SOIL POTASSIUM EFFECTS ON COTTON GROWTH, YIELD, AND QUALITY IN THE TEXAS HIGH PLAINS

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Abstract

When comparing typical soil potassium (K^+) levels observed in west Texas to current soil K^+ critical levels for cotton, deficiencies are rarely present and thus applications of K^+ are not often recommended. However, when K^+ is applied to soil, positive responses in yield of cotton (*Gossypium hirsutum* L.) have been reported. Cotton yield potential has increased due to changes in genetics which may have increased the quantity, and also the rate at which cotton takes up K^+. In this experiment, the effect of irrigation level and rate of K^+ on reproductive development and lint yield for the variety DP 1522 B2XF was investigated during 2016 and 2017 growing seasons in New Deal, TX. Our objectives were to 1) evaluate application rates of K^+ fertilizer coupled with irrigation level on cotton lint yield; and, 2) determine the effect of K^+ fertilizer rates within irrigation level on boll distribution and yield contribution from specific node zones. Potassium fertilizer (0-0-15) was applied two to four weeks before planting using knife injection. Rates of K^+ application included 0, 45, 90, 135, and 180 kg ha^{-1} with high (80% Evapotranspiration (ET)) and low (30% ET) irrigation levels. It has been observed in previous research that K^+ is important for reproductive growth, so box mapping was conducted on 1 m length of row from each plot and summarized by specific node zones. We grouped nodes based on similarities of maturities with first position nodes 5 to 8 representing the early node zone, 9 to 12 representing the middle node zone and the late node zone started at node 13 with 2nd and 3rd position nodes grouped also based on similar maturities.

In 2016 total water applied to the cotton crop was 487.8 mm with it being applied as rainfall (221 mm) and irrigation at different growth stages at pre-plant (53 mm), early-season (119 mm), 80% ET (91 mm), and 30% ET (3.8 mm) post July 15th. In 2017 total water applied was 416.8 mm with it being applied as rainfall (209 mm) and irrigation at different growth stages at pre-plant (38.1 mm), early-season (93.5 mm), 80% ET (76.2 mm) and 30% ET (0 mm) post July 12th. Soil K^+ levels in 2016 ranged from 522 mg kg^{-1} at the shallowest depth (0-15 cm) to 314 mg kg^{-1} at the deepest depth (30-60 cm), and 2017 ranged from 605 mg kg^{-1} at the shallowest depth to 370 mg kg^{-1} at the deepest depth. In 2016 and 2017 there was no significant difference in lint yield for K^+ application rate, while a significant difference in irrigation was observed in which the 80% ET irrigation level increased yield by approximately 1000 kg ha^{-1} in 2016 and 500 kg ha^{-1} in 2017. Similar to previous lint yield data, irrigation had a significant effect on boll distribution. Under 30% ET irrigation we observed a sharper increase in bolls with a peak at an earlier node and a sharper decline at the middle and upper nodes on the plant. Results in 2017 were different with a peak on higher nodes likely do to an increase in rainfall later in the season in 2017 than 2016. In comparison under 80% ET irrigation boll load was distributed under a wider range of nodes regardless of K^+ rate. Total bolls in 2016 under 30% ET irrigation resulted in an 175,000 boll ha^{-1} increase at 135 kg K^+ ha^{-1} over 45 and 90 kg K^+ ha^{-1}. Differences did not exist in 2016 for box picking yield between K^+-rate treatments. Total bolls and box picking yield in 2017 under 30% ET irrigation resulted in significant differences existing in the early and middle node zones and total nodes at 180 kg K^+ ha^{-1} over all other K^+ application rates. It can be concluded from this experiment that K^+ rates did not affect bulk lint yield, however when box picking was conducted in 2017, 180 kg K^+ ha^{-1} significantly

increased yield under 30% ET irrigation. In 2016, 135 kg K^+ ha^{-1} and in 2017, 180 kg K^+ ha^{-1} generally resulted in more bolls in the early nodes under 30% ET irrigation. Similar to previous studies, irrigation had a significant effect on yield (Balkom, 2006; Bordovsky, 2011). To further understand the relationship between potassium and cotton growth, yield, and quality continued research on fiber quality, soil and tissue sampling, and cotton K^+ uptake rate will be conducted.

References

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