

IFAS Citrus Initiative

Annual Research and Extension Progress Report 2011-12

EFFECT OF INITIAL TREE HEALTH and IRRIGATION TIMING ON SHORT AND LONG TERM IMPACTS of MECHANICAL HARVESTING

Investigator:

PI – Kelly T. Morgan

Co-PIs – Robert C. Ebel

Objective Pursued (Priority Topics):

Priority topic studied in this project is effect of mechanical harvesting on tree health. The objectives of this project are to determine the effect of tree condition prior to harvest and harvest method on measures of short-term and long-term tree health. The goal of the research will be the documentation of short-term and long-term impacts of mechanical harvesting on trees of selected levels of initial tree health compared with hand harvested trees over a three year period.

Detailed Accomplishments in 2011-12:

Two sets of plots were established with one of two irrigation treatments prior to harvest. Each plot consisted of six adjacent trees in the planted row and was replicated four times for a total of 16 plots per tree category. Trees received the same irrigation prior to start of the irrigation treatment. Irrigation treatments were; no water stress prior to harvest with irrigation applied up to date of harvest or water stress prior to harvest with no irrigation at least five days prior to harvest. One set of plots with all irrigation treatments were hand harvested and the other set of plots were machine harvested. A pull behind canopy shaker was used to harvest the plots mechanically. After harvest each plot was split into two-three tree plots with one sub-plot receiving irrigation (no stress) or no irrigation for eight days after harvest (stress). Leaf area index (LAI) was used to quantify initial tree condition prior to harvest and to determine effect of harvest method on tree canopy density. Stem water potential was measured using three leaves per tree, randomly selected from the 2nd and 5th tree of each plot. Sap flow sensors were used in one of the four replications of each tree category. Because the 2nd and the 5th tree of a plot represent two different irrigation treatments. On the day of harvesting, 5 fruit were randomly selected from the 2nd and the 5th tree of each plot (10 fruits/plot). The pull behind harvesters deposit harvested fruit on the ground thus fruit for both hand and machine harvested plots were picked off the trees or from the ground and placed into one or more designated 10-40.8 kg box tub(s).): The leaves, twigs, small stems, blooms, and immature fruits that fall from the tree while harvesting were referred to as the harvesting debris.

Areas where progress exceeded expectations:

Stem water potential of trees with water stress was significantly higher than non-stressed trees prior to harvest in 2011 and 2012. In third year of the study, the highest sap flows, as expected, were observed in the non-stressed irrigated trees in all categories. Under low

density category, trees subjected to water stress nine days before or after harvest did not show much change in sap flow despite lack of water. Irrigated trees with no stress showed sap flow as high as 612 and 547g/d while trees water-stressed nine days before harvesting peaked to 401 and 585 g/d, and water stressed after harvesting peaked to 175 and 383 g/d under hand and mechanical harvesting, respectively. A similar trend was observed in the trees under moderate and high density.

In 2012, fruit yields declined by 4% and 23% for hand and mechanically harvested low density trees, and 17% for hand harvested moderate density trees. However, the fruit yields for high density trees increased by 14 and 53% for hand and mechanically harvested tree categories, respectively over 2011 harvest.

Areas where progress didn't meet expectations:

After harvest, stem water potential increased for the water stressed trees in all tree densities but high density owing to rainfall totaling 42 mm on April 20 through 22, 2012, just a few days before taking the water potential measurements.

Impact of accomplishments towards overall goals of funding:

After three years, mechanical harvesting does not appear to affect short or long term tree health and yield of well maintained trees of high canopy densities. These data would support previous findings and suggest low impact of mechanical harvest on long-term yields. However, both hand and mechanical harvest trees with moderate or low density prior to harvest declined in yield in 2012.

Presentations associated with 2011-12 efforts:

Presentation to the CPI board of directors on June 8, 2011
Poster presented at the International Symposium on Mechanical Harvesting & Handling Systems of Fruits and Nuts, Lake Alfred, FL April 2-4, 2012

Publications from 2011-12 efforts:

Refereed: None (planned publications after third year)
Non-refereed: Proceedings of the International Symposium on Mechanical Harvesting & Handling Systems of Fruits and Nuts, Lake Alfred, FL April 2-4, 2012

Next steps:

Adequate data has been compiled to produce a referred journal article with repeated years of data and long-term effects tabulated.