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UPTAKE DYNAMICS OF FOLIAR-APPLIED POTASSIUM AND PHYSIOLOGICAL RESPONSE OF COTTON GROWN UNDER WATER- AND POTASSIUM-DEFICIENT CONDITIONS

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Abstract

According to the literature, development of cotton (*Gossypium hirsutum* L.) yield and fiber quality depends on adequate potassium (K) resources. However, little is known about the effect of plant water status on the management of K fertility inputs. A field study (repeated in previous seasons) was conducted in 2002 utilizing eight treatment combinations of well-watered or dryland conditions, high or low soil K, and with or without foliar-applied K arranged in a split-split plot design with five replications. Foliar-applied rubidium (Rb) was used as a tracer of K uptake by painting $RbNO_3$ solution on the adaxial surface of subtending leaves of tagged, first-position bolls at two, three and four weeks after the first flower stage. Each subtending leaf, petiole and boll components were harvested at intervals of 24, 48 and 96 hours after applying $RbNO_3$. Carbon isotopic discrimination (^{13}C) was measured at key phenological stages in uppermost, unfolded leaves. Final lint yield was determined by hand picking seedcotton from a one meter length on each of the two center rows at approximately 90 percent open boll. Fiber quality of a lint subsample was determined by HVI analysis. At three weeks after first flower, our field study showed that nearly 50 percent of foliar-applied Rb was detected in painted leaves within 24 hours. Futhermore, water-deficit stress slowed the uptake and export of Rb from leaf but increased the Rb content of lint within 96 hours. Foliar-applied K increased leaf ^{13}C discrimination under both levels of soil K and under irrigated conditions, thereby decreasing the stomatal limitation on photosynthesis. Averaged over three field locations and four seasons, lint yields responded to foliar-applied K at preplant soil K levels below 280 kg/ha. Lint yields responded better to foliar-applied K under dryland as compared to irrigated conditions. In 2002 at Fayetteville, foliar-applied K increased elongation under K-deficient and under dryland conditions. Overall, water-deficit stress and K deficiency moderated the uptake of foliar-applied Rb as well as the physiological, fiber quality and yield response of cotton to foliar-applied K.