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

A.R. Bumguardner
S.A. Byrd
Texas A&M AgriLife Extension
Lubbock, TX
K.L. Lewis
D.B. Kelley
Texas A&M AgriLife Research
Lubbock, TX
G.D. Morgan
Texas A&M AgriLife Extension
College Station, TX
R.L. Nichols
Cotton Incorporated
Cary, NC

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 rarely recommended. However, when K^+ is applied to soil there is a positive response in yield of cotton. The increase in yield potential of newer cotton varieties has also resulted in an increase K^+ demand. In this experiment, the effect of irrigation, fertilizer application methods, and rates of K^+ on reproductive development, lint yield and fiber quality for the variety DP 1522 B2XF was investigated during 2016 at New Deal and Lamesa, TX. Our objectives were to 1) Evaluate application methods and rates on K^+ that effect cotton quality, reproductive development, and yield; and, 2) Re-evaluate soil K^+ concentrations in order to improve soil recommendations to maximize yield in the Texas High Plains. In Lamesa two application methods of K^+ were utilized 2-4 weeks before planting, knife injected (0-0-15) and broadcast (0-0-60) while at New Deal K^+ was only applied using the knife injected method. Rates of K^+ application include 0, 45, 90, 135, and 180 kg ha^{-1} with high and low irrigation levels. It has been observed in previous research that K+ is important for reproductive growth, so box mapping was conducted on 3m per row for specific node zones. Nodes 5-1 to 6-2 represent the early node zone, nodes 9-1 to 8-3 represent the mid node zone and nodes 13-1 to 12-3 represent the late node zone.

Soil K^+ levels in New Deal 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), while Lamesa ranged from 287 mg kg^{-1} at the shallowest depth to 240 mg kg^{-1} at the deepest depth. New Deal leaf tissue showed no differences in application rate or irrigation levels. In New Deal there was no significant difference in lint yield for K^+ application rate, while a significant difference in irrigation was observed in which the high irrigation level significantly increased yield by approximately 1000 kg ha^{-1}. In Lamesa there was no significant difference in lint yield for K^+ application rate, while again a significant difference was observed in irrigation in which high irrigation significantly increased yield by approximately 200 kg ha^{-1}. Similar to previous lint yield data, irrigation had a significant effect on boll distribution. High irrigation levels resulted in a 300 kg ha^{-1} increase in lint yield when we added potassium from the early to mid-node zones. Under the low irrigation we observed the opposite where there was a 400 kg ha^{-1} decrease in lint yield from the early to mid-node zones. In the early node zone under low irrigation we observed an increase in yield of 900 kg ha^{-1} at 135 kg ha^{-1} rate with no additional benefit at 180 kg ha^{-1} rate. It can be concluded from this experiment that K^+ rates didn't have a significant effect on lint yield. Similar to previous studies, irrigation had a significant effect on yield (Balkom, 2006; Bordovsky, 2011). There was no influence on the timing of the transition from vegetative to reproductive development that has been observed previously (Makhdum, 2007). To further understand the relationship between potassium and cotton growth, yield, and quality further research on fiber quality, soil and tissue sampling, and cotton K^+ uptake rate will be conducted.

References

Balkom, K.S., D.W. Reeves, J.N. Shaw, C.H. Burmester, L.M. Curtis. 2006. Cotton Yield and Fiber Quality from Irrigated Tillage Systems in the Tennessee Valley. Agron. J. 98:596-602.

Bordovsky, J.P., J.T. Mustian, A.M. Cranmer, C.L. Emerson. 2011. Cotton Grain Sorghum Rotation under Extreme Deficit Irrigation Conditions. Applied Engineering in Agriculture. 27(3):359-371

Makhdum, M.I., H. Perevez, M. Ashraf. 2007. Dry matter accumulation and partitioning in cotton as influenced by potassium fertilization. Biol. Fertil. Soils. 43:295-301.