Kansas Agricultural Experiment Station Research Reports

Volume 7
Issue 8 *Kansas Fertilizer Research*

Article 10

2021

Evaluation of Corn Response to In-Season Potassium Fertilization Using Dry Fertilizer

D. A. Charbonnier
Kansas State University, dcharbonnier@ksu.edu

D. A. Ruiz Diaz
Kansas State University, ruizdiaz@ksu.edu

Recommended Citation

Charbonnier, D. A. and Ruiz Diaz, D. A. (2021) "Evaluation of Corn Response to In-Season Potassium Fertilization Using Dry Fertilizer," *Kansas Agricultural Experiment Station Research Reports*: Vol. 7: Iss. 8. https://doi.org/10.4148/2378-5977.8131

Evaluation of Corn Response to In-Season Potassium Fertilization Using Dry Fertilizer

Abstract

In-season application of potassium (K) fertilizer may offer an alternative to remediate deficiencies developed during the growing season. The objective of this study was to determine corn response to topdress K application under deficient K soil conditions. Treatments included a control and 50 lb K_2O/a in-season broadcasted at the V8 growth stage. The fertilizer source was potassium chloride (KCl). Measurements collected were plant biomass and tissue nutrient concentration at reproductive stage (R6), and grain yield. Potassium fertilization increased yield at the location evaluated in this study. The in-season fertilized treatment produced higher yield compared to the control ($P < 0.09$). The late K fertilization had higher K concentration and uptake in the plant at R6 ($P < 0.06$) with the same plant biomass as the control treatment. Also, broadcasting KCl at V8 resulted in a higher K/Mg ratio late in the season (R6). Preliminary results of this study suggest that in-season applications using dry K fertilizers could be used when pre-plant fertilization was not done. Nevertheless, for a dry growing season, corn response might be limited.

Keywords

potassium, in-season, corn

Evaluation of Corn Response to In-Season Potassium Fertilization Using Dry Fertilizer

D.A. Charbonnier and D.A. Ruiz Diaz

Summary
In-season application of potassium (K) fertilizer may offer an alternative to remediate deficiencies developed during the growing season. The objective of this study was to determine corn response to topdress K application under deficient K soil conditions. Treatments included a control and 50 lb K_2O/a in-season broadcasted at the V8 growth stage. The fertilizer source was potassium chloride (KCl). Measurements collected were plant biomass and tissue nutrient concentration at reproductive stage (R6), and grain yield. Potassium fertilization increased yield at the location evaluated in this study. The in-season fertilized treatment produced higher yield compared to the control ($P < 0.09$). The late K fertilization had higher K concentration and uptake in the plant at R6 ($P < 0.06$) with the same plant biomass as the control treatment. Also, broadcasting KCl at V8 resulted in a higher K/Mg ratio late in the season (R6). Preliminary results of this study suggest that in-season applications using dry K fertilizers could be used when pre-plant fertilization was not done. Nevertheless, for a dry growing season, corn response might be limited.

Introduction
Potassium (K) deficiency on corn (*Zea mays*) could be detected in the early stages when soil K levels are low. In-season application of K fertilizer may offer an alternative to remediate deficiencies developed during the growing season. Currently, there is limited information on how crops respond to post-emergence applications using dry K fertilizers. Previous study by Slaton and Roberts (2020) reported similar soybean yield by applying equal rates of potassium chloride (KCl) in-season compared to pre-plant. Despite reporting similar grain yields regardless of fertilization timing, recommendations include a pre-plant application and more K fertilizer applied in-season if an economic benefit is expected. Additionally, in-season K fertilization via foliar applications may affect corn by stimulating chlorophyll synthesis. A single spraying on corn using KNO_3-solution around tasseling day increased grain yield along with a higher N, P, K, Ca, and magnesium (Mg) absorption (Suwanarit and Sestapukdee, 1989). The objective of this study was to determine corn response to topdress K application timing using dry K fertilizer under deficient soil conditions.

Procedures
The experiment was conducted in a field under conventional tillage located in Osage County, KS, in 2020. Particular areas of the field with low soil test potassium (STK) levels (Table 1) were selected to evaluate late response to K fertilization. The experiment was a randomized complete block design with two treatments and four blocks.

Treatments included a control (0 lb K_2O/a), and 50 lb K_2O/a in-season broadcasted at the V8 growth stage. The fertilizer source was potassium chloride (KCl). Aboveground plant samples were collected at the R6 stage in order to measure total plant K uptake. The samples were dried at 140°F, ground to pass through a 2 mm screen, weighed, and digested by nitric-perchloric acid digestion. Total K concentration was determined by inductively coupled plasma (ICP) spectrometry. Soil samples were taken at V8 growth stage (one per plot), air-dried at 104°F, and ground to pass through a 2 mm screen. All samples were analyzed for soil pH (soil:water; 1:1), organic matter (OM) (loss on ignition method), extractable P and K (Mehlich-3), exchangeable cations (1 M NH_4OAc pH 7.0, flame atomic absorption), including the field-moist analysis for K, and cation exchange capacity (CEC) (displacement method). Grain was harvested from the center rows (20-ft length). Yield was corrected at 15.5% moisture. Statistical analysis (ANOVA) was performed using the GLIMMIX procedure in SAS v. 9.4 (SAS Inst. Inc., Cary, NC).

Results

Potassium fertilization applied in-season increased grain yield in this study by approximately 12 bu/a ($P < 0.09$) (Figure 1). This location had soil K levels that were below the critical level of 130 ppm (Table 1), and yield response to K fertilization was expected (Leikam, et al. 2003). Similar results were reported by Amanullah et al. (2015) with dry K application at V9. The K deficiency symptoms at the beginning of the experiment suggested that the soil could not provide enough K required by corn plants (Figure 2). The late K fertilization had significantly higher plant K uptake at R6 growth stage compared to control ($P < 0.04$ and $P < 0.06$, respectively) (Figure 1). Also, broadcasting KCl at V8 resulted in a higher plant K/Mg ratio late in the season (Figure 3). Preliminary results of this study suggest that in-season applications using dry K fertilizers could be used when pre-plant fertilization was not done. Nevertheless, for a dry growing season, corn response might be limited, and the full response to K can be achieved only with pre-plant applications. In-season K applications should be considered only as a rescue option.

References

Amanullah, A., A. Iqbal, and M. Iqbal. 2015. Impact of potassium rates and their application time on dry matter partitioning, biomass and harvest index of maize (*Zea mays*) with and without cattle dung application. Emir. J. Food Agric 27(5): 447. doi: 10.9755/ejfa.2015.04.042.

Leikam, D., R. Lamond, and D. Mengel. 2003. Soil test interpretations and fertilizer recommendations. Kansas State Univ. MF-2586, Kansas State Univ. Agri. Exp. Stat. and Coop. Ext. Serv., Manhattan.

Slaton, N.A., T.L. Roberts, W.J. Ross, and T.L. Richmond. 2020. Irrigated soybean response to granular fertilizer potassium application timing. Agron.j. 112(5): 4344–4357. https://doi.org/10.1002/agj2.20342.

Suwanarit, A., and M. Sestapukdee. 1989. Stimulating effects of foliar K-fertilizer applied at the appropriate stage of development of maize: A new way to increase yield and improve quality. Plant and Soil 120(1): 111–124.

Table 1. Selected soil properties for 0- to 6-in. samples

pH	OM	Sand	Silt	Clay	CEC	Soil P	Soil K dry	Soil K field moist
	----------	%	----------		meq/100 g	----------	ppm	----------
7.5	2.36	14	62	24	15.0	24.8	82.1	32.1

OM = organic matter. CEC = cation exchange capacity. P = phosphorus. K = potassium.

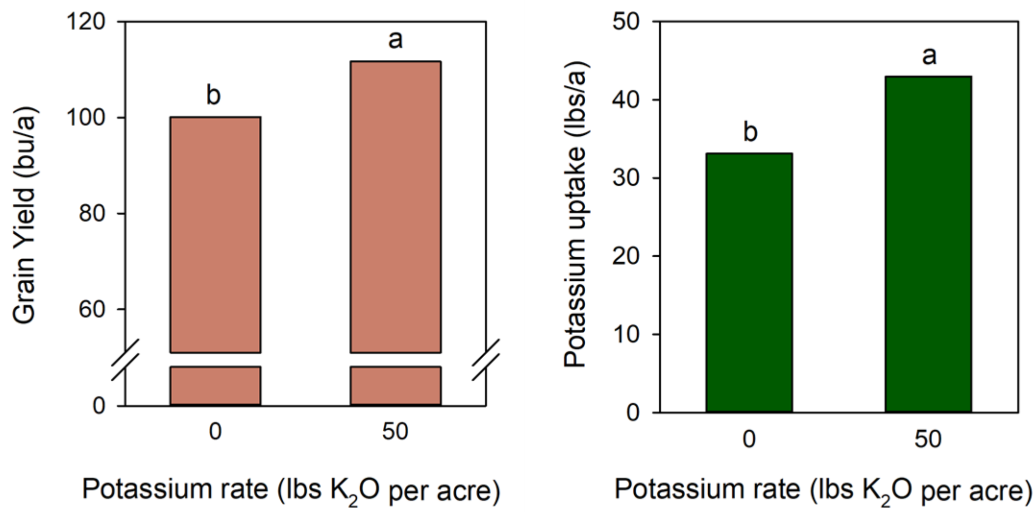

Figure 1. In-season potassium (K) application (using KCl) at the V8 stage and corn grain yield response. And corn K uptake at the R6 growth. Means followed by the same letter are not significantly different at *P* < 0.05.

Figure 2. Potassium deficiency symptoms at the beginning of the experiment (July 10, 2020).

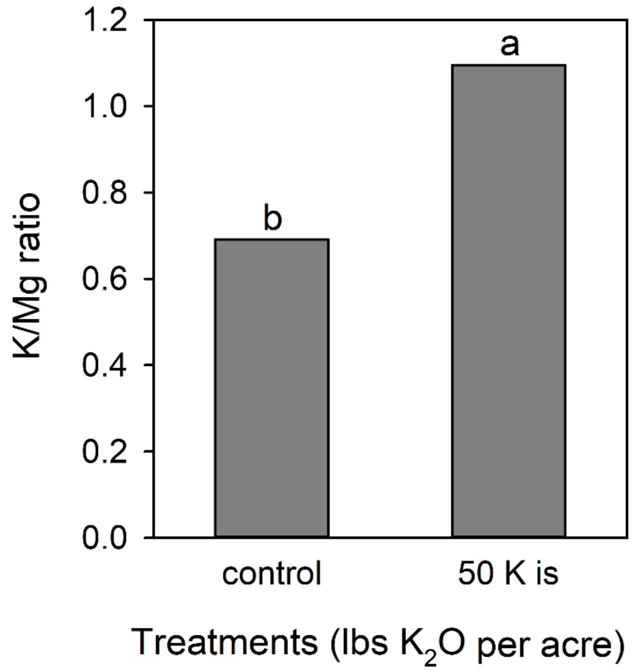

Figure 3. Plant potassium/magnesium (K/Mg) ratio at R6 growth stage as affected by treatment. Means followed by the same letter are not significantly different at $P < 0.01$.