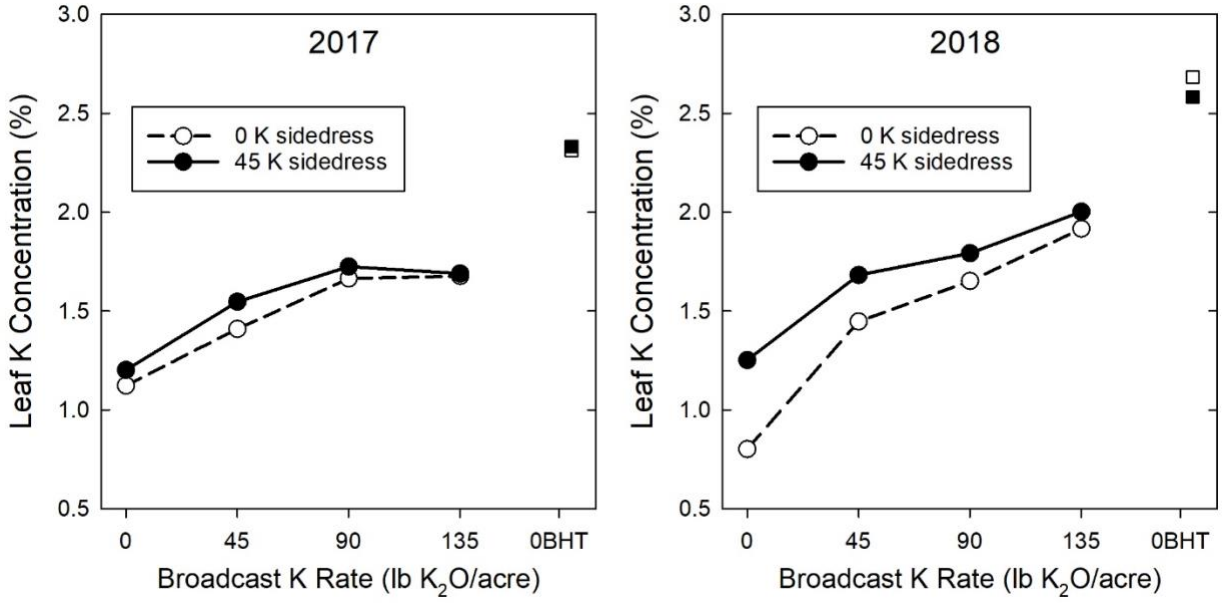

Figure 1. Corn ear-leaf K concentration response to preplant broadcast granulated K fertilizer with or without sidedressed liquid K fertilizer injected at the V6 growth stage in low-testing plots of two trials, and response to only sidedressed K to plots testing very high in K (0BHT) due to a history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

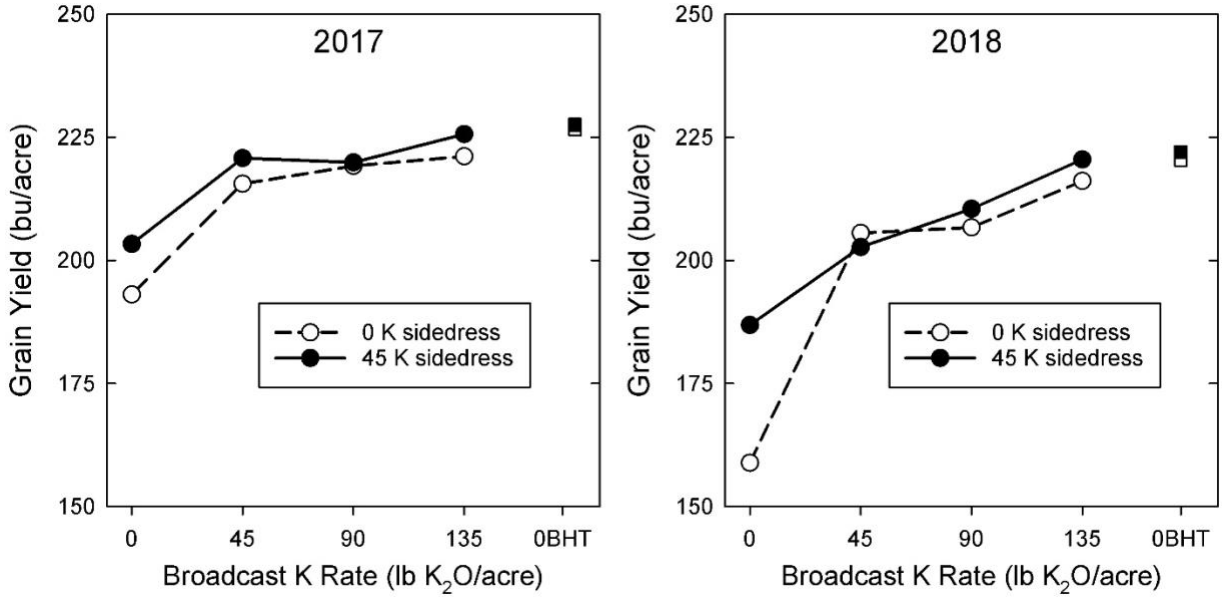

Figure 2. Corn grain yield response to preplant broadcast granulated K fertilizer with or without sidedressed liquid K fertilizer injected at the V6 growth stage in low-testing plots of two trials, and response to only sidedressed K to plots testing very high in K (0BHT) due to a history of large K application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