# COTTON VARIETAL RESPONSE TO POTASSIUM APPLICATION RATES UNDER IRRIGATED AND DRYLAND CONTDITIONS

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## Abstract

Potassium deficiency has been more commonly observed in the Cotton Belt over the past several growing seasons. This phenomenon is especially concerning as deficiency symptoms are commonly seen on soil that has adequate K levels according to soil test results. Widespread deficiency has been attributed to the environment and changes in cultivar characteristics. In terms of environment, cotton (*Gossypium hirsutum* L.) uptakes K via diffusion so the presence of nematodes, hardpans, or the lack of or excess moisture can hinder K uptake. Changes in cultivar characteristics have come about through breeding programs which operate with the goal of creating higher-yielding and earlier-maturing cultivars. The increase in yield potential alone has an impact on K demand of the crop but the shift in maturity (earlier) can also impact K uptake. Therefore, an experiment was conducted in order to determine if early and mid-maturing cotton cultivars respond differently to K fertilizer application with respect to growth, yield, and economic returns under irrigated and rainfed conditions. This experiment was located in Starkville, MS at the R.R. Foil Plant Science Research Center from 2016 to 2018. This field was selected due to low potassium levels present in the soil. Experimental units were located in the same place annually to reduce variability associated with fertilizer carry over. Muriate of potash (MOP) was applied pre-plant using hand spreaders at application rates of 0, 56, 112, and 168 kg $ha^{-1}$. Cultivars seeded in this study were DP 1518 B2XF and DP 1646 B2XF; an early and early-mid maturity, respectively. All fertility treatments for each cultivar were conducted under irrigated and dryland conditions in each field. Data were collected throughout the season and regressed on K application rate in SAS v9.4 using the PROC GLM procedure. Nonsignificant model terms ($\alpha = 0.05$) were removed sequentially until a satisfactory model was achieved.

Soil test K levels, leaf K concentrations, and cotton yield generally increased linearly at K application rate increased. Lint yields for DP 1518 B2XF increased at a rate of 1.9 kg $ha^{-1}$ for each additional kg K fertilizer applied whereas DP 1646 B2XF could not be described as a linear function of K rate as coefficients were not different than zero. In terms of net returns in rainfed environments, pooled across variety, greatest returns were observed when 168 kg K fertilizer $ha^{-1}$ ($241 $ha^{-1}$) were applied. Lowest returns in rainfed environments were observed when 56 kg K fertilizer $ha^{-1}$ (-$35 $ha^{-1}$) were applied. Unfortunately in irrigated environments, no potassium application treatment achieved a positive return on investment. The smallest loss was achieved when 168 kg K fertilizer $ha^{-1}$ (-$33 $ha^{-1}$) was applied. Therefore, in low yielding environments like this, the use of irrigation was not economical.