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DO MODERN CULTIVARS REQUIRE HIGHER LEVELS OF POTASSIUM FERTILIZATION?

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Abstract

During the past several years, late-season potassium deficiencies have been observed in many cotton fields across South Carolina. Some varieties have appeared to show potassium deficiency symptoms more frequently than other varieties. New, higher-yielding earlier-maturing cotton varieties develop more of their total boll load over a shorter period of time, which can lead to a more condensed boll filling period and an increased demand for the uptake and mobilization of potassium from the soil and leaf to the developing lint. Since Southeastern Coastal Plain soils typically have accumulations of potassium in clayey subsoil layers due to leaching of potassium incorporated into sandy surface soil layers, the extent of downward potassium movement during the growing season and access to subsoil potassium may govern potassium availability in Coastal Plain soils. Current potassium fertilizer recommendations in South Carolina are based on pre-season potassium levels of the topsoil that is adjusted by depth and potassium content of the subsoil. The data establishing the subsoil adjustment to fertilizer recommendations preceded development of these high potassium demanding cotton varieties. Research was conducted to determine if current soil testing procedures and recommendations are valid to optimize yield of modern cotton varieties. A replicated field experiment was conducted in 2002 and 2003 at the Pee Dee Research and Education Center located in Florence, SC, on a Norfolk-Bonneau soil complex identified as potassium deficient last growing season. Potassium treatments were broadcast applied prior to planting at 0, 50, 75, 100, and 125 lb K_20/acre. Five cotton varieties released between the years 1919 and 2001 (Dixie Triumph, DPL 90, DES 119, Paymaster 1218BR, and DPL 555BR) were evaluated.

Cotton growth and development was significantly altered by the various potassium treatments. Leaf and petiole potassium levels were positively related to the sum of the initial soil potassium level of the A-horizon plus 50% of the potassium fertilization rate. Including E- or B-horizon potassium levels and/or a higher or lower percentage of potassium fertilization rate did not improve these relationships. Leaf potassium appeared to be a better indicator of potassium supply than petiole potassium, but was also more affected by growth stage compared to petiole measurements. Leaf potassium concentrations were low throughout boll development (especially with the low potassium fertilizer treatments), attaining deficiency levels of less than 1.5% at early bloom and less than 0.75% at cutout. Visible differences in deficiency symptoms in the field occurred among varieties and potassium rates. All varieties responded favorably to increased levels of leaf potassium, but recently released higher-yielding varieties such as PM 1218BR and DPL 555BR responded more to potassium than older, lower-yielding varieties such as Dixie Triumph, DES 119, and DPL 90. Lint yields increased 400 to 800 lb/acre with each 1% increase in leaf K, with lint yields of newly released varieties increasing more than older varieties.