Photo courtesy of Oxbo International Corp

Popular Mechanics

By Barbara Hyman, Fritz Roka, Jim Syvertsen, Bob Ebel, Tim Spann, and Reza Ehsani

During the 2008-2009 season, 35,600 acres producing 9½ million boxes were mechanically harvested. The economic potential remains strong for existing harvesting equipment to dramatically reduce harvest costs and increase on-tree returns. Several impediments, however, still need to be overcome before the full benefits of mechanical harvesting can be realized. Incorporating fruit loosening abscission chemicals into the harvesting systems, addressing grower concerns about tree health, eliminating gleaning of unharvested fruit, and minimizing harvest debris in trailer loads are four challenges. These issues are being addressed by the collective efforts of Florida growers, harvesters, juice processors, and researchers. Solving these challenges would increase the adoption of mechanical harvesting, greatly enhance the harvesting capacity of existing equipment, and lower overall harvesting costs.

Abscission Obsession

Harvesting late season Valencia is the biggest barrier of current mechanical systems. Once next season's bloom fruitlets grow to more than 1 inch in diameter, they are readily removed by mechanical harvesting equipment and might cause a reduction in the next season's yield by at least 25%. Abscission compounds, specifically CMNP (5-chloro-3-methyl-4-nitro-1H-pyrazole), should solve this problem as it loosens fruit and allows equipment to operate with less shaking force. Current research efforts are collecting data that focus on CMNP concentration, harvester settings, and harvest timing. Data from this work is being used to develop a predictive model to ensure CMNP will be applied with the maximum probability of success. Presently, research trials on CMNP are limited to 10 treated acres annually, and all treated fruit must be destroyed.

If EPA grants an experimental use permit (EUP) for CMNP, the number of treated acres should be greatly expanded and treated fruit would be processed for juice. The additional data collected under the EUP will refine the predictive model.

Tree Health

The duration, speed, and intensity of the shaking action during mechanical harvesting can cause leaf loss and visible scarring of tree limbs and trunks. Growers have long been concerned that such damage might lead to reduced tree health and yields and ultimately increased tree mortality. UF/IFAS research trials have repeatedly shown healthy, well-nourished trees suffer no negative effects from

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mechanically harvesting. Specific studies have examined the effects of leaf loss, root damage, and drought stress in conjunction with mechanical harvesting. Results of these studies confirm citrus trees have the capacity to adapt to a number of stress factors as long as a tree's nutrition and irrigation requirements are well managed. Application of an abscission agent (CMNP) should ease growers' lingering tree health concerns in that machines could harvest fruit with less force, and thus reduce visible tree damage.

Gleaning And Machine Design

Harvesting contractors are reporting 75% to 82% fruit recovery with existing catch-frame designs. This means that, in an average block, between 80 and 120 boxes per acre are being gleaned by hand crews at an average cost of $3 per box (pick and roadside). Improved catch-frame design and better synchronization between harvesting units should enhance fruit recovery of a self-propelled canopy shaker and reduce the number of boxes gleaned. Addition of an abscission agent compound (CMNP) should facilitate fruit removal and increase overall fruit recovery.

An important goal is to improve fruit recovery to a point where gleaning becomes uneconomical. An analysis of productivity data indicates when gleaners have access to less than 20 boxes per acre, their productivity falls to less than 3 boxes per hour. If they expect to earn $9 per hour, their piece rate to glean fruit has to be increased to at least $3 per box. With the additional costs of roadside and fruit hauling, gleaning would only be profitable under extremely favorable market conditions.

Harvest Debris

Mechanical harvesting, without an abscission agent, has been shown to increase the amount of harvesting debris loaded into trailers and transported to processing plants. Juice processors are concerned woody debris can damage processing equipment, cause downtime in plant operations, and diminish overall juice-yield recovery. Although some of this debris removal might actually be good for the trees, an application of an abscission agent, along with mechanical harvesters, has been shown to reduce harvesting debris to equivalent levels of hand-harvested loads. Self-propelled canopy shakers need to fill at least 20 trailers a day to operate efficiently. Juice processors who control the daily load allocations to harvesting sites around the state have little economic incentive to accommodate these systems if their operating costs increase due to excess harvest debris.

A survey is under way to estimate the cost of handling debris at a juice-processing plant. The results of this survey should help focus an industry discussion on what would be the most cost-effective way to handle or avoid harvest debris. Faculty at UF/IFAS are working with the Florida Department of Citrus' Harvest Research Advisory Council, the Southwest Florida Mechanical Harvesting Advisory Committee, and AgroSource, the private company contracted by the DOC to submit the CMNP registration package to EPA and to commercialize CMNP once it is approved by the EPA. To learn more, visit **http://citrusmh.ifas.ufl.edu**.

Photo by Jackie Burns, CREC

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