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Response of drip-irrigated Kinnow mandarin to deficit irrigation under a semiarid climate

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Abstract

Availability of irrigation water is a major constraint to Kinnow mandarin cultivation in northern India. Drip irrigation is found as a potential water saving technique over traditional surface irrigation methods in Kinnow. Deficit irrigation (DI) is a recently proposed water saving technique in irrigated agriculture. The present study was planned with a hypothesis that drip irrigation scheduling with DI technique could save a substantial amount of water over full irrigation, without affecting the yield significantly. The experiment was conducted for 2 years during 2010 and 2011, with drip-irrigated Kinnow mandarin (*Citrus reticulata* Blanco) plants budded on Jatti Khatti (*Citrus Jambhiri* Lush) rootstock at IARI, New Delhi. The crop responses to DI scheduled at 50% and 75% full irrigation (FI, 100% ETc) were compared with that under FI. DI at 75% ETc produced marginally lower fruit yield (10-12%), with lower vegetative growth of the plants in comparison to that under FI. However, the irrigation water use efficiency and water use efficiency under DI at 75% ETc was observed to be 47% and 53% higher, respectively, over that under FI. The heavier fruits with better quality (higher TSS, ascorbic acid, total sugar and reducing sugar, and lower acidity) were harvested in DI at 75% FI compared to FI. The plant water status (relative leaf water content, leaf water concentration, leaf water potential, stem water potential) was superior with fully-irrigated plants. Likewise, under FI, the plants registered maximum rate of net-photosynthesis, stomatal conductance and transpiration in leaves. However, the plants under DI at 75% ETc exhibited the highest leaf water use efficiency (photosynthesis rate / transpiration rate). The leaf nutrient (N, P, K, Fe, Mn, Cu and Zn) analysis revealed that the concentration of all the nutrients was observed to be higher with fully-irrigated plants, which was associated with higher availability of such nutrients in soil under this treatment. However, P and Cu did not show any significant ($P < 0.05$) response to irrigation. Yield prediction employing principal component-regression, taking leaf-N, leaf-K, stem water potential stress index, stomatal conductance and water band index as the predictors, gave satisfactory result. Overall, these results reveal that DI at 75% ETc under drip irrigation saves 25% of irrigation water producing better quality fruits, without affecting the fruit yield significantly compared to fully-irrigated Kinnow mandarin in a semiarid climate.

Biography

Pravukalyan Panigrahi has completed his Ph. D in “Water Science and Technology” from Indian Agricultural Research Institute, New Delhi. He is a Scientist working at “Directorate of Water Management”, Bhubaneswar, India. He has published more than 20 papers in reputed National and International journals. He has expertise on soil and water conservation, micro-irrigation and citrus water management.