POTASSIUM NUTRITION AND COTTON GROWTH AND DEVELOPMENT

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Abstract

Late season potassium deficiency symptoms are widespread and attention is being refocused on the nutritional needs of the cotton. A recent survey of the Mississippi State Soil Testing Laboratory tests found one third of the soil samples received during a recent 12 month period tested either low or medium for K. Knowledge of the relationship between tissue K content and cotton growth is limited. With emphasis on site-specific agriculture, such information is needed to diagnose reasons for low producing areas. We conducted two experiments to determine the rates of growth and other growth related processes in response to different tissue K contents. One experiment was conducted in naturally-lit plant growth chambers. Cotton cultivar, DPL NuCoTN 33, was planted in sand on 2 May, 1996. The plants were provided adequate water and nutrients needed until first square, then variable amounts of K was provided, but the plants were always well-watered and all other nutrients provided sufficiently. The plants were grown at 30/22°C day/night temperature throughout the period. Organ K, photosynthesis, dry matter accumulation, flower/boll retention, plant height, leaf area, node development and chloroplast structures were monitored. A second experiment was conducted outdoors. Leaf K, growth parameters, and boll mass and boll components were monitored.

Potassium deficiency symptoms first developed in young and expanding canopy. K deficient symptoms first appeared as mottled leaves followed by marginal necrosis and curling, then crinkling and severe necrosis. The maximum and minimum K contents varied between organs and the information will be used to estimate K budgets for the whole plants. Leaf expansion and photosynthetic rates were K-dependent and were very sensitive to K levels. Leaf addition rates and stem elongation rates were not K-sensitive except at the very low K levels. Boll retention was K sensitive only at very low K levels, probably through its effects on photosynthesis. Boll components such as seed, burr, and lint weights were decreased in low K-treated plants while seed number was unaffected. Biomass partitioning was less sensitive to K. Chloroplasts of K deficient plants contain more and larger starch granules and plastoglobuli. Less chloroplast grana or disrupted grana stacking in low K plants was probably due to reduced rates of carbohydrate translocation. Potassium deficient plants grown outdoors were susceptible to diseases that resulted in defoliation just before bolls started opening. Extremely K-deficient plants had more locked bolls than plants with adequate K. Thus, K deficiency directly affects many physiological and growth processes. The effects can be quantified. This information will provide the essential database for modeling K deficit effects on cotton and also a diagnostic tool for K fertilizer management.

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