POTASSIUM APPLICATION TIMING AND COTTON YIELD IN TEXAS' SOUTHERN HIGH PLAINS

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Abstract

Cotton is a major cash crop cultivated mainly for its fiber and seed oil. Cotton is more sensitive to potassium (K) deficiency compared to most other field crops due to the fact that K is required in photosynthesis, enzyme activation, metabolism, osmotic potential maintenance, and water uptake during fiber development. Therefore, the demand for K can range from about 2.2 to 5.0 kg ha^{-1} day^{-1} during cotton's boll fill period. In order to meet the K demand of modern cotton varieties, which are high yielding, the soil must be able to replenish available K in a timely manner. The inability of a soil to do so may be a possible explanation for the yield response to increasing rates of knife injected K fertilizer. If this is the case and consequently K fertilizer is not being applied to a soil that cannot replenish K quickly enough to meet the demands of the crop, deficiency symptoms such as decreased lint yield and fiber quality, and reduced drought and disease tolerance are possible. Studies were conducted in 2016 and 2017 in Lubbock and Lamesa in the Texas Southern High Plains to determine K application timing and rate effects on lint yield and fiber quality of two cotton varieties, DP 1518 B2XF and DP 1612 B2XF. The treatments were applied at 0, 90, and 180 kg K ha^{-1} pre-plant (PP), side-dress (SD), and as a split (split) application with 40% PP and 60% SD. Soil from under the plant canopy at depths of 0 – 15 cm and 15 – 30 cm were collected at first bloom, and analyzed for K concentrations. Cotton was harvested, and seed cotton subsamples collected and ginned to determine lint turnout and yield, and fiber quality (Fiber and Biopolymer Research Institute, Lubbock, TX). Pre-plant and mid-season soil K concentrations were quantified using the Mehlich III soil extraction method. Pre-plant soil test K levels were greater than the Mehlich III critical value (150 mg kg^{-1}) used in Texas at the 0 – 15 cm, 15 – 30 cm, and 30 – 60 cm soil depths. Although K fertilizer recommendations would not have been made, a positive lint yield response to added K was determined for DP 1518 B2XF in both years in Lubbock, and in 2016 in Lamesa. For 2016 in Lubbock, the 180 kg K ha^{-1} SD application produced greater lint yield compared to the control (0 kg K ha^{-1}), whereas the 90 kg K ha^{-1} SD application and 180 kg K ha^{-1} split application produced greater lint yield in 2017. For 2016 in Lamesa, the 90 kg K ha^{-1} PP application resulted in greater lint yield compared to the control. DP 1612 B2XF did not respond to K fertilizer applications and treatment differences did not exist in either year or location.

The 2016 in-season soil K concentrations determined that the 180 kg K ha^{-1} (SD and split) application produced greater K concentrations at the 0 – 15 cm depth in Lamesa, whereas the 180 kg K ha^{-1} SD application produced greater K concentrations at the 0 – 15 cm depth in Lubbock. At the 15 – 30 cm depth in 2016, the 180 kg K ha^{-1} SD application produced greater plant available soil K in Lamesa, but no differences were determined between treatments in Lubbock. In 2017, the 180 kg K ha^{-1} SD application produced greater K concentrations at the 0 – 15 cm depth in Lamesa, whereas the 180 kg K ha^{-1} split application produced greater K concentrations at the 0 – 15 cm in Lubbock. No differences between treatments were determined in both locations at the 15 – 30 cm depths in 2017.

With a positive response to added K determined for DP 1518 B2XF at both locations, there may be a reason to believe that variety should be considered when developing a K fertilizer plan, however, additional site years of data are needed. The timing of application and rate responses to yield were different depending on location, which were irrigated using different methods. The 180 kg K ha^{-1} rate consistently produced greater soil K concentrations at the 0 – 15 cm depth across location, although response to timing was different across location. Further studies across the region need to be conducted to validate the timing and rate application response within the region for both yield and soil K concentration.

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