

MECHANICAL HARVESTING: The 2006-07 harvest season

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This article summarizes some of the highlights of the IFAS mechanical harvesting research and education program during the 2006-07 season. In this season, 35,600 acres were mechanically harvested, totaling 8.3 million boxes, or about 7 percent of the total Florida orange crop (129 million boxes).

Prior to the 2006-07 harvest campaign, Oxbo International Corp. sold six new units of their continuous travel canopy shake harvester to Florida harvesting contractors and growers. The new units helped to increase the citrus acres mechanically harvested by 23 percent, compared to the 2005-06 season.

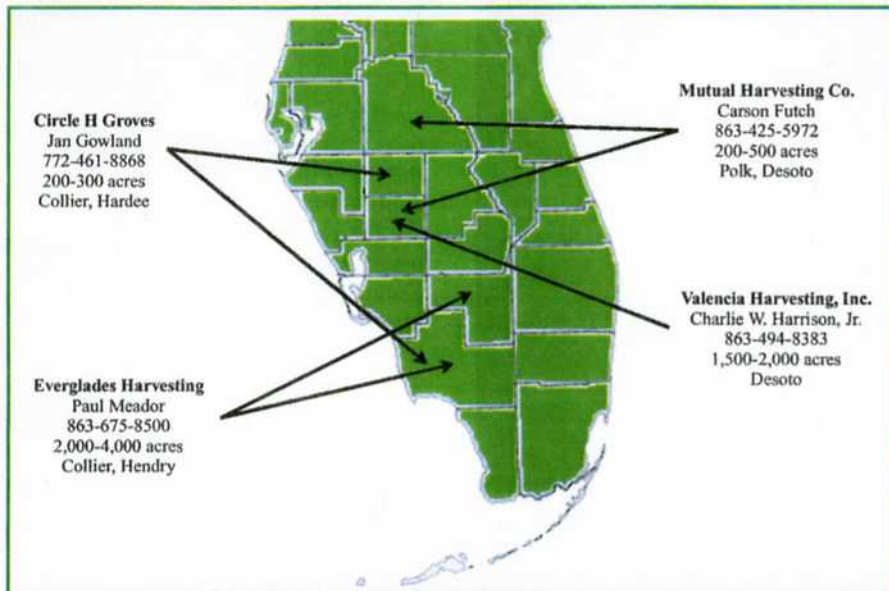
MECHANICAL HARVESTING EXTENSION AND EDUCATION

The Citrus Mechanical Harvesting Web site (<http://citrusMH.ifas.ufl.edu>) was launched on June 1, 2006 and has become the central distribution point of information for the UF/IFAS citrus mechanical harvesting project. The Web site now includes more than 250 mechanical harvesting-related extension and research publications, video clips of harvest equipment in

action, a history of mechanical harvesting in Florida and much more. During 2007, monthly articles on mechanical harvesting appeared in trade journals and the "What's Shakin'" monthly feature was introduced to *Citrus Industry* magazine. Two field days demonstrating mechanical harvesting equipment took place in Bartow (Jan. 17, 2007) and Immokalee (April 18, 2007). Each field day began with several presentations by IFAS researchers providing updates on mechanical harvesting and abscission agent research. The presentations and other information from the field days can be found on the mechanical harvesting Web site.

CMNP RESEARCH AND REGISTRATION

Research has continued to test the effect of application volume and sprayer type on the efficacy of the fruit loosening abscission agent CMNP to determine if annually repeated mechanical harvesting plus abscission agent treatments affect yield. The efficacy of CMNP can be significantly affected by weather and



Some of the harvesting companies operating mechanical harvesters and the counties they operated in during the 2006/07 harvest season.

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other environmental factors. For example, the force required to remove orange fruit from their stems (fruit detachment force, FDF) fluctuates throughout the day, with lowest FDF at 2 p.m. and the highest at either 8 a.m. or 5 p.m. Thus, anticipated natural variations in FDF throughout a given day can be used to enhance the efficacy of abscission agents.

The effect of rootstock on the efficacy of CMNP with various grapefruit, tangelo, tangerine and round orange cultivars revealed that CMNP was somewhat less effective on Swingle rootstock in most combinations tested, whereas Carrizo displayed maximum responsiveness to CMNP.

These research results contribute to an understanding of successful abscission agent management to maximize efficacy and to minimize

unwanted post-application fruit drop. Mechanical harvesting with a trunk shaker plus CMNP resulted in no yield reductions or change in tree health the following year. Collectively, this research is the basis of developing grower recommendations for optimizing abscission agent response and mechanical harvesting in the field.

The registration effort for CMNP is well under way and is being managed by AgroSource Inc. IFAS researchers are assisting in AgroSource's efforts where needed. This assistance includes testing of newly formulated material (compared with original 'Release' product), receiving, storing and dispensing formulated and technical material to testing agencies as needed, and collecting and shipping soil samples for testing. Registration appears to be on schedule and an Experimental Use Permit

is anticipated in 2009, with full registration by the end of 2011.

HARVESTING MACHINE ENHANCEMENTS

Machine enhancements have focused on the development of a yield monitoring system (YMS) for use with citrus mechanical harvesting machines. A YMS can assist the grower by measuring yield and producing a yield variability map, but no such system currently exists for citrus mechanical harvesting machines. The major component of a yield monitoring system is a Mass Flow Sensing (MFS) system, which measures the citrus fruit mass every second as fruit is conveyed through the citrus harvesting machines. In 2006-07, three methods of mass flow measurement — load cell-based, image-based and optical-based — were compared to select the best method for further yield monitor development. From these comparative tests, the load cell-based system proved to be easy to install and maintain, low-cost, low weight, rugged and durable. For these reasons, the load cell MFS system was selected as the best candidate for further development and the system is now ready to collect a full year of yield data for a pair of citrus mechanical harvesting machines.

Machine improvements also focused on the shaking mechanism and its action on the fruit. Use of small wireless sensors placed on fruit in the canopy showed that the actual force needed to remove fruit is approximately twice that measured by pulling straight down on a fruit with a force gauge and that the force experienced by fruit vary with canopy position. These findings may be due to the radial formation of the tines and that all of the forces applied to fruit by the machine are not focused in one direction as it is measured by hand with a force gauge. These data are being used to improve machine design to enhance fruit removal, decrease tree stress during harvest and reduce wear and tear on the machines.

During harvest, maximum fruit catching efficiency is achieved when the two machines' travel speeds are synchronized so that gaps in the catch system are prevented. Research has focused on developing a control system using a laser sensor to measure distance and angle between the



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