EVALUATION OF PHOSPHORUS AND POTASSIUM APPLICATION METHODS AND RATES ON COTTON LINT YIELD AND FIBER QUALITY

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Abstract

There are an increasing number of subsurface drip irrigation (SDI) acres on the Southern High Plains of Texas. The SDI technology has increased yield potential of cotton mainly due to reduced episodic moisture stress compared to pivot irrigation. Subsurface drip irrigation can be used to improve management and use efficiency of fertilizers. Using conventional application methods of phosphorus (P) and potassium (K) can reduce availability and plant response within a growing season. When fertilizers are applied with SDI, they are placed in the seed furrow potentially increasing plant uptake and use efficiency. However, there are few P and K fertilizer sources labeled for application with SDI. In this experiment the effect of application methods and rates of P sources on lint yield and fiber quality were investigated during the 2017 and 2018 growing season in New Deal, TX at the Texas Tech Research Farm. More specifically, our objective was to evaluate P fertilizer rates and sources (with and without K) applied with SDI compared to a conventional knife-injection method of ammonium polyphosphate (10-34-0). Two commercially available P fertilizers, Intelliphos 45 (3-38-0) and 32 (0-24-8), were applied using SDI.

Soil P levels ranged from low to very low and soil K levels were very high in both years, according to the rating system of the Texas A&M AgriLife Extension Soil, Forage and Water testing lab. Leaf tissue samples were collected to determine nutrient accumulation at three different timings starting at pinhead square until first open boll in 2018. Leaf tissue P was significant over the check 67 days after planting (DAP) when the fertilizer (0-24-8) was applied at a rate of 7 lb P acre^{-1} and 4 lb K acre^{-1} and at 81 DAP when applied at rates of 7 lb P acre^{-1} and 4 lb K acre^{-1} and 4 lb P acre^{-1} and 3 lb K acre^{-1}. When the fertilizer (3-38-0) was applied at 81 DAP leaf tissue P was significant at a rate of 8 lb P acre^{-1}. Leaf tissue K can be used as an indicator of in-season K deficiency, so Pearson's correlation was analyzed to determine a relationship between lint yield and leaf tissue K. We determined a poor relationship between leaf tissue nutrients and lint yield for all three timings (proc corr= 0.4235, 0.1223 and -0.4088). There was a negative relationship at 81 DAP, which could be due to the plant partitioning of nutrients to developing fruiting structures from vegetative plant parts. In 2017 lint yield was greater than the check when the 0-24-8 fertilizer was applied at a rate of 7 lb P acre^{-1} and 4 lb K acre^{-1}, while in 2018 it was significant at a rate of 4 lb P acre^{-1} and 3 lb K acre^{-1}. When 3-38-0 fertilizer was applied in 2018 at a rate of 13 lb P acre^{-1} lint yield was greater than the check. Phosphorus use efficiency (PUE) was greater with treatments that had the addition of K applied as 0-24-8 compared to treatments without the addition of K. With the addition of 4 lb K acre^{-1}, PUE nearly doubled. Fiber quality parameters were significantly affected by the application of the 3-38-0 and 0-24-8 fertilizers applied by SDI compared to the conventionally applied 10-34-0 fertilizer or the check. In summary, the 0-24-8 fertilizer applied using SDI resulted in more consistent positive effects on leaf tissue P, lint yield and PUE. Applying P and K fertilizer using SDI should provide more consistent responses than knife-injected fertilizers.