

# Effects of short-term drought stress and mechanical harvesting on sweet orange tree health, water uptake and yield

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## Abstract

One of the primary reasons for the slow adoption of mechanical harvesting by Florida citrus growers is the physical injuries to trees including loss of leaves, twigs, flowers young fruits, breaking of limbs and injuries to the bark and roots. However, it has been shown that well-managed trees are capable of tolerating defoliation, limb loss and root and bark injury caused by mechanical harvesting. Irrigation management is one of the most crucial factors influencing citrus tree health. A multiple-year field study was conducted on 'Valencia' sweet orange trees in a commercial citrus grove near Immokalee, Florida. The objective of the study was to determine the effect of initial tree canopy density and short-term drought stress on tree health, and productivity of mechanically harvested trees. Trees on similar soil type were categorized as low, moderate and high density based on the general tree appearance and canopy density. The experimental design was a split plot with four replications of six-tree plots of hand harvested or mechanically harvested trees with the main treatment of drought stress or full irrigation prior to harvest. After harvest, each plot was split with three of the six trees drought stressed and the other three trees fully irrigated for a total of 32 three-tree plots for each canopy density category. Harvesting trials were established in spring 2010 and 2011 with the same experimental design, treatments and data collection procedures. The percentage change in yield from 2010 to 2011 for mechanically harvested trees compared to hand harvested trees, was +17% for low, +8% for moderate and 0% for high density plots. This indicated similar or improved yield after mechanical harvesting. Drought stress significantly increased fruit detachment force (FDF) for low and moderate density but not for high density trees. Plant water use (stem water potential (SWP) and sap flow) data indicated no significant effect harvest methods on water use ( $P < 0.005$ ). However, drought stress significantly increased ( $P < 0.001$ ) SWP after harvest. Although mechanically harvested trees lost

leaf mass, water uptake was restored shortly after harvesting and should not have an adverse effect on long-term tree health unless trees are allowed to become drought stressed immediately after harvest.